

NNF 2018

NEPALESE
NATIONAL FORMULARY

3rd Edition



Government of Nepal
Ministry of Health & Population
Department of Drug Administration (DDA)

2018

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Nepalese National Formulary

Third edition
2018

Previous editions

First edition, 1997
Second edition, 2010

Published by

Government of Nepal
Ministry of Health & Population
Department of Drug Administration

Printed in

Kathmandu, Nepal

ISBN

978-9937-0-4337-3

Nepalese National Formulary 2018

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Preface

Nepalese National Formulary is prepared to provide unbiased information on medicines used in the country. It has wide application at various levels of healthcare providers and various levels of health institutions.

With the rapid development of science and technology, pharmaceutical research, invention and innovation has resulted into availability of significant treatment options worldwide. Since there are many new medicines added in the therapeutics armory and many previously used molecules have been found as inferior options or replaced by newer molecules in the clinical experience, it is imperative to revise the current Nepalese National Formulary. The formulary concept was conceived long before the adoption of National List of Essential Medicines (NLEM) in Nepal. The drug advisory committee in 1982 first recommended for the preparation of National formulary manuscript. Through a wide consultation between experts in various therapeutic areas, first draft was prepared in 1996 followed by subsequent edition on the draft the first edition of the formulary was issued in 1997. Then after about 12 years, the second edition with inclusion of new medicines, guidance on prescribing, adoption of INN, addition of appendix with NLEM, ADR reporting form etc, was published in 2010.

Third edition

The third edition of the Nepalese National Formulary consists of three sections containing guidelines on rational use of medicines, classified notes of drugs and appendices respectively. The second section contains 19 chapters including drugs used in dentistry as entirely new addition. Each chapter is dedicated to specific organ system. The chapter begins with classification with list of drugs in alphabetical order. The major classes of drugs are presented in white color against black background. Drug names are presented in all-capital cases for better visualization. The description of drug consists of dosage form and strength, indications, contraindications/precautions, dosage schedule, adverse effects, drug and food interaction, and patient information as applicable. The last section contains information on drug interaction, National List of Essential Medicines, 2016 and adverse drug reaction (ADR) reporting form.

The Formulary Committee appointed by the Ministry of Health steered the development process and progress. The editorial committee comprising of Dr. Sangha Ratna Bajracharya, Dr. Satish Deo and Mr. Navin Shrestha prepared and organized the information. The first draft of the revised edition was prepared in July 2017. Advisory meetings of experts were conducted on several occasions, feedbacks were incorporated and a two days Consultation Workshop held during the first week of December. Suggestions and inputs were incorporated and tabled at the formulary committee meeting as the third edition of the Nepalese National Formulary. I would like to extend my heartfelt thanks to World Health Organization for supporting the entire process of review and to all the contributors, whose scientific and technical input was highly appreciable.

Developed with the most current evidences and good practices, medical practitioners, pharmacist, nurses and other health care professional can benefit in aligning their day-to day practices for best clinical outcomes and help promote rational use of medicines. I strongly feel that the outcome of this herculean task needs wider distribution not only in print but also in the form of electronic application in future for easy access and regular updates. This edition is developed with significant new molecules and monographs presented in style that suffice the clinicians' demand as well as scientific information. However, inclusion of the newer drugs in the formulary does not ensure its official registration with Department of Drug Administration. It is expected that the formulary will be very helpful to medical practitioners as a valuable resource on various aspects of medicines used in the country.

Narayan Prasad Dhakal

Director General

Department of Drug Administration

Drugs added in NNF 2018

Drugs used in Gastrointestinal disorders

1. Adalimumab
2. Drotaverine
3. Macrogol 3350
4. Magnesium hydroxide
5. Mesalazine
6. Octreotide
7. Peg Interferon Alfa
8. Polyethylene glycol 3350
9. Probiotics
10. Rifaximin
11. Secnidazole
12. Terlipressin

Drugs used in Cardiovascular disorders

13. Bosentan
14. Clonidine
15. Ezetimide
16. Irbesartan
17. Labetalol
18. Metolazone
19. Milrinone
20. Nebivolol
21. Norepinephrine
22. Rosuvastatin
23. Telmisartan
24. Toremide

Drugs used in Blood disorders

25. Alteplase
26. Apixaban
27. Bivalirudin
28. Dabigatran
29. Factor IX complex
30. Ferrous fumarate with folic acid
31. Ferrous sulphate with ascorbic acid
32. Fondaparinux
33. Prasugrel
34. Rivaroxaban
35. Tenecteplase
36. Ticlopidine

Drugs used in Renal disorders

37. Bethanechol
38. Eplerenone
39. Mirabegron
40. Oxybutynin
41. Solifenacin
42. Tolterodine

Drugs used in Respiratory disorders

43. Acetylcysteine
44. Caffeine citrate
45. Doxofylline
46. Formoterol
47. Montelukast
48. Sodium cromoglycate
49. Zafirlukast

Drugs used in Neurological and Psychiatric disorders

50. Amisulpride
51. Aripiprazole
52. Atomoxetine
53. Donepezil Hydrochloride
54. Dosulepin (dothiepin)
55. Duloxetine
56. Entacapone
57. Flunarizine
58. Lacosamide
59. Levetiracetam
60. Memantine Hydrochloride
61. Methylphenidate
62. Naloxone
63. Pramipexole
64. Pregabalin
65. Quetiapine
66. Rasagiline
67. Rivastigmine
68. Rizatriptan
69. Ropinirole
70. Selegiline
71. Topiramate
72. Venlafaxine

Drugs used in Anesthesia and Critical Care

73. Atropine
74. Diazepam
75. Fentanyl
76. Lorazepam
77. Midazolam
78. Metochlopramide
79. Morphine
80. Omeprazole
81. Oxygen
82. Promethazine
83. Ranitidine
84. Sevoflurane

Drugs used in Musculoskeletal and Joint disorders

85. Abatacept
86. Adalimumab
87. Anakinra
88. Baclofen
89. Celecoxib
90. Denosumab
91. Dexmedetomidine
92. Diacerein
93. Etanercept
94. Etidronate
95. Etoricoxib
96. Febuxostat
97. Hydroxychloroquine Sulphate (HCQS)
98. Ibandronate
99. Infliximab
100. Leflunomide
101. Pamidronate
102. Penicillamine
103. Risedronate
104. Rituximab
105. Tizanidine
106. Tocilizumab
107. Tofacutinib
108. Zoledronate

Drugs used in Infections

109. Amoxicillin with clavulanic acid
110. Ampicillin with sulbactam
111. Artesunate
112. Bedaquiline

113. Capreomycin
114. Clindamycin
115. Didanosine
116. Entecavir
117. Linezolid
118. Lopinavir with ritonavir
119. Moxifloxacin
120. Nelfinavir
121. Oseltamivir
122. Para-aminosalicylic acid
123. Piperacillin
124. Piperacillin with tazobactam
125. Secnidazole
126. Sofosbuvir
127. Ritonavir

Drugs used in Endocrine disorders

128. Calcitonin
129. Exemestane
130. Fulvestrant
131. Liraglutide
132. Octreotide
133. Orlistat
134. Sitagliptin
135. Somatotropin
136. Teriparatide

Drugs used in Reproductive disorder

137. Bicalutamide
138. Dinoprostone
139. Mifepristone

Drugs used as Antidotes and other substances used in poisoning

140. Corrosives
141. Ethylene glycol

Drugs used in Malignant diseases

142. Anastrozole
143. Arsenic trioxide
144. Bevacizumab
145. Bortezomib
146. Capecitabine
147. Carboplatin
148. Cetuximab
149. Daunorubicin
150. Docetaxil

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- | | |
|-----------------------|---------------------------------------|
| 151. Epirubicin | precipitated sulfur |
| 152. Erlotinib | 191. Flucinolone |
| 153. Etoposide | 192. Fusidic acid |
| 154. Exemestane | 193. Hydrocortisone with Fusidic acid |
| 155. Fludarabine | 194. Imiquimod |
| 156. Fulvestrant | 195. Mometasone |
| 157. Gefitinib | 196. Mupirocin |
| 158. Hydroxyurea | 197. Retapamulin |
| 159. Imatinib | 198. Sertaconazole |
| 160. Irinotecan | 199. Terbinafine |
| 161. Interferon beta | 200. Tazarotene |
| 162. Interferon gamma | 201. Potassium permanganate |
| 163. Mitoxantrone | 202. Psoralen |
| 164. Nilotinib | |
| 165. Osimertinib | |
| 166. Oxaliplatin | |
| 167. Pemetrexed | |
| 168. Sunitimab | |
| 169. Temozolomide | |
| 170. Topotecan | |
| 171. Trastuzumab | |
| 172. Tretinoin | |
| 173. Vinorelbine | |

Immunologicals

174. Measels, mumps and rubella (MMR) vaccine
175. Human papilloma virus (HPV) vaccine
176. Influenza vaccine
177. Rotavirus vaccine
178. Tetanus immunoglobulin

Drugs used in Skin disorders

179. Acitretin
180. Adapalene
181. Adapalene with benzoyl peroxide
182. Aluminium chloride hexahydrate
183. Amorolfine
184. Azelaic acid
185. Benzoyl peroxide with clindamycin
186. Eflornithine
187. Calcipotriol
188. Capsaicin
189. Chlorhexidine
190. Coal tar with salicylic acid and

Drugs used in Ophthalmological disorders

203. Bimatoprost
204. Bevacizumab
205. Brimonidine
206. Carbomer
207. Dorzolamide
208. Fluorometholone
209. Idoxuridine
210. Olopatadine
211. Travoprost

Drugs used in Ear, Nose and Throat disorders

212. Benzalkonium Chloride with choline salicylates
213. Cefdinir
214. Chloramphenicol with dexamethasone
215. Chlorhexidine with clotrimazole with lidocaine with metronidazole
216. Chromic acid
217. Cinnarizine
218. Ciprofloxacin with hydrocortisone
219. Desloratadine
220. Ebastine
221. Fluticasone
222. Glucose in glycerin
223. Hydrogen peroxide
224. Neomycin with betamethasone
225. Neomycin with polymixin with hydrocortisone

- 226. Silver nitrate
- 227. Tobramycin with
dexamethasone
- 228. Turpentine oil
- 229. Valacyclovir

Drugs used in Dental disorders

This chapter has been added

Drugs omitted from NNF 2010

1. Acetic acid
2. Aluminium acetate
3. Aluminium diacetate
4. Amfebutamone hydrochloride
5. Ammoidin
6. Bacitracin
7. Bemiparin
8. Bendrofluazide
9. Bumetanide
10. Busulphan
11. Butorphanol
12. Cholera vaccine
13. Clidinium
14. Clioquinol
15. Cyproheptadine
16. Dehydroemetine
17. Demeclocycline
18. Dicycloverine hydrochloride
19. Dimethindene
20. Econazole
21. Ether
22. Flucytosine
23. Fluocinonide
24. Framycetin
25. Gallamine
26. Halcinonide
27. Hydroxypropyl cellulose
28. Isopropamide
29. Levamisole
30. Lindane
31. Magaldrate
32. Meclozine hydrochloride
33. Medrysone
34. Methoxsalen
35. Mianserin
36. Nimesulide
37. PABA
38. Paraldehyde
39. Pimozide
40. Polythiazide
41. Propantheline
42. Quinidine
43. Ritodrine
44. Rose bengal
45. Rosiglitazone
46. Simethicone
47. Sodium thiosulfate
48. Spectinomycin
49. Spermicidal contraceptives
50. Sulfadimidine
51. Sulphacetamide
52. Thioacetazone
53. Titanium dioxide
54. Triprolidine

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Section I

Guidelines on Rational Prescribing

Section I

Guidelines on Rational Prescribing

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- 2 *Personal drug (P-drug)*
- 3 *Drug combinations - how rational are they?*
- 4 *Prescription writing*
- 5 *Adherence with drug treatment*
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- 7 *Controlled drugs and drug dependence*
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- 9 *Drug interactions*
- 10 *Prescribing in pregnancy*
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1. Rational prescribing

In the context where a lot of potent medicines can exert harmful effects, the decision as to whether a medicine is necessary or not is very important. Drugs should only be prescribed when they are necessary, and in all cases the benefit of administering the medicine should be considered in relation to the risks involved. Rational prescribing means prescribing right medicine, to the right patient, for the right indication, at the right time, in right amount, for the right duration, its right documentation and providing right information to the patient.

Rational prescribing gained more significance in terms of medical, socio-economical and legal aspects. Increased number of drugs available has incredibly complicated the choice of appropriate drugs for particular indication. The irrational use of drugs may lead to overcrowding of 'me too' drugs and increased cost of treatment. Bad prescribing habits lead to ineffective and unsafe treatment, exacerbation or prolongation of illness, distress or harm to the patient and higher cost.

The following steps will help to remind prescribers of the rational approach to therapeutics:

1. Define the patient's problem

Whenever possible, making the right diagnosis is based on integrating many pieces of information: the complaint as described by the patient; a detailed history, physical examination and investigations.

2. Specify the therapeutic objective

Doctors must clearly state their therapeutic objectives based on the pathophysiology underlying the clinical situation. The pathophysiology determines the possible site of action of the drug and the maximum therapeutic effect that can be achieved.

3. Select the therapeutic strategies

The selected strategy should be agreed with the patient. The selected treatment can be non-pharmacological and/or pharmacological; it also needs to take into account the total cost of all therapeutic options.

a. Non-pharmacological treatment

It is very important to bear in mind that the patient does not always need a drug for treatment of their condition. Very often, health problems can be resolved by a change in lifestyle or diet, use of physiotherapy or exercise, provision of adequate psychological support, and other non-pharmacological treatments; and instructions for such treatments must be written, explained, and monitored in the same way.

b. Pharmacological treatment

Selecting the correct group of drugs

Knowledge about the pathophysiology involved in the clinical situation of each patient and the pharmacodynamics of the chosen group of drugs, are the two fundamental principles for rational therapeutics.

Selecting the drug from the chosen group

The selection process must consider benefit, risk and cost of treatment. This step is based on evidence about maximal clinical benefits of the

drug for a given indication (efficacy) with the minimum production of adverse effects (safety). In cost comparisons between drugs, the cost of the total treatment and not only the unit cost of the drug must be considered.

Verifying the suitability of the chosen pharmaceutical treatment for each patient

The prescriber must check whether the active substance chosen, its dosage form, standard dosage schedule, and standard duration of treatment are suitable for each patient. Drug treatment should be individualized to the needs of each patient.

4. Prescription writing

As the prescription is the link between the prescriber, the pharmacist (or dispenser), and the patient, it is vital to the successful management of the presenting medical condition. This item is covered in more detail in a following section (see Prescription writing).

5. Giving information, instructions, and warnings

This step is important to ensure patient adherence and is covered in detail in section “Adherence with drug treatment”.

6. Monitoring treatment

Evaluation of the follow-up and the outcome of treatment assist for an appropriate decision for stopping it (if the patient’s problem is solved) or its reformulation when necessary. This step gives rise to important information about the effects of drugs, contributing to the building up of the body of knowledge of pharmacovigilance, which is needed to promote the rational use of drugs.

2. Personal drug (P-drug)

Personal drugs (or P-drug) are the drugs you have chosen to prescribe regularly, and with which you have become familiar. They are your priority choice for given indications. Choice of P-drug will differ among prescribers and any choice should be based on availability and cost of drugs, different national formularies and essential drugs lists, medical culture, and individual interpretation of information.

Steps in choosing a P-drug

1. Define the diagnosis

A definite diagnosis is essential to begin choosing a P-drug.

2. Specify the therapeutic objective

Depending on the pathophysiology of disease, the therapeutic objective should be well defined, i.e. for which pathological change you would like to modify with the drug you are about to choose.

3. Make an inventory of effective groups of drugs

Management of a disease condition can be non-pharmacological

4. Choose an effective group according to criteria

5. Choose a P-drug from the P-group

6. Conclude with an active ingredient, dosage form and dosage schedule

3. Drug combinations - how rational are they?

Fixed-dose combination products are acceptable only when the dose of each ingredient meets the requirement of a defined population group and when the combination provides a proven advantage over single compound administered separately in therapeutic effect, safety or compliance.

Fixed-dose combinations are only acceptable if the following criteria are met:

1. Clinical documentation justifies the concomitant use of more than one drug.
2. The therapeutic effect is greater than the sum of the effect of each.
3. The cost of the combination product is less compared to the sum of the individual products.
4. Compliance is improved.
5. Sufficient drug ratios are provided to allow dosage adjustment satisfactory for the majority of the population.

Examples of useful drug combinations in Nepal's National List of Essential Medicines, 2016 are as follows:

- Amoxicillin + clavulanic acid (anti-bacterial)
- Artemether + lumefantrine (antimalarial)
- Benzoic acid + salicylic acid (for external use)
- Ethambutol + isoniazid (anti-tubercular)
- Ethambutol + rifampicin + isoniazid (anti-tubercular)
- Ethambutol + rifampicin + isoniazid + pyrazinamide (anti-tubercular)
- Ichthammol + glycerine (ear drop)
- Isoniazid + rifampicin (anti-tubercular)
- Isoniazid + rifampicin + pyrazinamide (anti-tubercular)
- Ethinylestradiol+ levonorgestrel (oral contraceptive)
- Ethinylestradiol + norethisterone (oral contraceptive)
- Ferrous sulfate + folic acid (anti-anaemic)
- Lopinavir + ritonavir (anti-viral)
- Levodopa + carbidopa (Parkinson's disease)
- Lidocaine + epinephrine (local anaesthetic)
- Mifepristone + misoprostol
- Saquinavir + ritonavir (anti-viral)
- Sulfadoxine + pyrimethamine (anti-malarial)
- Sulfamethoxazole + trimethoprim (anti-bacterial)
- Zidovudine + Lamivudine + Nevirapine (anti-retrovirals)

4. Prescription writing

A prescription is an instruction from a prescriber to a dispenser. The prescriber is not always a doctor but can be a paramedical worker, such as health assistant and community health workers (with restrictions). The dispenser is not always a pharmacist, but can be a pharmacy technician, an assistant, or a layperson. Thus, it is essential that following guidelines, which are not exclusive, for prescription writing be followed:

1. Prescriptions should be written legibly in ink and should be dated. The local language is preferred.
2. The prescriber's name, address and telephone number so that s/he can be

contacted if necessary.

3. The patient's full name, age, sex and address. If required, patient's body weight should also be mentioned.
 - Mentioning age is especially important for children under 12 years of age. Body weight is important when medicine doses are to be adjusted accordingly and body weight is expected to change during therapy.
4. The name, form, strength, frequency of the drugs and duration of the therapy should be clearly stated.
 - International Non-proprietary name or generic names should be used unless prescriber desires a specific brand name formulation for justifiable reasons.
 - Strengths of the formulation should be mentioned in standard (International System, SI) units.
 - Whole numbers should be used (500 mg instead of 0.5g, 500 micrograms instead of 0.5 mg).
 - For oral liquid preparations especially those for children, the dose should preferably be stated in terms of 5 ml spoonfuls.
 - Confusing abbreviations (mcg, U) and unnecessary decimals (1.00) should be avoided. When decimals are unavoidable, a zero should be written in front of the decimal points when there is no other figure e.g. 0.5 ml.
 - The route of administration and specific guidelines such as "whenever pain is severe" or "before" or "after meals" or "not to exceed twelve tablets a day" must be clearly stated.
 - Old Latin phrases should be avoided. To lessen the chance of error in giving medicines, it is very important that the frequency and time of giving drugs should be clearly stated in easily understandable terms, which may mean writing these instructions in the language which even the patient can read and understand.
5. Finally, the prescription should be signed by the prescriber and his/her registration number should be written at the bottom of the prescription.

5. Adherence with drug treatment

Adherence of the patient with the treatment plan is an important determinant of success of the treatment.

There are sometimes valid reasons for poor adherence – the drug may be poorly tolerated, may cause obvious adverse effects or may be prescribed in a toxic dose.

Bad prescribing or a dispensing error may also create a problem, which patients may have neither the insight nor the courage to question. Even with good prescribing, failure to adhere to treatment is common.

Reasons for non-compliance may be related to the patient, the disease, the doctor, the prescription, the pharmacist or the health system and can often be avoided.

Patients' perceptions of the risk and severity of adverse drug reactions may differ from those of the health-care provider and may affect adherence. Low-cost strategies for improving adherence increase effectiveness of health interventions and reduce costs. Such strategies must be tailored to the

individual patient. Health-care providers should be familiar with techniques for improving adherence and they should employ systems to assess adherence and to determine what influences it.

- **Patient factors**

In general, women tend to be more adherent than men, younger patients and the very elderly are less adherent, and people living alone are less adherent than those with partners or spouses. Specific education interventions have been shown to improve adherence. Patient disadvantages such as illiteracy, poor eyesight, or cultural attitudes (for example, preference for traditional or alternative medicines and suspicion of modern medicine) may be very important in some individuals or societies, as may economic factors. Such limitations or attitudes need to be discussed and taken into account.

- **Disease factors**

Conditions with a known worse prognosis (for example, cancer) or painful conditions (for example, rheumatoid arthritis) elicit better adherence than asymptomatic “perceived as benign” conditions such as hypertension.

- **Clinician**

Treating clinician/physician may cause poor adherence in many ways – by failing to inspire confidence in the treatment offered, by giving too little or no explanation, by thoughtlessly prescribing too many medicines, by making errors in prescribing, or by their overall attitude towards the patient.

- **The doctor–patient interaction**

There is considerable evidence that the quality of the doctor–patient interaction is crucial to concordance. “Satisfaction with the interview” is one of the best predictors of good adherence. Patients are often well informed and expect a greater say in their health care. If they are in doubt or dissatisfied, they may turn to alternative options, including “complementary medicine”. There is no doubt that the word “doctor” has a powerful effect on inspiring confidence and perhaps contributing directly to the healing process.

- **Prescription factors**

Many aspects of the prescription may lead to non-adherence (non-compliance). It may be illegible or inaccurate; it may not be refilled as intended or instructed for a chronic disease. Also, the prescription may be too complex; the greater the number of different medicines, the poorer the adherence. Multiple doses also decrease adherence, especially if more than two doses per day are given. Not surprisingly, adverse effects like drowsiness, impotence, or nausea reduce adherence and patients may not admit to the problem.

- **Pharmacist**

The pharmacist’s manner and professionalism, may have a positive influence on adherence, or a negative one, raising suspicions or concerns. This has been reported in relation to generic drugs when substituted for brand-name drugs. Pharmacist information and advice can be a valuable reinforcement, as long as it agrees with the doctor’s advice.

- **The health-care system**

The health-care system may be the biggest factor to adherence. Long

waiting times, uncaring staff, an uncomfortable environment, and unreliable drug supplies, are all common problems in many settings, and have a major impact on adherence. An important problem is the distance from and the accessibility to the clinic. Some studies have confirmed the obvious, that patients furthest from the clinic are least likely to adhere to treatment in the long term.

Recommendations

- Review the prescription to make sure it is correct.
- Spend time explaining the health problem and the reason for the drug.
- Establish good rapport with the patient.
- Explore problems, for example, difficulty with reading the label or getting the prescription filled.
- Encourage patients to bring their medication to the clinic, so that tablet counts can be done to monitor compliance.
- Encourage patients to learn the names of their medicines, and review their regimen with them. Write notes for them.
- Keep treatment regimens simple.
- Communicate with other health-care professionals to develop a team approach and to collaborate on helping and advising the patient.
- Involve the partner or another family member.
- Listen to the patient.

6. General guidance

Medicine should be prescribed only when necessary after taking into account the risk/benefit ratio. Majority of drugs besides their therapeutic benefits have side-effects and some even have toxic effects. Some of these may be dose-related and preventable, but others may appear at doses which are necessary for the required therapeutic effect. In such conditions the prescriber will have to make a decision as to whether the benefit obtained from the use of the drug justifies the risk involved. It is particularly important during pregnancy. It is also known that many clinical symptoms are caused by self-limiting illnesses which will pass even without treatment. Use of drug such as potent antibiotics for fairly trivial condition is not justified.

What is a medicine?

A medicine has been defined by National Medicine Policy, Nepal as “Any substance which is intended to be used in human beings or animals and birds for diagnosis, treatment, mitigation and prevention of diseases or for promotion of health or for the destruction of micro-organisms which have caused diseases or to affect the physical structure or function of the body”.

National list of essential drugs

Essential drugs are those that satisfy the priority health care needs of the population. They should therefore be available at all times in adequate amounts and in appropriate dosage forms, with assured quality and adequate information, and at a price the individual and the community can afford. WHO has provided a model list of essential drugs, which is revised periodically. National List of Essential Drugs for Nepal was prepared in 1986 based on WHO model list of essential drugs and considering other factors

such as the pattern of prevalent diseases; the treatment facilities; the training and experience of the available personnel; the genetic, demographic and environmental factors. First revision of the list was done in 1992, second revision in 1997, third revision in 2002, fourth revision in 2010 and fifth revision in 2016. The National List of Essential Medicines, fifth revision 2016 contains 409 medicines. The list also contains complementary drugs which are for treating rare disorders, drugs with special pharmacological properties and alternative drugs when there is no response to the main essential drug or when the latter cannot be administered for any reason.

The National Medicine Policy aims at ensuring the availability of safe, effective, standard and quality drugs at affordable price, in quantity sufficient to cover the need of every corner of the country. This will be possible by implementation of the concept of essential medicines, following standard treatment schedule at various levels of health institutions, managing procurement, distribution, quality assurance of essential medicines.

Medicine names

1. Non-proprietary names

Non-proprietary or generic names should be used in prescribing as this will enable any suitable product to be dispensed, thus saving time and expense.

2. Proprietary names

Brand names are applied only to products marketed by owners of the trademarks. A single drug may have several brand names which might cause confusion to prescribers and patients alike. It adds to the cost of treatment, as brand names are more expensive.

Dose

It is the amount of medicine that is supposed to be administered at once. The dose stated is intended for general guidance and represent, unless otherwise stated, the usual range of doses suitable for adult use.

Dilutions

When it is necessary to prescribe fractional doses, liquid preparation for oral use should be diluted with suitable vehicle to make a dose volume of 5 ml or multiple of this, unless otherwise directed. Diluted preparations are less stable than the original preparation and dilution should be performed at the time of dispensing. Directions must be given on the suitable length of time the preparation can be kept with retained potency.

Strength and quantity

The strength or quantity to be contained in capsules, tablets etc. should be stated by the prescriber.

If the pharmacist receives an incomplete prescription for a systemically administered preparation the under-mentioned procedures should apply:

- a. An attempt must be made to contact the prescriber and ascertain the intention.
- b. If the prescriber can be contacted, details of quantity, strength and dose should be inserted by the prescriber on the incomplete prescription.
- c. If the prescriber has been contacted but it is not possible to obtain a

written intention regarding the incomplete prescription, the pharmacist may write on the form “prescriber contacted” and add the necessary details. This endorsement should be initialed and dated by the pharmacist.

- d. If the prescriber cannot be contacted and the pharmacist is qualified enough to make a professional judgement, a small quantity of the preparation, sufficient for 1-2 days may be dispensed and the patient asked to contact the prescriber for further action. When prepacked preparations are prescribed, the smallest pack should be dispensed. If the pharmacist has any doubt, an incomplete prescription must be referred back to the prescriber.

Advice to patients

Prescribers should advise patients if treatment is likely to affect their ability to drive motor vehicles, e.g., sedatives and antihistamines and the effect of alcohol on such drugs. When handling chemical or biological materials, particular attention must be given to the possibility of allergy, fits, explosion, radiation or poisoning. Patient must be warned to keep all medicines out of reach of children and poisons should be locked.

Labelling of containers

Name of patient, medicine, its preparations, strength and frequency/timing should be clearly labelled. If the prescriber desires that the description of the preparation be written, e.g. “sedative tablets”, it should appear on the label.

7. Controlled drugs and drug dependence

Medicines classified as Group Ka as per Drug Standard Rules, 2035 have high abuse potential and should be dispensed only after presentation of legal prescription (prescription written by a registered practitioner, registration number mentioned, dated) as well as in presence of a registered pharmacist. Medicine having high addiction potential are diamorphine (heroin), morphine, and the synthetic opiates. The likelihood, that the dose will be increased is considerable, physical dependence is common and the withdrawal syndrome may be severe.

Prescriptions ordering controlled drugs must be signed and dated by the prescriber, and the prescriber's address specified. The prescription must always be in the prescriber's own handwriting in ink or otherwise so that it cannot be effaced. It should contain the following information:

1. The name and address of the patient.
2. The medicine name, dose/strength and formulation.
3. The total quantity of the preparation or the number of dose units.

Dependence and misuse

The prevalence of drug dependence and misuse is a cause for concern to patient's family, social workers, police as well as to the prescribers.

The prescriber has three main responsibilities:

1. To prescribe medicines rationally. Prescriber should be careful about the indication, dose prescribed should be minimal and for minimal duration.
2. To see that the patient does not gradually increase the dose of the prescribed medicine by himself (without indication). This tendency is seen especially with hypnotics and anxiolytics. A minimal amount for minimum

duration should be prescribed, at least for the first prescription.

3. To avoid being used as an unwitting source or supply for addicts.

8. Adverse drug reactions (ADR)

Any drug may produce unwanted or unexpected adverse reactions. ADRs are defined as an appreciably harmful or unpleasant reaction, resulting from an intervention related to the use of a medicinal product, which predicts hazard from future administration and warrants prevention or specific treatment, or alteration of the dosage regimen, or withdrawal of the product.

ADRs can be classified and has characteristics as shown in the table below:

Table 1.1 : Classification of ADRs

Type	Mechanism	Examples
A	Augmented, dose related, Predictable	<ul style="list-style-type: none"> • Postural hypotension with antihypertensives • Hypoglycaemia with oral hypoglycaemics • Hypokalemia with diuretics
B	Bizzare, idiosyncratic, not dose related, Non-predictable	<ul style="list-style-type: none"> • Antibiotic induced rash • Phenytoin induced Steven-Johnson Syndrome/ Toxic Epidermal Necrolysis
C	Chronic/continuous, time related	<ul style="list-style-type: none"> • Analgesic Nephropathy • Dyskinesia with Levodopa
D	Delayed	<ul style="list-style-type: none"> • Thalidomide induced phocomelia • Vaginal cancer due to diethylstilbestrol
E	End of treatment	<ul style="list-style-type: none"> • Adrenocortical insufficiency due to abrupt corticosteroid withdrawal • Opioid withdrawal causing withdrawal syndrome • Insomnia due to abrupt benzodiazepam withdrawal

Major factors predisposing to adverse effects

Factors which predispose to adverse drug reactions are overdose, error during dose adjustments or relative overdose due to age or disease. The detection and recording of these reactions, known as pharmacovigilance, is of vital importance. Prescribers are urged to help by reporting adverse reactions to the ADR Regional Centres or Department of Drug Administration (Appendix III). Prescribers should be particularly alert when drugs are given to the elderly, children or pregnant women.

Prevention of adverse reactions

1. Never use a drug without good indication. If the patient is pregnant, do not use a drug unless the need for it is imperative.
2. Ask the history of previous reactions, allergy or idiosyncrasy to drugs.
3. Ask if the patient is taking other drugs. Drug interactions may occur.
4. Make suitable dose adjustments for the elderly and for patients with hepatic or renal disease. Pharmacogenetic factors may also be responsible for variation in metabolism of drugs, e.g. isoniazid and tricyclic antidepressants.
5. Prescribe as few drug as possible, use drugs with which you are familiar and give clear instruction so as not to be misunderstood.
6. Use a new drug cautiously and if serious reactions are expected, warn the

patient.

9. Drug interactions

Two or more drugs given at the same time may interact with each other. The interaction may be synergism (additive or potentiation) or antagonism of one drug by another, or occasionally some other effect.

Drug interactions may be pharmacodynamic or pharmacokinetic.

Pharmacodynamic interactions occur between drugs which have similar or antagonistic pharmacological effects. They are usually predictable from knowledge of the pharmacology of the interacting drugs and an interaction occurring with one drug is likely to occur with a related drug.

Pharmacokinetic interactions occur when one drug increases or reduces the amount of another drug available to produce its pharmacological action. An interaction occurring with one drug cannot be assumed to occur with a related drug unless their pharmacokinetic properties are similar. Drug interaction in some of the patients on a combination of drugs have potential for harmful effects. A known interaction will not necessarily occur to the same extent in all patients. Drugs with a narrow therapeutic index (such as phenytoin) and drugs which require careful dose control (such as anticoagulants, antihypertensives or antidiabetics) are most often involved in drug interaction. Patients at increased risk from drug interactions include the elderly and those with impaired renal or liver function.

For more detailed account see Appendix - I.

10. Prescribing in pregnancy

If possible, counselling of women before a planned pregnancy should be carried out, including discussion of risks associated with specific therapeutic agents, traditional medicines, and abuse of substances such as nicotine and alcohol. Folic acid supplements should be given during pregnancy planning because periconceptual use of folic acid reduces neural tube defects.

Drugs should be prescribed in pregnancy only if the expected benefits to the mother are thought to be greater than the risk to the fetus. All drugs should be avoided if possible during the first trimester. Drugs which have been used extensively in pregnancy and appear to be usually safe should be prescribed in preference to new or untried drugs and the smallest effective dose should be used. Well known single component drugs should usually be preferred to multi-component drugs.

Pregnancy risk categories

In 1979, the FDA established five letter risk categories - A, B, C, D and X - to indicate the potential of a drug to cause birth defects if used during pregnancy. The categories were determined by assessing the reliability of documentation and the risk to benefit ratio. These categories did not take into account any risks from pharmaceutical agents or their metabolites in breast milk. In the drug product label, this information was found in the section "Use in Specific Populations".

The former pregnancy categories, which still may be found in some package inserts, were as follows:

1. Category A

- Adequate and well-controlled studies have failed to demonstrate a risk to the fetus in the first trimester of pregnancy (and there is no evidence of risk in later trimesters).
- Example drugs or substances: levothyroxine, folic acid, liothyronine

2. Category B

- Animal reproduction studies have failed to demonstrate a risk to the fetus and there are no adequate and well-controlled studies in pregnant women.
- Examples: metformin, hydrochlorothiazide, cyclobenzaprine, amoxicillin, pantoprazole

3. Category C

- Animal reproduction studies have shown an adverse effect on the fetus and there are no adequate and well-controlled studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks.
- Example drugs: tramadol, gabapentin, amlodipine, trazodone

4. Category D

- There is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience or studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks.
- Example drugs: lisinopril, alprazolam, losartan, clonazepam, lorazepam

5. Category X

- Studies in animals or humans have demonstrated fetal abnormalities and/or there is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience, and the risks involved in use of the drug in pregnant women clearly outweigh potential benefits.
- Example drugs: atorvastatin, simvastatin, warfarin, methotrexate, finasteride

The following table lists drugs which may have harmful effects in pregnancy and indicates the trimester of risk. It is based on human data but information on animal studies has been included for some drugs when its omission might be misleading.

Absence of a medicine from the list does not imply safety

Table 1.2 : Pregnancy risk categories of drugs

Medicine	Comment	Cat.
Abacavir	Toxicity in animal studies;	C
Acetazolamide	Not used to treat hypertension in pregnancy First trimester: Avoid (toxicity in animal studies)	C

Medicine	Comment	Cat.
Acetylsalicylic acid	Third trimester: Impaired platelet function and risk of haemorrhage; delayed onset and increased duration of labour with increased blood loss; avoid analgesic doses if possible in last few weeks (low doses probably not harmful); with high doses, closure of fetal ductus arteriosus in utero and possibly persistent pulmonary hypertension in the newborn; kernicterus in jaundiced neonates	C*
	*D in 3 rd trimester	
Aciclovir	Not known to be harmful; limited absorption from topical preparations	B
Albendazole	First trimester: avoid in nematode infections	C
Alcohol	First and second trimesters: Regular daily drinking is teratogenic (fetal alcohol syndrome) and may cause growth retardation; Third trimester: Withdrawal may occur in babies of alcoholic mothers	C
Allopurinol	Toxicity not reported; use only if no safer alternative and disease carries risk for mother or child	C
Amiloride	Not used to treat hypertension in pregnancy	B
Amitriptyline	Manufacturer advises avoid unless essential, particularly during first and third trimesters	C
Amlodipine	No information on use in humans; risk to fetus should be balanced against risk of uncontrolled maternal hypertension	C
Amoxicillin	Not known to be harmful	B
Amoxicillin + clavulanic acid	See Amoxicillin	B
Amphotericin B	Not known to be harmful but use only if potential benefit outweighs risk	B
Ampicillin	Not known to be harmful	B
Artemether	First trimester: Avoid	X
Artesunate	First trimester: Avoid	C
Asparaginase	Avoid	C
Atenolol	May cause intrauterine growth restriction, neonatal hypoglycaemia, and bradycardia; risk greater in severe hypertension	D
Atropine	Not known to be harmful	C
Azathioprine	Transplant patients should not discontinue azathioprine on becoming pregnant; use in pregnancy should be carefully supervised; there is no evidence that azathioprine is teratogenic but premature birth and low birth weight and spontaneous abortion reported following maternal or paternal exposure	D
Azithromycin	Limited information available; use only if adequate alternatives not available	B
Beclometasone	Benefit of treatment, for example in asthma, outweighs risk	C
Benzathine penicillin	Not known to be harmful	B
Benzyl penicillin	Not known to be harmful	B

Medicine	Comment	Cat.
Betamethasone	Benefit of treatment, for example in asthma, outweighs risk	C
Bleomycin	Avoid (teratogenic and carcinogenic in animal studies);	D
Bupivacaine	Third trimester: With large doses, neonatal respiratory depression, hypotonia, and bradycardia after paracervical or epidural block; lower doses of bupivacaine for intrathecal use during late pregnancy	C
Calcium	Manufacturer advises use only if potential benefit outweighs risk	C
Carbamazepine	First trimester: Risk of teratogenesis including increased risk of neural tube defects; risk of teratogenicity greater if more than one antiepileptic used; Third trimester: May possibly cause vitamin K deficiency and risk of neonatal bleeding; if vitamin K not given at birth, neonate should be monitored closely for signs of bleeding	D
Cefazolin	Not known to be harmful	B
Cefixime	Not known to be harmful	B
Ceftazidime	Not known to be harmful	B
Ceftriaxone	Not known to be harmful	B
Chlorambucil	Avoid; use effective contraception during administration to men or women	D
Chloramphenicol	Third trimester: Neonatal "grey" syndrome	C
Chloroquine	First and third trimesters: Benefit of prophylaxis and treatment in malaria outweighs risk	C
Chlorpheniramine	No evidence of teratogenicity	C
Chlorpromazine	Third trimester: Extrapyramidal effects in neonate occasionally reported or withdrawal symptoms after delivery	C
Cyclosporin	Only few studies available; but it does not appear to be any more harmful than azathioprine; use in pregnancy should be supervised in specialist units, take into consideration alcohol content of various cyclosporine formulations	C
Ciprofloxacin	Avoid (arthropathy in animal studies); safer alternatives available	C
Cisplatin	Avoid (teratogenic and toxic in animal studies);	D
Clindamycin	Not known to be harmful	B
Clomifene	Possible effects on fetal development	X
Clomipramine	Manufacturer advises avoid unless essential, particularly during first and third trimesters	C
Cloxacillin	Not known to be harmful	B
Codeine	Third trimester: Depresses neonatal respiration; withdrawal effects in neonates of dependent mothers; gastric stasis and risk of inhalation pneumonia in mother during labour	C
Contraceptives, Oral	Avoid; risk of developmental defects in sex organs and also non-genital malformations	X
Cyclophosphamide	Avoid; use effective contraception during and for at least 3 months after administration to men or women;	D
Cytarabine	Avoid (teratogenic in animal studies)	D

Medicine	Comment	Cat.
Dacarbazine	Avoid (carcinogenic and teratogenic in animal studies); use effective contraception during and for at least 6 months after administration to men or women	C
Dactinomycin	Avoid (teratogenic in animal studies)	D
Dapsone	Third trimester: Neonatal haemolysis and methaemoglobinaemia; folic acid, 5 mg daily, should be given to mother	C
Daunorubicin	Avoid (teratogenic and carcinogenic in animal studies)	D
Deferoxamine	Teratogenic in animal studies; manufacturer advises use only if potential benefit outweighs risk	C
Dexamethasone	Benefit of treatment, for example in asthma, outweighs risk; risk of intrauterine growth retardation on prolonged or repeated systemic treatment; corticosteroid cover required by mother during labour; monitor closely if fluid retention	C
Diazepam	Avoid regular use (risk of neonatal withdrawal symptoms); use only if clear indication such as seizure control (high doses during late pregnancy or labour may cause neonatal hypothermia, hypotonia, and respiratory depression)	D
Didanosine	Avoid if possible in first trimester; increased risk of lactic acidosis and hepatic steatosis;	B
Diethyl-carbamazine	Avoid: Delay treatment until after delivery	X
Digoxin	May need dosage adjustment	C
Diloxanide	Defer treatment until after first trimester	
Doxorubicin	Avoid (teratogenic and toxic in animal studies); with liposomal product use effective contraception during and for at least 6 months after administration to men or women	D
Doxycycline	First trimester: Effects on skeletal development in animal studies Second and third trimesters: Dental discoloration; maternal hepatotoxicity with large doses	D
Efavirenz	Avoid (potential teratogenic effects)	D
Eflornithine	Avoid	C
Emtricitabine	No information available; use only if essential	B
Enalapril	Avoid; may adversely affect fetal and neonatal blood pressure control and renal function; also possible skull defects and oligohydramnios; toxicity in animal studies	C, D*
	*C in 1 st trimester; D in 2 nd and 3 rd trimester	
Ephedrine	Increased fetal heart rate reported with parenteral ephedrine; potential; metabolic acidosis (umbilical artery pH of ≤ 7.2 in newborns at delivery with maternal ephedrine exposure)	C
Ergocalciferol	High doses teratogenic in animals but therapeutic doses unlikely to be harmful	C
Erythromycin	Not known to be harmful	B
Estradiol cypionate	Avoid - risk of developmental and psycho-sexual defects	X
Ethambutol	Not known to be harmful	B

Medicine	Comment	Cat.
Ethinylestradiol	Avoid - risk of developmental and psycho-sexual defects	X
Ethosuximide	First trimester: May possibly be teratogenic; risk of teratogenicity greater if more than one antiepileptic used	C
Etoposide	Avoid (teratogenic in animal studies)	D
Fluconazole	Avoid (multiple congenital abnormalities reported with long-term high doses)	D*
	*for indications other than vaginal candidiasis	
Flucytosine	Teratogenic in animal studies; manufacturer advises use only if potential benefit outweighs risk	C
Fluorouracil	Avoid (teratogenic)	D
Fluoxetine	Use only if potential benefit outweighs risk; risk of neonatal withdrawal, potential risk of persistent pulmonary hypertension in the newborn.	C
Fluphenazine	Third trimester: Extrapyramidal effects in neonate occasionally reported	C
Furosemide	Not used to treat hypertension in pregnancy	C
Gentamicin	Second and third trimesters: Auditory or vestibular nerve damage; risk probably very small with gentamicin, but avoid unless essential (if given, serum gentamicin concentration monitoring essential)	D
Glibenclamide/ Glyburide	Third trimester: Neonatal hypoglycaemia; insulin is normally substituted in all diabetics; if oral drugs are used, therapy should be stopped at least 2 days before delivery	C
Griseofulvin	Avoid (fetotoxicity and teratogenicity in animals); use effective contraception during and for at least 1 month after administration (important: effectiveness of oral contraceptives reduced; also men should avoid fathering a child during and for at least 6 months after administration)	X
Haloperidol	Third trimester: Extrapyramidal effects in neonate occasionally reported	C
Halothane	Third trimester: Depresses neonatal respiration	C
Heparin	Maternal osteoporosis has been reported after prolonged use; multidose vials may contain benzyl alcohol; some manufacturers advise avoid	C
Hydralazine	Avoid during first and second trimesters; no reports of serious harm following use in third trimester	C
Hydrochloro- thiazide	Not used to treat hypertension in pregnancy Third trimester: May cause neonatal thrombocytopenia	B
Hydrocortisone	Benefit of treatment, for example in asthma, outweighs risk; risk of intrauterine growth retardation on prolonged or repeated systemic treatment; corticosteroid cover required by mother during labour; monitor closely if fluid retention	C
Ibuprofen	Avoid unless potential benefit outweighs risk Third trimester: With regular use closure of fetal ductus arteriosus in utero and possibly persistent pulmonary hypertension in the newborn; delayed onset and increased duration of labour	C*
	* Not recommended during 3 rd trimester	

Medicine	Comment	Cat.
Imipenem + cilastatin	Use only if potential benefit outweighs risk (toxicity in animal studies)	C
Indinavir	Avoid if possible in first trimester; theoretical risk of hyperbilirubinaemia and renal stones in neonates if used at term	C
Insulin	Insulin requirements should be assessed frequently by an experienced diabetes clinician	B
Iodine	Second and third trimesters: Neonatal goitre and hypothyroidism	D
Ipratropium bromide	Not known to be harmful	B
Isoniazid	Not known to be harmful	C
Ivermectin	Delay treatment until after delivery	C
Ketamine	Third trimester: Depresses neonatal respiration	C
Lamivudine	Avoid if possible in first trimester; benefit of treatment considered to outweigh risk in second and third trimesters;	C
Levamisole	Third trimester: Avoid	C
Levodopa + carbidopa	Toxicity in animal studies	C
Levonorgestrel	Avoid	X
Levothyroxine	Monitor maternal serum thyrotrophin concentration; levothyroxine may cross the placenta and excessive dosage can be detrimental to fetus	A
Lidocaine	Third trimester: With large doses, neonatal respiratory depression, hypotonia, and bradycardia after paracervical or epidural block	B
Lithium	First trimester: Avoid if possible (risk of teratogenicity including cardiac abnormalities) Second and third trimesters: Dose requirements increased (but on delivery return to normal abruptly); close monitoring of serum lithium concentration advised (risk of toxicity in neonate)	D
Lopinavir + ritonavir	Avoid if possible in first trimester; avoid oral solution due to high propylene glycol content	C
Magnesium sulfate	Fetal skeletal demineralization, hypocalcemia, hypermagnesium reported with continuous long-term use (ie longer than 5-7days), preterm labor in pregnant women; the effect on the developing fetus may result in neonates with skeletal abnormalities. Third trimester: not known to be harmful for short term intravenous administration in eclampsia but excessive doses may cause neonatal respiratory depression	D
Mebendazole	Toxicity in animal studies. Contraindicated in cestode infections First trimester: Avoid in nematode infections	C
Medroxy-progesterone acetate	Avoid (genital malformations and cardiac defects reported in male and female fetuses); inadvertent use of depot medroxyprogesterone acetate contraceptive injection in pregnancy unlikely to harm fetus	X
Mefloquine	Use only if other antimalarials inappropriate,	B
Mercaptopurine	Avoid (teratogenic)	D

Medicine	Comment	Cat.
Metformin	All trimesters: Avoid; insulin is normally substituted in all diabetics	B
Methadone	Third trimester: Depresses neonatal respiration; withdrawal effects in neonates of dependent mothers; gastric stasis and risk of inhalation pneumonia in mother during labour	C
Methotrexate	Avoid (teratogenic); fertility may be reduced during therapy but this may be reversible; use effective contraception during and for at least 6 months after administration to men or women	X
Methyldopa	Not known to be harmful	B
Metoclopramide	Not known to be harmful	B
Metronidazole	Avoid high-dose regimens	B
Mifepristone	If treatment fails, pregnancy must be terminated by another method	X
Misoprostol	Potent uterine stimulant; may be teratogenic; if medical abortion fails, pregnancy must be terminated by another method	X
Morphine	Third trimester: Depresses neonatal respiration; withdrawal effects in neonates of dependent mothers; gastric stasis and risk of inhalation pneumonia in mother during labour	C*
* Category D on prolonged use or high dose		
Naloxone	Use only if potential benefit outweighs risk	C
Nelfinavir	Avoid if possible in first trimester; potential benefit of treatment considered to outweigh risk in second and third trimesters	B
Neostigmine	Third trimester: Neonatal myasthenia with large doses	C
Nevirapine	Avoid if possible in first trimester; benefit of treatment considered to outweigh risk in second and third trimesters	C
Niclosamide	T. solium infections in pregnancy should be treated immediately	B
Nifedipine	Some dihydropyridines are teratogenic in animals, but risk to fetus should be balanced against risk of uncontrolled maternal hypertension; may inhibit labour (used for premature labour)	C
Nifurtimox	First trimester: Avoid	B
Nitrofurantoin	Third trimester: May produce neonatal haemolysis if used at term	B*
* Contraindicated at term		
Nitrous oxide	Third trimester: Depresses neonatal respiration	C
Norethisterone	Avoid	X
Nystatin	No information available, but absorption from gastrointestinal tract negligible	C
Ofloxacin	Avoid (arthropathy in animal studies); safer alternatives available	C
Oxamniquine	If immediate treatment not required, schistosomiasis treatment should be delayed until after delivery;	C
Paracetamol	Not known to be harmful	B

Medicine	Comment	Cat.
Paromomycin	Second and third trimesters: Auditory or vestibular nerve damage possible; no information on use in humans	C
Penicillamine	Fetal abnormalities reported rarely; avoid if possible	D
Pentamidine isetionate	Potentially fatal visceral leishmaniasis must be treated without delay; should not be withheld in trypanosomiasis even if evidence of meningoencephalitic involvement; potentially fatal <i>P. carinii</i> (<i>P. jiroveci</i>) pneumonia must be treated without delay	C
Pentavalent antimony compounds	Potentially fatal visceral leishmaniasis must be treated without delay	
Phenobarbital	First and third trimesters: Congenital malformations – risk of teratogenicity greater if more than one antiepileptic used; may possibly cause vitamin K deficiency and risk of neonatal bleeding; if vitamin K not given at birth, neonate should be monitored closely for signs of bleeding	D
Phenytoin	First and third trimesters: Congenital malformations (screening advised); adequate folate supplements should be given to mother (for example, folic acid 5 mg daily); risk of teratogenicity greater if more than one antiepileptic used; may possibly cause vitamin K deficiency and risk of neonatal bleeding; if vitamin K not given at birth, neonate should be monitored closely for signs of bleeding NOTE. Caution in interpreting plasma phenytoin concentrations – bound phenytoin may be reduced but free (or effective) phenytoin unchanged;	D
Phytomenadione	No specific information available; use only if potential benefit outweighs risk	C
Podophyllum resin	Avoid; neonatal death and teratogenesis have been reported	X
Potassium iodide	Second and third trimesters: Neonatal goitre and hypothyroidism	D
Praziquantel	<i>T. solium</i> infections in pregnancy should be treated immediately; benefit of treatment in schistosomiasis outweighs risk; if immediate treatment not considered essential for fluke infections, treatment should be delayed until after delivery	B
Prednisolone	Benefit of treatment, for example in asthma, outweighs risk; risk of intrauterine growth retardation on prolonged or repeated systemic treatment; corticosteroid cover required by mother during labour; monitor closely if fluid retention	C
Primaquine	Third trimester: Neonatal haemolysis and methaemoglobinaemia; delay treatment until after delivery	C
Procarbazine	Avoid (teratogenic in animal studies and isolated reports in humans)	D

Medicine	Comment	Cat.
Proguanil	Benefit of prophylaxis and of treatment outweighs risk; adequate folate supplements should be given to mother	C
Promethazine	No evidence of teratogenicity	C
Propranolol	May cause intrauterine growth restriction, neonatal hypoglycaemia, and bradycardia; risk greater in severe hypertension	C
Propylthiouracil	Second and third trimesters: Neonatal goitre and hypothyroidism	D
Pyrazinamide	Use only if potential benefit outweighs risk	C
Pyridostigmine	Third trimester: Neonatal myasthenia with large doses	B
Pyrimethamine	First trimester: Theoretical teratogenic risk (folate antagonist); adequate folate supplements should be given to the mother; avoid in pneumocystosis and toxoplasmosis; see Sulfadiazine	C
Quinidine	Not known to be harmful at therapeutic doses	C
Quinine	First trimester: High doses are teratogenic; but in malaria benefit of treatment outweighs risk	X
Ranitidine	Not known to be harmful	B
Retinol	First trimester: Excessive doses may be teratogenic	A*
	* A (oral); C (doses >RDA); X (parenteral >6000U/day)	
Ribavirin	Avoid (teratogenic); use effective contraception during and for at least 7 months after administration to men or women	X
Rifampicin	First trimester: Very high doses teratogenic in animal studies; Third trimester: Risk of neonatal bleeding may be increased	C
Salbutamol	Appropriate to use for asthma; high doses should be given by inhalation only – parenteral use can affect the myometrium and possibly cause cardiac problems	C
Saquinavir	Avoid if possible in first trimester; potential benefit of treatment considered to outweigh risk in second and third trimesters	B
Silver sulfadiazine	Third trimester: Neonatal haemolysis and methaemoglobinaemia; fear of increased risk of kernicterus in neonates appears to be unfounded	C*
	* X: near term	
Simvastatin	Avoid – congenital anomalies reported; decreased synthesis of cholesterol possibly affects fetal development	X
Sodium nitroprusside	Potential for accumulation of cyanide in fetus – avoid prolonged use	C
Spironolactone	Toxicity in animal studies	C
Stavudine	Avoid if possible in first trimester; increased risk of lactic acidosis and hepatic steatosis	C
Streptokinase	Possibility of premature separation of placenta in first 18 weeks; theoretical possibility of fetal haemorrhage throughout pregnancy; risk of maternal haemorrhage on postpartum use	C
Streptomycin	Second and third trimesters: Auditory or vestibular nerve damage; avoid unless essential (if given, serum streptomycin concentration monitoring essential)	D

Medicine	Comment	Cat.
Sulfadiazine	Third trimester: Neonatal haemolysis and methaemoglobinaemia; fear of increased risk of kernicterus in neonates appears to be unfounded In toxoplasmosis, avoid in first trimester, but may be given in second and third trimester if danger of congenital transmission	C
Sulfadoxine + pyrimethamine	In malaria, benefit of prophylaxis and treatment outweigh risk First trimester possible teratogenicity Third trimester: Neonatal haemolysis and methaemoglobinaemia; fear of increased risk of kernicterus in neonates appears to be unfounded	C
Sulfamethoxazole + trimethoprim	First trimester: Teratogenic risk (trimethoprim is a folate antagonist) Third trimester: Neonatal haemolysis and methaemoglobinaemia; fear of increased risk of kernicterus in neonates appears to be unfounded	D
Sulfasalazine	Third trimester: Theoretical risk of neonatal haemolysis; adequate folate supplements should be given to mother * D (prolonged use)	B,D*
Suramin sodium	In onchocerciasis, delay treatment until after delivery; in <i>T. brucei rhodesiense</i> , treatment should be given even if evidence of meningoencephalopathic involvement	NA
Suxamethonium	Mildly prolonged maternal paralysis may occur	C
Tamoxifen	Avoid (possible effects on fetal development); use effective contraception during treatment and for at least 2 months after administration to women	D
Tenofovir	No information available; use only if potential benefit outweighs risk	B
Testosterone	Masculinization of female fetus	X
Tetracycline	First trimester: Effects on skeletal development in animal studies Second and third trimesters: Dental discoloration; maternal hepatotoxicity with large doses * D(systemic); C(periodontal fiber)	D*
Thiopental	Third trimester: Depresses neonatal respiration; dose should not exceed 250 mg	C
Trimethoprim	First trimester: Teratogenic risk (folate antagonist)	C
Vaccine, BCG	First trimester: Theoretical risk of congenital malformations, but need for vaccination may outweigh possible risk to fetus	C
Vaccine, Influenza	First trimester: avoid; Second and third trimester: not known to be harmful	C
Vaccine, MMR	Avoid; pregnancy should be avoided for 1 month after immunization	X
Vaccine, Poliomyelitis, live attenuated	First trimester: Theoretical risk of congenital malformations, but need for vaccination may outweigh possible risk to fetus * B (oral-trivalent)	B*
Vaccine, Rubella	Avoid; pregnancy should be avoided for 1 month after immunization	C

Medicine	Comment	Cat.
Vaccine, Vari-cella	Avoid; pregnancy should be avoided for 3 months after immunization	X
Vaccine, Yellow fever	First trimester: Theoretical risk of congenital malformations, however need for vaccination may outweigh possible risk to fetus especially after the 6th month of pregnancy; pregnant women should be advised not to travel to areas where there is a risk of exposure to yellow fever	C
Valproic acid	First and third trimesters: Increased risk of congenital malformations and developmental delay (counselling and screening advised – folic acid supplements may reduce risk of neural tube defects); risk of teratogenicity greater if more than one antiepileptic used; neonatal bleeding (related to hypofibrinaemia) and neonatal hepatotoxicity also reported	D*
	* D (seizure and manic episodes); X (migraine)	
Vancomycin	Use only if potential benefit outweighs risk – plasma vancomycin concentration monitoring essential to reduce risk of fetal toxicity	C*
	*C (injection); B (oral)	
Vecuronium	No information available; use only if potential benefit outweighs risk	C
Verapamil	May reduce uterine blood flow with fetal hypoxia; may inhibit labour	C
Vinblastine	Avoid (limited experience suggests fetal harm; teratogenic in animal studies)	D
Vincristine	Avoid (teratogenicity and fetal loss in animal studies)	D
Warfarin	Congenital malformations; fetal and neonatal haemorrhage	D
Zidovudine	Avoid if possible in first trimester; benefit of treatment considered to outweigh risk in second and third trimesters	C

11. Prescribing during breast-feeding

Infants should be exclusively breastfed for the first 6 months of life; thereafter they should receive appropriate complementary food and continue to be breastfed up to 2 years of age or beyond.

Breastfeeding mothers should inform their health care provider and their child's pediatrician of any medications or supplements they are taking, including herbal and over-the-counter products. Administration of some drugs (for example, ergotamine) to nursing mothers may harm the infant, whereas administration of others (for example, digoxin) has little effect. Some drugs inhibit lactation (for example, estrogens).

According to American Academy of Paediatrics (AAP), healthcare providers should weigh the risks and benefits of breastfeeding when prescribing medications to breastfeeding mothers by considering the following:

- Need for the drug by the mother.
- Potential effects of the drug on milk production.

- Amount of the drug excreted into human milk.
- Extent of oral absorption by the breastfeeding infant.
- Potential adverse effects on the breastfeeding infant.
- Age of the infant.

Toxicity to the infant can occur if the drug enters the milk in pharmacologically significant quantities. The concentration in milk of some drugs (for example, iodides) may exceed the concentration in the maternal plasma so that therapeutic doses in the mother may cause toxicity to the infant. Some drugs inhibit the infant's sucking reflex (for example, phenobarbital). Drugs in breast milk may, at least theoretically, cause hypersensitivity in the infant even when the concentration is too low for a pharmacological effect.

The following table lists drugs: which should be used with caution or which are contraindicated in breast-feeding for the reasons given above; which, on present evidence, may be given to the mother during breast-feeding, because they appear in milk in amounts which are too small to be harmful to the infant; which are not known to be harmful to the infant although they are present in milk in significant amounts.

For many drugs sufficient evidence is not available, and it is advisable to administer only drugs essential to a mother during breast-feeding. Because of the inadequacy of information on drugs in breast milk the following table should be used only as a guide; absence from the table does not imply safety.

Advice in the table may differ from other sources, including manufacturer's product literature.

Table 1.3 : Breast feeding and drugs

Drug	Comments
Abacavir	Antiretroviral drugs may be present in breast milk, and may reduce viral load in breast milk and reduce the risk of transmission through breast-feeding. However, the concentration of antiretroviral drugs in breast milk may not be adequate to prevent viral replication and there is therefore possibility of promoting the development of drug-resistant virus which could be transmitted to the infant. Avoid breast-feeding if possible. Otherwise, exclusive breast-feeding is recommended during the first months of life, then should be discontinued as soon as feasible
Acetazolamide	Amount too small to be harmful
Aciclovir	Significant amount in milk after systemic administration, but considered safe to use
Alcohol	Large amounts may affect infant and reduce milk consumption
Allopurinol	Present in milk—not known to be harmful
Amiloride	Manufacturer advises avoid—no information available
Amitriptyline	Presence in milk possible; monitor infant
Amlodipine	Presence in milk possible; monitor infant
Amoxicillin	Trace amounts in milk; safe in usual dosage; monitor infant
Amoxicillin + clavulanic acid	Trace amounts in milk
Ampicillin	Trace amounts in milk; safe in usual dosage; monitor infant

Drug	Comments
Artemether + lumefantrine	Discontinue breast-feeding during and for 1 week after stopping treatment; present in milk in animal studies
Asparaginase	Breast-feeding contraindicated
Aspirin	Short course safe in usual dosage; monitor infant; regular use of high doses could impair platelet function and produce hypoprothrombinaemia in infant if neonatal vitamin K stores low; possible risk of Reye syndrome
Atenolol	Significant amounts in milk; safe in usual dosage; monitor infant
Atropine	Small amount present in milk; monitor infant
Azathioprine	Breast-feeding contraindicated
Azithromycin	Present in milk; limited information available—use only if no suitable alternative
Beclometasone	Systemic effects in infant unlikely with maternal dose of less than equivalent of prednisolone 40 mg daily; monitor infant's adrenal function with higher doses—the amount of inhaled drug in breast milk is probably too small to be harmful
Benzathine penicillin	Trace amounts in milk; safe in usual dosage; monitor infant
Benzylpenicillin	Trace amounts in milk; safe in usual dosage; monitor infant
Betamethasone	Systemic effects in infant unlikely with maternal dose of less than equivalent of prednisolone 40 mg daily; monitor infant's adrenal function with higher doses
Bleomycin	Breast-feeding contraindicated
Bupivacaine	Amount too small to be harmful
Carbamazepine	Continue breast-feeding; adverse effects possible (severe skin reaction reported in 1 infant), monitor infant for drowsiness
Cefixime	Probably present in milk but safe in usual dosage; monitor infant
Ceftazidime	Excreted in low concentrations; safe in usual dosage; monitor infant
Ceftriaxone	Excreted in low concentrations; safe in usual dosage; monitor infant
Chlorambucil	Breast-feeding contraindicated
Chloramphenicol	Continue breastfeeding; use alternative drug if possible; may cause bone-marrow toxicity in infant; concentration in milk usually insufficient to cause 'gray baby syndrome'
Chloroquine	For malaria prophylaxis, amount probably too small to be harmful; inadequate for reliable protection against malaria; avoid breast-feeding when used for rheumatic disease
Chlorpheniramine	Safe in usual dosage; monitor infant for drowsiness
Chlorpromazine	Continue breast-feeding; adverse effects possible; monitor infant for drowsiness
Ciclosporin	Present in milk—manufacturer advises avoid
Ciprofloxacin	Continue breast-feeding; use alternative drug if possible; high concentrations in breast milk
Cisplatin	Breast-feeding contraindicated

Drug	Comments
Clindamycin	Amount probably too small to be harmful but bloody diarrhoea reported in 1 infant
Clofazimine	Limited information available—can cause reversible skin discoloration in nursing infant
Clomifene	May inhibit lactation
Clomipramine	Small amount present in milk; continue breastfeeding; adverse effects possible; monitor infant for drowsiness
Cloxacillin	Trace amounts in milk; safe in usual dosage; monitor infant
Codeine	Amount too small to be harmful
Contraceptives, oral	Combined oral contraceptives may inhibit lactation—use alternative method of contraception until weaning or for 6 months after birth; progestogen-only contraceptives do not affect lactation (preferably start 6 weeks after birth or later)
Cyclophosphamide	Breast-feeding contraindicated during and for 36 hours after stopping treatment
Cytarabine	Breast-feeding contraindicated
Dacarbazine	Breast-feeding contraindicated
Dactinomycin	Breast-feeding contraindicated
Dapsone	Although significant amount in milk risk to infant very small; continue breast-feeding; monitor infant for jaundice
Daunorubicin	Breast-feeding contraindicated
Deferoxamine	Manufacturer advises use only if potential benefit outweighs risk—no information available
Dexamethasone	Systemic effects in infant unlikely with maternal dose of less than equivalent of prednisolone 40 mg daily; monitor infant's adrenal function with higher doses
Diazepam	Continue breast-feeding; adverse effects possible; monitor infant for drowsiness
Didanosine	see abacavir
Digoxin	Amount too small to be harmful
Diloxanide	Manufacturer advises avoid
Dimercaprol	Avoid
Doxorubicin	Contraindicated
Doxycycline	Continue breastfeeding; use alternative drug if possible (absorption and therefore discoloration of teeth in infant probably usually prevented by chelation with calcium in milk)
Efavirenz	see abacavir
Eflornithine	Avoid
Enalapril	Amount probably too small to be harmful
Ephedrine	Irritability and disturbed sleep reported
Ergocalciferol	Caution with high doses; may cause hypercalcaemia in infant
Erythromycin	Only small amounts in milk—not known to be harmful
Ethambutol	Amount too small to be harmful
Ethinylestradiol	Use alternative method of contraception; may inhibit lactation; see also contraceptives, oral
Ethosuximide	Significant amount in milk; continue breast-feeding; adverse effects possible; monitor infant for drowsiness
Etoposide	Contraindicated
Fluconazole	Present in milk; safe in usual dosage; monitor infant

Drug	Comments
Flucytosine	Manufacturer advises avoid
Fluorouracil	Discontinue breast-feeding
Fluphenazine	Amount excreted in milk probably too small to be harmful; continue breast-feeding; adverse effects possible; monitor infant for drowsiness
Furosemide	Amount too small to be harmful
Gentamicin	Amount probably too small to be harmful; monitor infant for thrush and diarrhoea
Glibenclamide	Theoretical possibility of hypoglycaemia in infant
Griseofulvin	Avoid—no information available
Haloperidol	Amount present in milk probably too small to be harmful; continue breast-feeding; adverse effects possible; monitor infant for drowsiness
Halothane	Present in milk
Hydralazine	Present in milk but not known to be harmful; monitor infant
Hydrochlorothiazide	Continue breast-feeding; may inhibit lactation
Hydrocortisone	Systemic effects in infant unlikely with maternal dose of less than equivalent of prednisolone 40 mg daily; monitor infant's adrenal function with higher doses
Ibuprofen	Amount too small to be harmful; short courses safe in usual doses
Imipenem + cilastatin	Present in milk—manufacturer advises avoid
Indinavir	see abacavir
Insulin	Amount too small to be harmful
Iodine	Stop breast-feeding; danger of neonatal hypothyroidism or goitre; appears to be concentrated in milk
Isoniazid	Monitor infant for possible toxicity; theoretical risk of convulsions and neuropathy; prophylactic pyridoxine advisable in mother and infant
Ivermectin	Avoid treating mother until infant is 1 week old
Lamivudine	Present in milk; see abacavir
Levamisole	Breast-feeding contraindicated
Levodopa + carbidopa	Present in milk—levodopa may inhibit lactation
Levonorgestrel	Combined oral contraceptives may inhibit lactation—use alternative method of contraception until weaning or for 6 months after birth; progestogen-only contraceptives do not affect lactation (preferably start 6 weeks after birth or later)
Levothyroxine	Amount too small to affect tests for neonatal hypothyroidism
Lidocaine	Amount too small to be harmful
Lithium	Present in milk and risk of toxicity in infant; continue breast-feeding; monitor infant carefully, particularly if risk of dehydration
Lopinavir + ritonavir	see abacavir
Lumefantrine	see artemether + lumefantrine
Mebendazole	Amount too small to be harmful

Drug	Comments
Medroxy-progesterone	Present in milk—no adverse effects reported (preferably start injectable contraceptive 6 weeks after birth or later)
Mefloquine	Present in milk but risk to infant minimal
Mercapto-purine	Breast-feeding contraindicated
Metformin	Present in milk but safe in usual doses; monitor infant
Methadone	Withdrawal symptoms in infant; dose should be as low as possible and infant monitored to avoid sedation
Methotrexate	Breast-feeding contraindicated
Methyldopa	Amount too small to be harmful
Metoclopramide	Present in milk; adverse effects possible; monitor infant for adverse effects
Metronidazole	Significant amount in milk; continue breast-feeding; avoid large doses; use alternative drug if possible
Mifepristone	Avoid breast-feeding for 14 days after administration
Misoprostol	No information available—manufacturer advises avoid
Morphine	Short courses safe in usual doses; monitor infant
Nelfinavir	see abacavir
Neostigmine	Amount probably too small to be harmful; monitor infant
Nevirapine	Present in milk; see abacavir
Nifedipine	Small amount in milk; continue breast-feeding; monitor infant
Nitrofurantoin	Only small amounts in milk but could be enough to produce hemolysis in G6PD deficient infants
Norethisterone	Combined oral contraceptives may inhibit lactation—use alternative method of contraception until weaning or for 6 months after birth; progestogen-only contraceptives do not affect lactation (preferably start injectable contraceptive 6 weeks after birth or later)
Nystatin	No information available, but absorption from gastrointestinal tract negligible
Ofloxacin	Continue breast-feeding; use alternative drug if possible
Oxamniquine	No information available, but considered preferable to avoid
Paracetamol	Small amount present in milk: short courses safe in usual dosage; monitor infant
Penicillamine	No information available—manufacturer advises avoid unless potential benefit outweighs risk
Pentamidine isetionate	Manufacturer advises avoid unless essential
Pentavalent antimony compounds	Avoid
Phenobarbital	Continue breast-feeding; adverse effects possible; monitor infant for drowsiness
Phenoxymethylpenicillin	Trace amounts in milk; safe in usual dosage; monitor infant
Phenytoin	Small amount present in milk; continue breast-feeding; adverse effects possible; monitor infant for drowsiness
Potassium iodide	Stop breast-feeding; danger of neonatal hypothyroidism or goitre; appears to be concentrated in milk

Drug	Comments
Povidone–iodine	Avoid; iodine absorbed from vaginal preparations is concentrated in milk
Praziquantel	Avoid breast-feeding during and for 72 hours after treatment; considered safe to continue breast-feeding in treatment of schistosomiasis
Prednisolone	Systemic effects in infant unlikely with maternal dose of less than prednisolone 40 mg daily; monitor infant's adrenal function with higher doses
Primaquine	No information available; risk of haemolysis in G6PD-deficient infants
Procainamide	Present in milk; continue breastfeeding; monitor infant
Procaine benzylpenicillin	Trace amounts in milk; safe in usual dosage; monitor infant
Procarbazine	Breast-feeding contraindicated
Proguanil	Amount probably too small to be harmful when used for malaria prophylaxis; inadequate for reliable protection against malaria in breastfed infant
Promethazine	Safe in usual dosage; monitor infant for drowsiness
Propranolol	Present in milk; safe in usual dosage; monitor infant
Propylthiouracil	Monitor infant's thyroid status but amounts in milk probably too small to affect infant; high doses might affect neonatal thyroid function
Pyrazinamide	Amount too small to be harmful
Pyridostigmine	Amount probably too small to be harmful
Pyrimethamine	Significant amount—avoid administration of other folate antagonists to infant; avoid breast-feeding during toxoplasmosis treatment
Quinidine	Significant amount but not known to be harmful
Quinine	Present in milk—continue breast-feeding and monitor infant; risk of haemolysis in G6PD-deficient infants
Ranitidine	Significant amount present in milk, but not known to be harmful
Retinol	Theoretical risk of toxicity in infants of mothers taking large doses
Rifampicin	Amount too small to be harmful
Ritonavir	see lopinavir with ritonavir
Salbutamol	Safe in usual dosage; monitor infant
Saquinavir	see abacavir
Senna	Continue breast-feeding; monitor infant for diarrhoea
Silver sulfadiazine	Continue breast-feeding; monitor infant for jaundice—small risk of kernicterus in infants particularly with long acting sulphonamides, and of haemolysis in G6PD-deficient infants
Sodium valproate	see valproate
Spectinomycin	No information available
Spironolactone	Amount probably too small to be harmful
Stavudine	see abacavir
Streptomycin	Present in milk; continue breast-feeding—monitor infant for thrush and diarrhoea

Drug	Comments
Sulfadiazine	Monitor infant for jaundice—small risk of kernicterus in infants and of haemolysis in G6PD-deficient infants; caution in ill or premature infants
Sulfadoxine + pyrimethamine	Monitor infant for jaundice—small risk of kernicterus in infants and of haemolysis in G6PD-deficient infants (due to sulfadoxine); caution in ill or premature infants
Sulfamethoxazole + trimethoprim	Monitor infant for jaundice—small risk of kernicterus in infants and of haemolysis in G6PD-deficient infants (due to sulfamethoxazole); caution in ill or premature infants
Sulfasalazine	Use with caution; monitor infant for jaundice—small amounts in milk (1 report of bloody diarrhoea and rashes); theoretical risk of neonatal haemolysis especially in G6PD-deficient infants; caution in ill or premature infants
Tamoxifen	Suppresses lactation; avoid unless potential benefit outweighs risk
Testosterone	Avoid; may cause masculinization in the female infant or precocious development in the male infant; high doses suppress lactation
Tetracycline	Continue breast-feeding; use alternative drug if possible (absorption and therefore discoloration of teeth in infant probably usually prevented by chelation with calcium in milk)
Thiamine	Severely thiamine-deficient mothers should avoid breast-feeding as toxic methyl-glyoxal excreted in milk
Thiopental	Present in milk—not known to be harmful
Trimethoprim	Present in milk; safe in usual dosage;
Valproic acid	Amount too small to be harmful
Vaccine, Influenza	Not known to be harmful
Vancomycin	Present in milk—significant absorption following oral administration unlikely
Verapamil	Amount too small to be harmful
Vinblastine	Breast-feeding contraindicated
Vincristine	Breast-feeding contraindicated
Warfarin	Risk of haemorrhage; increased by vitamin K deficiency. Trace amounts of warfarin found in breast milk. Amounts too small to reduce the blood clotting. Use cautiously.
Zidovudine	see abacavir

12. Prescribing in renal impairment

Reduced renal function may need adjustment in drug therapy for the following reasons:

1. The failure to excrete a drug or its metabolites may produce toxicity.
2. The sensitivity to some drugs is increased even if the renal elimination is unimpaired.
3. The tolerance to adverse effects may be impaired.
4. The efficacy of some drugs may diminish.

The dosage of many drugs must be adjusted in patients with renal impairment to avoid adverse reactions and to ensure efficacy. The level of renal function below which the dose of a drug must be reduced depends on

how toxic it is and whether it is eliminated entirely by renal excretion or is partly metabolized to inactive metabolites.

In general, all patients with renal impairment are given a loading dose which is the same as the usual dose for a patient with normal renal function. Maintenance doses are adjusted to the clinical situation. The maintenance dose of a drug can be reduced either by reducing the individual dose leaving the normal interval between doses unchanged or by increasing the interval between doses without changing the dose. The interval extension method may provide the benefits of convenience and decreased cost, while the dose reduction method provides more constant plasma concentration.

Renal impairment is usually divided into three grades:

1. **Mild** : GFR 20–50 ml/minute or approximate serum creatinine 150–300 micromol/litre
2. **Moderate** : GFR 10–20 ml/minute or serum creatinine 300–700 micromol/litre
3. **Severe** : GFR <10 ml/minute or serum creatinine >700 micromol/litre

When using the dosage guidelines the following must be considered:

- Drug prescribing should be kept to a minimum.
- Nephrotoxic drugs should, if possible, be avoided in all patients with renal disease because the nephrotoxicity is more likely to be serious.
- It is advisable to determine renal function not only before but also during the period of treatment and adjust the maintenance dose as necessary.
- Renal function (GFR, creatinine clearance) declines with age so that by the age of 80 it is half that in healthy young subjects. When prescribing for the elderly, assume at least a mild degree of renal impairment.
- Uraemic patients should be observed carefully for unexpected drug toxicity. In these patients the complexity of clinical status as well as other variables for example altered absorption, protein binding or metabolism, or liver function, and other drug therapy precludes use of fixed drug dosage and an individualized approach is required.

In the following table drugs are listed in alphabetical order. The table includes only drugs for which specific information is available. Many drugs adjustment is available; it is therefore important to also refer to the individual drug entries. The recommendations are given for various levels of renal function as estimated by the glomerular filtration rate (GFR), usually measured by the creatinine clearance (best calculated from a 24-hour urine collection). The serum-creatinine concentration is sometimes used instead as a measure of renal function but it is only a rough guide even when corrected for age, sex and weight by special nomograms.

Drugs to be avoided or used with caution in renal impairment:

Table 1.4 : Drugs and Renal impairment

Drug	Grade	Comment
Abacavir	Severe	Avoid
Acetazolamide	Mild	Avoid; metabolic acidosis
Aciclovir	Mild	Reduce intravenous dose Moderate to severe: Reduce dose

Drug	Grade	Comment
Allopurinol	Moderate	100–200 mg daily; increased toxicity; rashes Severe 100 mg on alternate days (maximum 100 mg daily)
Aluminium hydroxide	Severe	Aluminium is absorbed and may accumulate NOTE. Absorption of aluminium from aluminium salts is increased by citrates which are contained in many effervescent preparations (such as effervescent analgesics)
Amiloride	Mild	Monitor plasma potassium; high risk of hyperkalaemia in renal impairment; excreted by kidney unchanged
	Moderate	Avoid
Amoxicillin	Mild to moderate	Risk of crystalluria with high doses
	Severe	Reduce dose; rashes more common and risk of crystalluria
Amphotericin B	Mild	Use only if no alternative; nephrotoxicity may be reduced with use of lipid formulations
Ampicillin	Severe	Reduce dose; rashes more common
Artemether + lumefantrine	Severe	Caution; monitor ECG and plasma potassium
Aspirin	Severe	Avoid; sodium and water retention; deterioration in renal function; increased risk of gastrointestinal bleeding
Atenolol	Mild to moderate	Reduce dose to max. 50 mg daily if creatinine clearance 15–35 ml/minute
	Severe	May reduce renal blood flow and adversely affect renal function; reduce dose to max. 25 mg daily if creatinine clearance less than 15 ml/minute
Azathioprine	Severe	Reduce dose
Benzathine benzylpenicillin	Severe	Neurotoxicity—high doses may cause convulsions
Benzylpenicillin	Severe	Maximum 6 g daily; neuro-toxicity—high doses may cause convulsions
Bleomycin	Moderate	Reduce dose
Carbamazepine		Manufacturer advises caution
Cefixime	Moderate	Reduce dose
Ceftazidime	Mild	Reduce dose
Ceftriaxone	Severe	Maximum 2 g daily; also monitor plasma concentration if both severe renal impairment and hepatic impairment
Chlorambucil	Moderate	Use with caution and monitor response; increased risk of myelo-suppression
Chloramphenicol	Severe	Avoid unless no alternative; dose-related depression of haematopoiesis
Chloroquine	Mild to moderate	Reduce dose in rheumatic disease
	Severe	Reduce dose for malaria prophylaxis; avoid in rheumatic disease

Drug	Grade	Comment
Chlorpheniramine	Severe	Dose reduction may be required
Chlorpromazine	Severe	Start with small doses; increased cerebral sensitivity
Ciclosporin	Mild	Monitor kidney function—dose dependent increase in serum creatinine and urea during first few weeks may necessitate dose reduction (exclude rejection if kidney transplant)
Ciprofloxacin	Moderate	Use half normal dose
Cisplatin	Mild	Avoid if possible; nephrotoxic and neurotoxic
Cloxacillin	Severe	Reduce dose
Codeine	Moderate to severe	Reduce dose or avoid; increased and prolonged effect; increased cerebral sensitivity
Cyclophosphamide	Mild	Reduce dose
Dacarbazine	Mild to moderate	Dose reduction may be required
	Severe	Avoid
Daunorubicin	Mild to moderate	Reduce dose
Deferoxamine	Severe	Metal complexes excreted by kidneys (in severe renal impairment dialysis increases rate of elimination)
Diazepam	Severe	Start with small doses; increased cerebral sensitivity
Didanosine	Mild	Reduce dose; consult manufacturer's literature
Diethylcarbamazine	Moderate to severe	Reduce dose; plasma half life prolonged and urinary excretion considerably reduced
Digoxin	Mild	Reduce dose; toxicity increased by electrolyte disturbances
Doxycycline	Mild	Use with caution; avoid excessive doses
Efavirenz	Severe	No information available—caution advised
Enalapril	Mild	Use with caution and monitor response; initial dose 2.5 mg once daily if creatinine clearance less than 30 ml/minute. Hyperkalaemia and other adverse effects more common
Ephedrine	Severe	Avoid; increased CNS toxicity
Ergometrine	Severe	Manufacturer advises avoid
Erythromycin	Severe	Maximum 1.5 g daily (ototoxicity)
Ethambutol	Mild	Reduce dose; if creatinine clearance less than 30 ml/minute monitor plasma ethambutol concentration; optic nerve damage
Etoposide	Mild	Consider dose reduction
Fluconazole	Mild to moderate	Usual initial dose then halve subsequent doses
Flucytosine	Mild	Reduce dose if creatinine clearance < 40 ml/min and monitor plasma-flucytosine concentration; consult manufacturer's literature
Fluphenazine	Severe	Start with small doses; increased cerebral sensitivity

Drug	Grade	Comment
Furosemide	Moderate	May need high doses; deafness may follow rapid i/v injection
Gentamicin	Mild	Reduce dose; monitor plasma concentrations
Glibenclamide	Severe	Avoid
Haloperidol	Severe	Start with small doses; increased cerebral sensitivity
Heparin	Severe	Risk of bleeding increased
Hydralazine	Mild	Reduce dose if creatinine clearance less than 30 ml/minute
Hydrochlorothiazide	Moderate	Avoid; ineffective
Ibuprofen	Mild	Use lowest effective dose and monitor renal function; sodium and water retention; deterioration in renal function possibly leading to renal failure
	Moderate to severe	Avoid
Imipenem + cilastatin	Mild	Reduce dose
Insulin	Severe	May need dose reduction; insulin requirements fall; compensatory response to hypoglycaemia is impaired
Iohexol	Moderate to severe	Increased risk of nephrotoxicity; avoid dehydration
Iopanoic acid	Mild to moderate	Maximum 3 g
	Severe	Avoid
Isoniazid	Severe	Maximum 200 mg daily; peripheral neuropathy
Lamivudine	Mild	Reduce dose; consult manufacturer's literature
Lidocaine	Severe	Caution
Lithium	Mild	Avoid if possible or reduce dose and monitor plasma concentration carefully
	Moderate	Avoid
Lopinavir + ritonavir	Severe	Avoid oral solution due to propylene glycol content; use tablet/capsules with caution in severe impairment
Magnesium hydroxide	Moderate	Avoid or reduce dose; increased risk of toxicity
Magnesium sulfate	Moderate	Avoid or reduce dose; increased risk of toxicity
Mannitol	Severe	Avoid unless test dose produces diuretic response
Meglumine antimoniate	Moderate	see pentavalent antimony compounds
Meglumine iotroxate	Moderate to severe	Increased risk of nephrotoxicity; avoid dehydration
Mercaptopurine	Moderate	Reduce dose
Metformin	Mild	Avoid; increased risk of lactic acidosis
Methadone	Moderate to severe	Increased and prolonged effect; increased cerebral sensitivity

Drug	Grade	Comment
Methotrexate	Mild	Reduce dose; accumulates; nephrotoxic
	Moderate	Avoid
Methyldopa	Moderate	Start with small dose; increased sensitivity to hypotensive and sedative effect
Metoclopramide	Severe	Avoid or use small dose; increased risk of extrapyramidal reactions
Morphine	Moderate to severe	Reduce dose or avoid; increased and prolonged effect; increased cerebral sensitivity
Neostigmine	Moderate	May need dose reduction
Nitrofurantoin	Mild	Avoid; peripheral neuropathy; ineffective because of inadequate urine concentrations
Penicillamine	Mild	Reduce dose and monitor renal function
	Moderate to severe	Avoid
Pentamidine isetionate	Mild	Reduce dose; consult manufacturer's literature
Pentavalent antimony compounds	Moderate	Increased adverse effects
	Severe	Avoid
Phenobarbital	Severe	Avoid large doses
Povidone iodine	Severe	Avoid regular application to inflamed or broken mucosa
Potassium chloride	Moderate	Avoid routine use; high risk of hyperkalaemia
Procainamide	Mild	Avoid or reduce dose
Procaine penicillin	Severe	Neurotoxicity—high doses may cause convulsions
Procarbazine	Severe	Avoid
Proguanil	Mild	100 mg once daily
	Moderate	50 mg on alternate days
	Severe	50 mg once weekly; increased risk of haematological toxicity
Propranolol	Severe	Start with small dose; higher plasma concentrations after oral administration; may reduce renal blood flow and adversely affect renal function
Propylthiouracil	Mild to moderate	Use three-quarters normal dose
	Severe	Use half normal dose
Pyridostigmine	Moderate	Reduce dose; excreted by kidney
Quinine	Severe	Reduce parenteral maintenance dose for malaria treatment to 5-7 mg/kg
Ranitidine	Severe	Use half normal dose; occasional risk of confusion
Ritonavir	Severe	see lopinavir with ritonavir
Saquinavir	Severe	Dose adjustment possibly required
Sodium chloride	Severe	Avoid
Sodium bicarbonate	Severe	Avoid; specialized role in some forms of renal disease

Drug	Grade	Comment
Sodium nitroprusside	Moderate	Avoid prolonged use
Spironolactone	Mild	Monitor plasma K ⁺ ; high risk of hyperkalaemia in renal impairment
	Moderate	Avoid
Stavudine	Mild	20 mg twice daily (15 mg if body weight less than 60 kg)
	Moderate to severe	20 mg once daily (15 mg if body weight less than 60 kg)
Streptomycin	Mild	Reduce dose; monitor plasma concentrations
Sulfadiazine	Severe	Avoid; high risk of crystalluria
Sulfamethoxazole + trimethoprim	Mild	Use half normal dose if creatinine clearance 15–30 ml/minute; avoid if creatinine clearance less than 15 ml/minute and if plasma-sulfamethoxazole concentration cannot be monitored
Sulfasalazine	Moderate	Risk of toxicity including crystalluria—ensure high fluid intake
	Severe	Avoid
Trimethoprim	Mild	Use half normal dose after 3 days if creatinine clearance 15–30 ml/minute
	Moderate to severe	Use half normal dose if creatinine clearance less than 15 ml/minute; avoid if creatinine clearance less than 10 ml/minute (unless plasma-trimethoprim concentration monitored)
Valproic acid	Mild to moderate	Reduce dose
	Severe	Alter dosage according to free serum valproic acid concentration
Vancomycin	Mild	Reduce dose—monitor plasma-vancomycin concentration and renal function regularly
Warfarin	Severe	Avoid
Zidovudine	Severe	Reduce dose; manufacturer advises oral dose of 300–400 mg daily in divided doses or intravenous dose of 1 mg/kg 3–4 times daily

13. Prescribing in hepatic impairment

Liver disease may alter the response to drugs. However, the hepatic reserve appears to be large and liver disease has to be severe before important changes in drug metabolism take place. The ability to eliminate a specific drug may or may not correlate with the liver's synthetic capacity for substances such as albumin or clotting factors, which tends to decrease as hepatic function declines. Unlike renal disease, where estimates of renal function based on creatinine clearance correlate with parameters of drug elimination such as clearance and half-life, routine liver function tests do not reflect actual liver function but are rather markers of liver cellular damage.

The altered response to drugs in liver disease can include all or some of the following changes:

- Impaired intrinsic hepatic eliminating (metabolizing) capacity due to lack of or impaired function of hepatocytes.

- Impaired biliary elimination due to biliary obstruction or transport abnormalities (for example, rifampicin is excreted in the bile unchanged and may accumulate in patients with intrahepatic or extrahepatic obstructive jaundice).
- Impaired hepatic blood flow due to surgical shunting, collateral circulation or poor perfusion with cirrhosis and portal hypertension.
- Altered volume of distribution of drugs due to increased extracellular fluid (ascites, oedema) and decreased muscle mass.
- Decreased protein binding and increased toxicity of drugs highly bound to proteins (for example phenytoin) due to impaired albumin production.
- Increased bioavailability through decreased first-pass metabolism.
- Decreased bioavailability due to malabsorption of fats in cholestatic liver disease.
- In severe liver disease increased sensitivity to the effects of some drugs can further impair cerebral function and may precipitate hepatic encephalopathy (for example, morphine). Oedema and ascites in chronic liver disease may be exacerbated by drugs that cause fluid retention (for example, acetylsalicylic acid, ibuprofen, prednisolone, dexamethasone).
- Usually drugs are metabolized without injury to the liver. A few drugs cause dose-related hepatotoxicity. However, most hepatotoxic reactions to drugs are rare but tend to be unpredictable. In patients with impaired liver function, the dose-related hepatotoxic reaction may occur at lower doses and the unpredictable reactions seem to occur more frequently. Both should be avoided.

Information to help prescribing in hepatic impairment is included in the following table. The table contains only those drugs that need dose adjustment. However, absence from the table does not automatically imply safety as for many drugs data about safety are absent; it is therefore important to also refer to the individual drug entries.

Medicines to be avoided or used with caution in liver disease and type liver disease induced by the drug

Table 1.5 : Hepatic impairment and drugs

Medicine	Comment	Drug induced liver disease
Abacavir	Avoid in moderate hepatic impairment unless essential; avoid in severe hepatic impairment	-
Acetylsalicylic acid	Avoid in severe hepatic impairment increased risk of gastrointestinal bleeding	-
Allopurinol	Reduce dose	Acute Hepatocellular necrosis, Granulomatous hepatitis
Amitriptyline	Sedative effect increased (avoid in severe liver disease)	Acute hepatitis
Amlodipine	Half-life prolonged – may need dose reduction; consider initial dose of 2.5 mg	Cholestasis with hepatitis, chronic active hepatitis

Medicine	Comment	Drug induced liver disease
Amoxicillin + clavulanic acid	Monitor liver function in liver disease; cholestatic jaundice reported either during or shortly after treatment – more common in patients over the age of 65 years and in males; duration of treatment should not usually exceed 14 days	Cholestasis with hepatitis (clavulanic acid)
Artemether + lumefantrine	Caution in severe impairment – monitor ECG and plasma potassium	-
Aspirin	-	Acute Hepatocellular necrosis
Azathioprine	May need dose reduction	Cholestasis with hepatitis
Azithromycin	Avoid; jaundice reported	-
Bupivacaine	Avoid (or reduce dose) in severe liver disease	-
Carbamazepine	Metabolism impaired in advanced liver disease	Acute Hepatocellular necrosis, Chronic cholestasis, Granulomatous hepatitis
Ceftriaxone	Reduce dose and monitor plasma concentration if both hepatic and severe renal impairment	-
Chlorambucil	Limited information available – consider dose reduction in severe hepatic impairment	-
Chloramphenicol	Avoid if possible – increased risk of bone marrow depression; reduce dose and monitor plasma chloramphenicol concentration	-
Chlorpheniramine	Sedation inappropriate in severe liver disease – avoid	-
Chlorpromazine	Can precipitate coma; hepatotoxic	Cholestasis with hepatitis, Chronic cholestasis, Granulomatous hepatitis
Ciclosporin	May need dose adjustment	Cholestasis without hepatitis
Clindamycin	Reduce dose	-
Clomifene	Avoid in severe liver disease	-
Clomipramine	Sedative effects increased; avoid in severe liver disease	Acute hepatitis
Cloxacillin	Cholestatic jaundice may occur up to several weeks after treatment has been stopped; administration for more than 2 weeks and increasing age are risk factors	-
Codeine	Avoid or reduce dose may precipitate coma	-

Medicine	Comment	Drug induced liver disease
Contraceptives, Oral	Avoid in active liver disease and if history of pruritus or cholestasis during pregnancy	-
Cyclophosphamide	Reduce dose	Acute Hepatocellular necrosis
Cytarabine	Reduce dose	
Dacarbazine	Dose reduction may be required in mild to moderate liver disease; avoid if severe	-
Dantrolene	-	Acute Hepatocellular necrosis, Acute hepatitis, Chronic active hepatitis
Daunorubicin	Reduce dose	
Diazepam	Can precipitate coma	
Didanosine	Insufficient information but monitor for toxicity	Acute Hepatocellular necrosis
Doxorubicin	Reduce dose according to bilirubin concentration	-
Doxycycline	Avoid (or use with caution)	-
Efavirenz	In mild to moderate liver disease, monitor for dose related side-effects (for example, CNS effects) and monitor liver function; avoid in severe hepatic impairment	-
Enalapril	Closely monitor liver function in patients with hepatic impairment	Acute Hepatitis, Cholestasis with hepatitis
Ergometrine	Avoid in severe liver disease	
Erythromycin	May cause idiosyncratic hepatotoxicity	Cholestasis with hepatitis, Chronic cholestasis
Estradiol cypionate	Avoid	-
Ethinylestradiol	Avoid	-
Etoposide	Avoid in severe hepatic impairment	-
Fluconazole	Toxicity with related drugs	-
Fluorouracil	Caution advised; dose reduction may be required	-
Fluoxetine	Reduce dose or administer on alternate days	-
Fluphenazine	Can precipitate coma; hepatotoxic	-
Furosemide	Hypokalaemia may precipitate coma (use potassiumsparing diuretic to prevent this); increased risk of hypomagnesaemia in alcoholic cirrhosis	-
Glibenclamide	Increased risk of hypoglycaemia in severe liver disease; avoid or use small dose; can produce jaundice	Cholestasis without hepatitis

Medicine	Comment	Drug induced liver disease
Griseofulvin	Avoid in severe liver disease	Cholestasis without hepatitis
Haloperidol	Can precipitate coma	-
Halothane	Avoid if history of unexplained pyrexia or jaundice following previous exposure to halothane	Acute Hepatocellular necrosis
Heparin	Reduce dose in severe liver disease	-
Hydralazine	Reduce dose	Granulomatous hepatitis
Hydrochlorothiazide	Avoid in severe liver disease; hypokalaemia may precipitate coma (potassium-sparing diuretic can prevent this); increased risk of hypomagnesaemia in alcoholic cirrhosis	-
Ibuprofen	Increased risk of gastrointestinal bleeding and can cause fluid retention; avoid in severe liver disease	Acute Hepatocellular necrosis
Indinavir	Increased risk of nephrolithiasis; reduce dose to 600 mg every 8 hours in mild to moderate hepatic impairment; not studied in severe impairment	-
Isoniazid	Use with caution; monitor liver function regularly and particularly frequently in the first 2 months;	Acute Hepatocellular necrosis, Acute hepatitis, Chronic active hepatitis
Labetalol	-	Acute Hepatocellular necrosis
Levonorgestrel	Caution in active liver disease and recurrent cholestatic jaundice	Cholestasis without hepatitis
Lidocaine	Avoid (or reduce dose) in severe liver disease	-
Lopinavir + ritonavir	Avoid oral solution because of propylene glycol content; avoid capsules in severe hepatic impairment	-
Magnesium hydroxide	Avoid in hepatic coma if risk of renal failure	-
Magnesium sulfate	Avoid in hepatic coma if risk of renal failure	-
Medroxyprogesterone acetate	Avoid in active liver disease and if history of pruritus during pregnancy	-
Mefloquine	Avoid for prophylaxis in severe liver disease	-
Mercaptopurine	May need dose reduction	-
Metformin	Withdraw if tissue hypoxia likely—manufacturers advise avoid	-
Methadone	Avoid or reduce dose—may precipitate coma	-

Medicine	Comment	Drug induced liver disease
Methotrexate	Dose-related toxicity; avoid in non-malignant conditions (for example, rheumatic disorders); avoid for all indications in severe hepatic impairment	-
Methyldopa	Manufacturer advises caution in history of liver disease; avoid in active liver disease	Acute Hepatocellular necrosis, Acute hepatitis, Granulomatous hepatitis
Metoclopramide	Reduce dose	-
Metronidazole	In severe liver disease, reduce total daily dose to one third and give once daily	-
Monoamine oxidase inhibitors (MAOIs)	-	Acute hepatocellular necrosis, Acute hepatitis
Morphine	Avoid or reduce dose—may precipitate coma	-
Nelfinavir	No information available; manufacturer advises caution	-
Nevirapine	Caution in moderate hepatic impairment; avoid in severe hepatic impairment	-
Nifedipine	Reduce dose in severe liver disease	Acute hepatitis
Nitrofurantoin	Cholestatic jaundice and chronic active hepatitis reported	Cholestasis with hepatitis, Chronic active hepatitis, Granulomatous hepatitis
Norethisterone	Avoid in active liver disease and if history of pruritus or cholestasis during pregnancy	Cholestasis without hepatitis
Ofloxacin	Hepatic dysfunction reported; reduce dose in severe liver disease	-
Paracetamol	Dose-related toxicity—avoid large doses	Acute Hepatocellular necrosis, chronic active hepatitis
Pentavalent antimony compound	Increased risk of liver damage and hepatic failure in pre-existing liver disease	-
Phenobarbital	May precipitate coma	-
Phenytoin	Reduce dose to avoid toxicity	Acute hepatitis, Cholestasis with hepatitis, chronic active hepatitis, Chronic cholestasis, Granulomatous hepatitis
Prednisolone	Adverse effects more common	-

Medicine	Comment	Drug induced liver disease
Procainamide	Avoid or reduce dose	Granulomatous hepatitis
Procarbazine	Avoid in severe hepatic impairment	-
Promethazine	Avoid—may precipitate coma in severe liver disease; hepatotoxic	-
Propranolol	Reduce oral dose	-
Propylthiouracil	Reduce dose;	-
Pyrazinamide	Monitor hepatic function—idiosyncratic hepatotoxicity more common; avoid in severe hepatic impairment;	Acute hepatitis
Pyrimethamine	Use with caution	-
Ranitidine	Increased risk of confusion; reduce dose	Cholestasis with hepatitis
Ribavirin	Avoid in severe hepatic dysfunction or decompensated cirrhosis	-
Rifampicin	Impaired elimination; monitor liver function; avoid or do not exceed 8 mg/kg daily	Acute hepatitis
Ritonavir	See Lopinavir + ritonavir	-
Saquinavir	Manufacturer advises caution in moderate hepatic impairment; avoid in severe impairment	-
Simvastatin	Avoid in active liver disease or unexplained persistent elevations in serum transaminases	-
Sodium nitroprusside	Avoid in severe liver disease	-
Sulfadiazine	Avoid if severe	-
Sulfamethoxazole + trimethoprim	Manufacturer advises avoid in severe liver disease	-
Sulphonamides	-	Acute Hepatocellular necrosis, Acute hepatitis, Cholestasis with hepatitis, chronic active hepatitis, Granulomatous hepatitis
Suxamethonium	Prolonged apnoea may occur in severe liver disease due to reduced hepatic synthesis of plasma cholinesterase	-
Testosterone	Preferably avoid—possibility of dose-related toxicity and fluid retention	-
Thiopental	Reduce dose for induction in severe liver disease	-
Valproic acid	Avoid if possible—hepatotoxicity and hepatic failure may occasionally occur (usually in first 6 months)	Acute Hepatocellular necrosis
Verapamil	Reduce oral dose	-

Medicine	Comment	Drug induced liver disease
Vinblastine	Dose reduction may be necessary	-
Vincristine	Dose reduction may be necessary	-
Warfarin	Avoid in severe liver disease, especially if prothrombin time already prolonged	Cholestasis without hepatitis
Zidovudine	Accumulation may occur	-

Section II
Classified Notes on Drugs

Section II - Chapter 1

Drugs used in Gastrointestinal Disorders

1.1 *Antacids*

Aluminum hydroxide
Magnesium hydroxide

1.2 *Antispasmodics*

Atropine sulphate
Drotaverine
Flavoxate hydrochloride
Hyoscine butyl bromide
Mebeverine hydrochloride

1.3 *Ulcer healing drugs*

Cimetidine
Esomeprazole
Famotidine
Lansoprazole
Omeprazole
Pantoprazole
Rabeprazole
Ranitidine
Sucralfate

1.4 *Antiemetics*

Cyclizine
Dimenhydrinate
Domperidone
Metoclopramide
Ondansetron
Prochlorperazine
Promethazine

1.5 *Anti-diarrhoeal drugs*

Diphenoxylate
Loperamide
Oral rehydration salts
Rifaximin
Zinc sulfate

1.6 *Laxatives*

1.6.1 *Bulk forming agent*

Bran
Ispaghula husk

1.6.2 *Stool softener*

Docusate sodium
Liquid paraffin

1.6.3 Stimulant laxative

Bisacodyl

Senna

1.6.4 Osmotic laxatives

Lactulose

Macrogol 3350

Magnesium hydroxide (Milk of Magnesia)

Magnesium sulphate

Polyethylene glycol 3350

1.7 Drugs used in inflammatory bowel disease**1.7.1 Aminosalicylates**

Adalimumab

Budesonide

Hydrocortisone acetate

Infliximab

Mesalazine

Sulfasalazine

1.8 Drugs used in oesophageal varices

Octreotide

Terlipressin

1.9 Drugs affecting biliary composition and flow

Ursodeoxycholic acid

1.10 Probiotics

1.1 Antacids

Antacids are chemical substances that increase the pH of gastric contents thereby neutralizing the acidic contents of stomach, thus providing symptomatic relief in ulcer dyspepsia and non-erosive gastro-oesophageal reflux. Liquid preparations are more effective than solid preparations.

ALUMINIUM HYDROXIDE

Dosage form and strength: *Oral suspension:* Aluminium hydroxide 250 mg/5 ml and Magnesium hydroxide 250 mg/5 ml; *Tablets/Gel:* may contain simethicone, and some contain algenic acid

Indication: Ulcer and non ulcer dyspepsia; gastro-oesophageal reflux.

Contraindication/Precautions: Hypophosphatemia, undiagnosed GI or rectal bleeding, appendicitis, porphyria, renal impairment (aluminium may accumulate), constipation, hepatic impairment, dehydration.

Dosage schedule:

- *Tablets:* 1-2 tablets chewed 4 times a day and at bed time or as required;
- *Suspension:* 5-10 ml 4 times daily between meals and at bedtime; Children (6-12 years): up to 5 ml 3 times daily

Adverse effects: Constipation, haemorrhoids, fissures, faecal impaction

Drug and food interaction: Decreases absorption of digoxin, azithromycin, ciprofloxacin, norfloxacin, rifampicin, tetracycline, isoniazid

Patient information: Take with water to decrease constipation

MAGNESIUM HYDROXIDE

Dosage form and strength: *See under aluminium hydroxide*

Indication: Ulcer and non ulcer dyspepsia, gastro-oesophageal reflux

Contraindication/Precautions: Severe renal impairment, renal impairment, hepatic impairment.

Dosage schedule: 250-500 mg, per oral 3-4 times a day

Adverse effects: Diarrhoea in renal impairment, respiratory depression, hypotension, loss of tendon reflexes, cardiac arrest

Drug and food interaction: Decrease absorption of other drugs

Patient information: Do not take this medicine within 2 hours of taking other medicines (especially flouroquinolones); causes diarrhoea

1.2 Antispasmodics

ATROPINE SULPHATE

Dosage form and strength: *Injection:* 0.6 mg/ml

Indication: Gastrointestinal spasm, renal colic, anesthetic premedication, OP poisoning

Contraindication/Precautions: Avoid in case of angle closure glaucoma, hypersensitivity, tachycardia secondary to cardiac insufficiency or thyrotoxicosis. Use in pregnancy only when potential benefits justify possible risk to fetus.

Dosage schedule:

- *Premedication:* intravenous injection, 200-600 micrograms immediately before induction of anesthesia and in incremental doses of 100 micrograms for the treatment of bradycardia; intramuscular injection, 300-600 micrograms 30-60 minutes before induction; child 20 micrograms/kg;
- *For control of muscarinic side effects of neostigmine:* in reversal of competitive neuromuscular block, by intravenous injection, 0.6-1.2 mg;
- *Bradycardia:* particularly complicated by hypotension after myocardial infarction, intravenous injection of 300 micrograms, increasing to 1 mg if necessary;
- *Antidote to organophosphorous poisoning:* by intramuscular or intravenous injection, 1 to 2 mg, repeated in 20-30 minutes as soon as cyanosis has cleared

Adverse effects: Dry mouth, constipation, urinary retention, blurred vision

Drug and food interaction: Anticholinergic effect is more pronounced with tricyclic antidepressants, amantidine, antiparkinsonism agents; decreases the absorption of ketoconazole, levodopa; antacids decrease the effect of atropine

Patient information: Do not perform strenuous activity in high temperatures, heat stroke may occur; do not perform tasks requiring motor co-ordination and alertness (e.g. driving)

DROTAVERINE

Dosage form and strength: *Tablet:* 10 mg, 40 mg and 80 mg; *Injection:* 20 mg/ml

Indication: Gastrointestinal colicky pain, renal colic, 1st stage of labour (dilation of cervical opening)

Contraindication/Precautions: Paralytic ileus (or about to undergo surgery), gall bladder disease, diabetes, depression, ulcerative colitis, heart disease, liver disease, kidney disease

Dosage schedule: 40-80 mg 3 times per day

Adverse effects: Nausea, vomiting, fainting, dry mouth

FLAVOXATE HYDROCHLORIDE

Dosage form and strength: *Tablet:* 100 mg and 200 mg

Indication: Increased urinary frequency and incontinence, bladder spasms due to catheterization, urgency, dysuria

Contraindication/Precautions: Obstructive uropathy, ileus, GI obstruction, GI bleeding, glaucoma

Dosage schedule: 200 mg 3 times daily

Adverse effects: *Same as in hyoscine*, fatigue, vertigo

Drug and food interaction: Can be taken without regard to food

Patient information: Do not perform tasks requiring motor co-ordination/alertness (e.g. driving)

HYOSCINE BUTYL BROMIDE

Dosage form and strength: *Tablet:* 10 mg and 20 mg; *Injection:* 20 mg/ml

Indication: Symptomatic GI and pain to urinary spasm, irritable bowel syndrome, excessive respiratory secretion, bowel colic

Contraindication/Precautions: Pregnancy, geriatric patient, hyperthyroidism, dysarrhythmias, ulcerative colitis, hypertension, renal disease, hepatic disease, urinary retention

Dosage schedule: 10 mg 3 times a day; 4 to 20 mg 4 times a day

Adverse effects: Headache, confusion, dizziness, hallucination, palpitation, tachycardia, blurred vision, tachycardia, blurred vision, photophobia, cycloplegia, dry mouth, constipation, paralytic ileus

MEBEVERINE HYDROCHLORIDE

Dosage form and strength: *Tablet:* 135 mg; *Suspension:* 50 mg/5ml

Indication: Irritable bowel syndrome, other spasmodic conditions

Contraindication/Precautions: Paralytic ileus. To be taken 20 minutes before meal

Dosage schedule: 135-150 mg 3 times a day to be taken 20 minutes before meal

Adverse effects: Allergic reaction, angioedema, urticaria, rash

1.3 Ulcer healing drugs

CIMETIDINE

Dosage form and strength: *Tablets:* 200 mg and 400 mg; *Injection:* 100 mg/ml

Indication: *see Ranitidine*

Contraindication/Precautions: *see Ranitidine*

Dosage schedule:

- *Benign ulcer (oral):* 400 mg twice daily followed by 800 mg once at night for 4 weeks, maintenance 400 mg at night; *Child:* 25-30 mg/kg; *Infant:* 20 mg/kg in divided doses;
- *Injection(IM):* 200 mg every 4-6 hrs, *Injection(IM):* 200 mg slowly over 2 minutes; *IV infusion:* 400 mg in 100 ml of normal saline over 1/2-1 hours, 50-100 mg/hour over 24 hrs for continuous infection

Adverse effects: *See ranitidine*, gynaecomastia, microsomal enzyme inhibition and hepatotoxicity are higher

Drug and food interaction: *See ranitidine*

ESOMEPRAZOLE

Dosage form and strength: *Tablets:* 20 mg and 40 mg; *Injection:* 40 mg/ml

Indication: *See omeprazole*

Contraindication/Precautions: *See omeprazole*

Precautions: *See omeprazole*

Dosage schedule:

- *Duodenal ulcer associated with H. pylori:* 20 mg twice daily
- *NSAID associated GU:* 20mg once daily for 4-8 weeks; for prophylaxis with increase rate of gastroduodenal complication who require continued NSAID treatment 20 mg daily

• *GERD*: 40 mg once daily for 4 weeks, continued for further 4 weeks if not fully healed or symptom persist, maintenance 20 mg daily

Adverse effects: *See omeprazole*

Drug and food interaction: *See omeprazole*

FAMOTIDINE

Dosage form and strength: *Tablets: 20 mg and 40mg; Injection: 10 mg/ml*

Indication: *See ranitidine*

Contraindication/Precautions: *See ranitidine*

Dosage schedule:

• *Benign ulcer*: Oral 40 mg at night for 4-8 weeks, maintenance dose 20 mg at night

• *Reflux oesophagitis*: 20-40 mg twice daily for 5-12 weeks

• *Zollinger–Ellison syndrome*: 20 mg every 6 hours

Adverse effects: *See ranitidine*

Drug and food interaction: *See ranitidine*

Patient information: Avoid alcohol, NSAIDs, extreme hot and spicy foods

LANSOPRAZOLE

Dosage form and strength: *Capsule: 15 mg and 30 mg*

Indication: *See omeprazole*

Contraindication/Precautions: *See omeprazole*

Dosage schedule:

• *Duodenal ulcer*: 30 mg daily in morning for 4 week, maintenance 15 mg daily; *Benign gastric ulcer*: 30 mg daily in morning for 8 week;

• *NSAID associated duodenal or gastric ulcer*: 15-30 mg once daily for 4 weeks continued for further 4 weeks if not fully healed;

• *Reflux oesophagitis*: 30 mg daily in morning for 4 weeks, continued for further 4 weeks if not fully healed;

• *Zollinger–Ellison syndrome*: initially 60 mg once daily adjusted according to response, daily dose of 120 mg or more given in two divided doses;

• *Reflux oesophagitis refractory to other treatment*: 40 mg for 8 weeks

Adverse effects: *See omeprazole*

Drug and food interaction: *See omeprazole*

OMEPRAZOLE

Dosage form and strength: *Capsule: 10 and 20mg*

Indication: Benign gastric and duodenal ulcer, NSAID associated duodenal or gastric ulcer, duodenal or benign gastric ulcer associated with *Helicobacter pylori*, reflux oesophagitis, Zollinger–Ellison syndrome, stress ulcer

Contraindication/Precautions: Hypersensitivity reaction, breast-feeding, patients with liver disease

Dosage schedule: Adult: 20 mg/day for 4-8 week

Adverse effects: Nausea, vomiting, diarrhoea, abdominal colic, skin rash, headache and dizziness

Drug and food interaction: Inhibits hepatic metabolism of diazepam, phenytoin, flurazepam, digoxin etc; increases the bleeding tendency with

warfarin

Patient information: Avoid alcohol, salicylates, NSAIDs; avoid excessive amounts of caffeine; report onset of black tarry stools, diarrhoea, abdominal pain

PANTOPRAZOLE

Dosage form and strength: Tablets: 20 and 40mg; Injection: 40 mg/vial

Indication: See *omeprazole*

Contraindication/Precautions: Report severe diarrhoea, black tarry stools, abdominal pain, product may have to be discontinued. See *omeprazole*

Precautions: See *omeprazole*

Dosage schedule:

- *Duodenal ulcer:* 40 mg daily in the morning for 2 weeks
- *Benign gastric ulcer:* 40mg daily in the morning for 2 weeks

Adverse effects: See *omeprazole*

Drug and food interaction: See *omeprazole*

RABEPRAZOLE

Dosage form and strength: Tablet: 10 mg and 20 mg

Indication: See *omeprazole*

Contraindication/Precautions: See *omeprazole*, children - not recommended

Dosage schedule:

- *Benign gastric ulcer:* 20 mg daily in the morning for 6 weeks, continued for further 6 weeks if not fully healed;
- *Duodenal ulcer:* 20 mg daily in the morning for 4 week continued for further 4 week if not fully healed;
- *GERD:* 20 mg once daily for 4-8 weeks, maintenance 10-20mg daily

Adverse effects: See *omeprazole*

Drug and food interaction: See *omeprazole*

RANITIDINE

Dosage form and strength: Tablets: 150 mg and 300 mg; Injection: 25 mg/ml

Indication: Benign duodenal and gastric ulcer, reflux oesophagitis, Zollinger-Ellison syndrome, GERD, stress ulcer

Contraindication/Precautions: Hypersensitivity, pregnancy, impaired renal function, children <12 years. Sexual dysfunction in male (loss of libido, impotence, gynaecomastia)

Dosage schedule:

- *Benign ulcer:* oral 150 mg twice daily, 300 mg at night for 4-8 weeks
- *Chronic episodic dyspepsia:* 6 weeks
- *NSAID induced ulcer:* for 8 weeks
- *Reflex oesophagitis:* 150 mg twice daily, 300 mg at night for 8 weeks, or if necessary 12 weeks
- *Gastric acid reduction (Prophylaxis of acid aspiration in obstetric):* oral - 150 mg at onset of labour, then every 6 hours

• *Surgical procedure:* IM or slow IV injection, 50 mg 45-60 minutes before induction of anaesthesia, oral 150 mg 2 hours before induction of anaesthesia, IM 50 mg every 6-8 hours IV infusion, 25 mg/hour for 2 hours, repeated every 6-8 hours

Adverse effects: Headache, dizziness, myalgia, nausea, skin rash and diarrhoea or constipation

Drug and food interaction: Decreases absorption of sucralfate, decreased absorption by ketoconazole, itraconazole

SUCRALFATE

Dosage form and strength: *Tablet:* 1 g

Indication: Benign gastric and duodenal ulceration, chronic gastritis

Contraindication/Precautions: Pregnancy, safety and efficacy of sucralfate in children have not been established

Dosage schedule: 2 g twice daily (on rising and at bed time) for 4-6 week or in resistant case 12 weeks, morning 8 g daily; Prophylaxis of NSAIDs induced ulcer (suspension) 1 g 6 times daily (maximum 8 g daily)

Drug and food interaction: Concomitant use with cimetidine, phenytoin, tetracyclines and fluoroquinolones result in reduction in bioavailability of these drugs. It should be taken at least 2 hours after administration of other drugs

Patient information: Complete full course of treatment to ensure ulcer healing, increase fluid intake, dietary bulk and exercise to prevent constipation

1.4 Antiemetics

CYCLIZINE

Dosage form and strength: *Tablets:* 25 mg and 50 mg

Indication: Prevention and treatment of nausea, vomiting and vertigo associated with motion sickness

Contraindication/Precautions: Asthma, glaucoma, emphysema, chronic pulmonary disease. Should not be concurrently used with sedatives, tranquilizers and anticholinergic medication

Dosage schedule: *Motion sickness:* 50 mg 30 minutes before traveling, can be repeated in 6 hours (up to 200 mg/day), 6-12 hours, 25 mg up to 3 times/day not to exceed 75 mg/day

Adverse effects: Drowsiness, xerostomia, headache, dermatitis, urinary retention, diplopia

Patient information: Avoid hazardous activities, activities requiring alertness because dizziness may occur; avoid alcohol, other CNS depressants; take 30 minutes before travelling

DIMENHYDRINATE

Dosage form and strength: *Tablet:* 50 mg; *Injectable:* 50 mg/ml

Indication: Prevention of motion sickness, Meniere's disease

Contraindication/Precautions: Hypersensitivity, pregnancy and neonates, breast-feeding, seizures, angle closure glaucoma, benign enlargement of

prostate. Masks early signs of ototoxicity if given consistently with ototoxic drugs

Dosage schedule:

- *Prevention of motion sickness:* 50-100 mg 4-6 hours or 30 minutes before traveling (not to exceed 400mg/day);
- *Meniere's disease:* 50 mg intra-muscular for acute attack, 25-50 mg 8 hourly for maintenance

Adverse effects: Paradoxical CNS stimulation (children & occasionally in adults), CNS depression, dizziness

Drug and food interaction: Eluxadolone, sodium oxalate increases effects by pharmacodynamics synergism

Patient information: Avoid hazardous activities, activities requiring alertness because dizziness may occur; avoid alcohol, other CNS depressants

DOMPERIDONE

Dosage form and strength: *Tablet:* 10 mg; *Suspension:* 1 mg/ml

Indication: Antiemetic, gastrokinetic to accelerate gastric emptying, dyspepsia, GERD (Gastro esophageal reflux disease)

Contraindication/Precautions: Obstruction to GIT, urinary outflow, paralytic ileus, comatose condition, hepatic and cardiovascular disease, glaucoma

Dosage schedule:

- *Acute nausea and vomiting:* 10-20 mg 6-8 hours (child 0.25-0.5 mg/kg);
- *Functional dyspepsia:* 10-20 mg 3 times daily before food for maximum of 12 hours

Adverse effects: Galactorrhoea, gynaecomastia, decreased libido, skin rashes

Drug and food interaction: Anticholinergic drugs may reduce the therapeutic effects of domperidone

Patient information: Avoid grapefruit juice during therapy

METOCLOPRAMIDE

Dosage form and strength: *Tablet:* 10 mg; *Injection:* 5 mg/ml

Indication: Nausea and vomiting in GI disorders and treatment with cytotoxic or radiotherapy, GERD, gastroparesis, premedication and post operatively

Contraindication/Precautions: Gastro intestinal obstruction, haemorrhage or perforation, 3-4 days after GI surgery, pheochromocytoma, convulsive disorders, renal and hepatic impairment, elderly, children, pregnancy and breast feeding, Parkinson's disease, epilepsy, depression, porphyria. Assess for extra-pyramidal side effects (difficulty in speaking, loss of balance, rigidity, tremor), signs of depression

Dosage schedule:

- *Nausea and vomiting, GERD, Gastroparesis:* Adult: 10 mg 3 times daily (children 2-5 mg/kg);
- *Premedication:* 10 mg single dose
- *Aid to gastrointestinal procedure:* 10-20 mg as single dose 5-10 minutes

before examination

Adverse effects: Extrapyramidal symptoms (children and young adult), tardive dyskinesia on prolonged use, hyperprolactinemia, drowsiness, dizziness, restlessness, headache, neuroleptic malignant syndrome, rashes, pruritus, cardiac conduction abnormalities following IV administration

Drug and food interaction: Alcohol, other CNS depressants increase sedation effects. haloperidol, phenothiazines increase risk for EPS

Patient information: Avoid concurrent use of alcohol and other CNS depressants

ONDANSETRON

Dosage form and strength: *Injectable:* 2 mg/ml; *Tablet:* 4 mg, 8 mg and 24 mg; *Oral solution:* 4 mg/5ml

Indication: Chemotherapy induced nausea and vomiting, post operative nausea and vomiting, radiation induced nausea and vomiting, uremic pruritus, rosacea, hyperemesis gravidarum

Contraindication/Precautions: Hypersensitivity reactions, co-administration with apomorphine, pregnancy, breastfeeding, moderate to severe liver impairment; child below 4 years of age - safety and efficacy not established

Dosage schedule:

- *Chemotherapy induced nausea and vomiting:* moderate - 8 mg started 30 minutes prior, highly emetogenic 24 mg; IV - 0.15 mg/kg over 15 minutes, 30 minutes prior to chemotherapy then 4 and 8 hours
- *Postoperative nausea and vomiting :* 4 mg IV/IM before anaesthesia as after procedures
- *Radiation induced nausea and vomiting:* 8 mg PO 1-2 hours before radiation, subsequent doses every 8 hours
- *Cholestatic pruritus:* 8 mg 12 hours or 8 hours for 7 days
- *Uremic pruritus:* 8 mg 12 hours or 8 hours for 14 days,
- *Child below 4 years of age:* Safety and efficacy not established, can be given 0.1 mg/kg IV in postoperative nausea & vomiting

Adverse effects: Headache, constipation, hiccups, flushing, transient visual disturbances, involuntary movements, dizziness, arrhythmia, hypotension

Patient information: Report to health care professional immediately if symptoms of irregular heart beat or involuntary movement of eyes, face or limbs occur

PROCHLORPERAZINE

Dosage form and strength: *Injection:* 12.5 mg/ml; *Tablets:* 5 mg and 25 mg

Indication: Postoperative nausea and vomiting, chemotherapy induced nausea and vomiting, vertigo, psychosis

Contraindication/Precautions: Coma, hypersensitivity. Should be protected from light

Dosage schedule:

- *Acute attack of vomiting:* 20 mg initially then 10 mg after 2 hours
- *Prevention of nausea and vomiting:* 5-10 mg 2-3 times daily (0.25 mg/kg)

• *Labyrinthine disorders*: 5 mg 3 times daily (up to 30 mg daily in divided doses)

Adverse effects: Muscle dystonia and other extrapyramidal side effect, dry mouth, drowsiness

Drug and food interaction: Increase serotonin syndrome, neuroleptic malignant syndrome with SSRIs, SNRIs

Patient information: Avoid hazardous activities, activities requiring alertness, alcohol; not to double or skip doses; avoid sun, wear sunscreen, protective clothing

PROMETHAZINE

Dosage form and strength: *Tablets*: 25 mg, 50 mg and 125 mg; *Syrup*: 6.25 mg/ml; *Suppository*: 25 mg, 50 mg and 125 mg; *Injection*: 25 and 50 mg/ml

Indication: Nausea, vomiting, motion sickness, pre-operative and post-operative sedation, obstetric sedation

Contraindication/Precautions: Porphyria, child under 2 years (risk of respiratory depression), pregnancy. May cause photosensitivity

Dosage schedule:

- *Nausea and vomiting*: PO/PR 12.5-25 mg 4-6 hours, IV/IM 12.5-25 mg 4-6 hours
- *Motion sickness*: 25 mg PO/PR 30-60 minutes before travel
- *Pre-operative sedation*: 50 mg PO/PR on night before procedure
- *Post-operative*: 25-50 mg IV/IM combined with reduced doses of analgesics
- *Allergic conditions*: 25 mg at bedtime or 12.5 mg (PO/PR), 25 mg may be repeated in 2 hours (IV/IM)

Adverse effects: Sedation, blurred vision, confusion, hallucination, disorientation, extrapyramidal symptoms

Drug and food interaction: May potentiate the sedative action of opiates, other CNS depressants, antihistamines and alcohol

Patient information: Avoid prolonged exposure to sunlight, avoid concurrent use of alcohol or other CNS depressants

1.5 Anti-diarrhoeal drugs

DIPHENOXYLATE

Dosage form and strength: *Tablet*: 2.5 mg diphenoxylate and 0.025 mg atropine

Indication: Acute diarrhoea, chronic mild ulcerative colitis

Contraindication/Precautions: Children <4 years, hypersensitivity, hepatorenal disease, pregnancy, obstructive jaundice, abnormal liver function, diarrhoea, pseudomembranous colitis, pregnancy, breast feeding, hepatic disease, ulcerative colitis, hypertensive crisis

Dosage schedule: Initial dose for adults is 4 tablets, followed by 2 tablets every 6 hours until diarrhoea is controlled. Maintenance dose as low as ¼th of initial dose

Adverse effects: Blurred vision, sedation, nausea, vomiting, abdominal discomfort, dryness of mouth, urinary retention

Drug and food interaction: Antimuscarinics, opioids and analgesics, avoid in those with NAD inhibitors

LOPERAMIDE

Dosage form and strength: *Tablet:* 2 mg

Indication: Acute nonspecific diarrhoea, chronic diarrhoea, faecal incontinence, pain of intestinal colic

Contraindication/Precautions: Active ulcerative colitis, antibiotic associated colitis, condition where abdominal distention develops, condition where inhibition of peristalsis should be avoided. Hypersensitivity, bloody diarrhoea, high fever, infectious diarrhoea; pseudomembranous colitis, age < 2 years. Patients in whom constipation must be avoided. Avoid use as primary therapy with acute dysentery. Discontinue if no improvement seen within 48 hours in patient with acute diarrhoea, symptoms worsen or abdominal swelling or bulging develops

Dosage schedule:

- *Acute diarrhoea:* Initially 4 mg, followed by 2 mg for up to 5 days; usual dose 6 to 8 mg daily; maximum 16 mg per day
- *Chronic diarrhoea:* Initially 4 to 8 mg daily in divided doses; subsequently adjusted accordance to response, maintenance up to 16 mg daily in 2 divided doses

Adverse effects: Dizziness, drowsiness, fatigue, flatulence, headache, nausea

Drug and food interaction: Eluxadoline and fentanyl increase chance and severity of constipation

Patient information: Do not take missed doses, do not double dose

ORAL REHYDRATION SALTS

Dosage form and strength: *Sachet:* 2.6 g/l sodium chloride, 2.9 g/l sodium citrate (dihydrate), 1.5 g/l potassium chloride, 13.5 g/l glucose (anhydrous)

Indication: Dehydration from acute diarrhoea

Contraindication/Precautions: Renal impairment. Should be protected from moisture

Dosage schedule: Fluid and electrolyte loss in acute diarrhoea: oral - adult 200-400 ml solution after every loose motion; infant 1-1.5 times usual feed volume; child 200 ml after every loose motion

Adverse effects: Vomiting (too rapid administration), hypernatremia and hyperkalaemia (overdose in renal impairment or administration of too concentrated solution)

Patient information: One sachet should be used to prepare one litre of solution, discard any unused solution after 24 hours; do not boil/dilute the solution

RIFAXIMIN

Dosage form and strength: *Tablet:* 200 mg and 550 mg

Indication: Traveller's diarrhoea, hepatic encephalopathy, irritable bowel

syndrome

Contraindication/Precautions: Hypersensitivity, pregnancy category C, breast feeding. Not effective in traveller's diarrhoea due to organism other than *E. coli*; discontinue if symptoms worsen or persist > 24-48 hours; hepatic impairment. Possibility of pseudomembranous colitis

Dosage schedule:

- *Traveller's diarrhoea*: oral, 200mg TDS for 3 days
- *Hepatic encephalopathy (maintenance of remission)*: oral, 550mg BD
- *Irritable bowel syndrome*: oral, 550 mg TDS for 14 days

Adverse effects: Flatulence, rectal tenesmus, abdominal pain, defecation urgency, constipation, nausea, vomiting

ZINC SULFATE

Dosage form and strength: *Oral solution*: 10 mg/5 ml; *Tablet*: 10 mg, 20 mg

Indication: Adjunct to ORS in acute diarrhoea

Contraindication/Precautions: Acute renal failure (may accumulate)

Dosage schedule:

- *Infants < 6 months*: 10 mg daily for 10-14 days
- *Child 6 months-5 years* *ronic diarrhoea*: 20 mg daily for 10-14 days

Adverse effects: Abdominal pain, dyspepsia, Nausea, Vomiting, Diarrhoea, Headache, Gastric irritation

Drug and food interaction: Absorption of ciprofloxacin, levofloxacin, ofloxacin, ferrous salt and calcium salt can be reduced

Patient information: Tablets may be dispersed in breast milk, in oral rehydration solution or in water on a small spoon, older children may chew tablets or swallow them with water; inform doctor if severe nausea/vomiting, abdominal pain or tarry stools seen

1.6 Laxatives

1.6.1 Bulk forming agents

ISPAGHULA HUSK

Dosage form: *Powder (in plastic bottles)*: 50 g, 100 g, 200 g, 500 g

Indication: Constipation

Contraindication/Precautions: Useful to patient who cannot tolerate bran

Dosage schedule: 0.5-2 gm/day (3 tea spoonful) at bed time, children ½ of adult dose

Adverse effects: Abdominal distension, flatulence

Patient information: increase fluid intake, bulk forming foods in diet and mobility

1.6.2 Stool softeners

DOCUSATE SODIUM

Dosage form and strength: *Tablet*: 100 mg; *Syrup*: 50 mg/ml; *Drops*: 25mg/drop

Indication: Constipation, adjunct to radiological procedure (with Barium meal 400 mg)

Contraindication/Precautions: Hypersensitivity reaction, intestinal obstruction, prolong use and children

Dosage schedule: 50-300 mg per oral single or divided dose (up to 500 mg), initially large dose, gradually decrease dose, with barium meal 400 mg

Adverse effects: Rashes, transient abdominal cramping pain

LIQUID PARAFFIN

Dosage form and strength: *Emulsion:* 25% v/v

Indication: Constipation

Contraindication/Precautions: Hypersensitivity reactions

Dosage schedule: 10-30 ml at night

Adverse effects: Lipoid pneumonia due to aspiration, interfere fat soluble vitamin absorption, Foreign body granulomatous lesion on mesenteric, liver and spleen

1.6.3 Stimulant laxative

BISACODYL

Dosage form and strength: *Tablet:* 5 mg, 10 mg; *Suppository:* 5 mg, 10 mg

Indication: Constipations, bowel preparation for radiology and surgery

Contraindication/Precautions: Intestinal obstruction, pregnancy, children <4 years.

Dosage schedule:

- *Constipation:* 5-10 mg (oral) at night, 10 mg at morning suppository
- *Radiological procedure:* 10 mg per oral at night then 10 mg suppository at morning, 1 hour before procedure
- *Paediatric:* >6 yr, 5 mg per oral at night, <10 yrs, 5 mg suppository
- *Radiological procedure:* 5 mg by mouth at night, 5 mg per rectal at morning

Adverse effects: Abdominal cramp, local irritation

Drug and food interaction: Increase risk of mucosal ulceration while coadministering with sodium sulfate, potassium sulfate or magnesium sulfate. May produce hypokalemia with deflazacort or dichlorphenamide.

Patient information: Better to be taken in empty stomach, to be taken with full glass of water. Swallow tabs whole with full glass of water; do not break, crush, chew tabs. alone only with water for better absorption. Do not take with antacid with in 1 hour

SENNA

Dosage form and strength: *Tablet:* 7.5 mg

Indication: Constipation, bowel preparation for radiological and surgical procedure

Contraindication/Precautions: Avoid in children and pregnancy, intestinal obstruction. Should be avoided except when straining, increased risk of rectal bleeding in haemorrhoids

Dosage schedule:

• *Constipation*: Adult: 2-4 tablets at night, Children (>6 years): ½ of adult dose

• *Bowel preparation*: 1 mg/kg in two divided doses

Adverse effects: Abdominal cramps

1.6.4 Osmotic laxatives

LACTULOSE

Dosage form and strength: *Syrup*: 10 mg/15 ml

Indication: Constipation, hepatic encephalopathy

Contraindication/Precautions: Hypersensitivity, intestinal obstruction, diabetic patient, pregnancy- use if benefit > risk. Take adequate water

Dosage schedule:

• *Constipation*: adult, 15 ml per oral twice daily (not more than 60ml/day) gradually titrate the dose to produce 2-3 soft stool/day

• *Children*: <1 year, 2.5 ml twice a day titrate according to stool frequency, 1-5 years, 5 ml twice a day titrate according to stool frequency, >6-12 years – 10 ml twice a day, titrate according to stool frequency;

• *Hepatic encephalopathy*: 30-45 ml (20-30 g) per oral to induce rapid detection, 30-45 ml per oral after 6-8 hours

Adverse effects: Dehydration, hypernatremia, abdominal distension

Drug and food interaction: Do not use with other laxative (hepatic encephalopathy), increase chance of GI obstruction with nifedipine

Patient information: Dilute with fruit juice or water to counteract sweet taste, take in empty stomach for rapid action; may cause belching, flatulence, abdominal cramping

MACROGOL 3350

Dosage form and strength: *Powder (in sachet)*: 13.125 g (macrogol 3350) with 0.3507 g sodium chloride, 0.1785 g sodium bicarbonate, 46.6 mg potassium chloride

Indication: Constipation, fecal impaction

Contraindication/Precautions: Gut obstruction, gut perforation, severe inflammatory bowel disease, known hypersensitivity, cardiovascular diseases.

Dosage schedule:

• *Constipation*: dissolve 1 sachet in 125 ml of water, to be taken 1-3 times/day as required;

• *Fecal impaction*: dissolve 1 sachet in 125 ml of water, 8 sachets to be taken within 6 hours, up to 3 days if required

Adverse effects: Diarrhoea, dehydration, indigestion, pain abdomen, allergic reactions

Drug and food interaction: Anti-epileptics (decreased effectiveness)

Patient's information: Take plenty of fluids. Reconstituted solution can be kept in fridge (2-8°C) and covered, remaining solution to be discarded after 6 hours if not consumed

MAGNESIUM HYDROXIDE (MILK OF MAGNESIA)

Dosage form and strength: *Tablet:* 400 mg; *Suspension:* 7.75%, 400 mg/5 ml, 800 mg/5 ml, 1200 mg/5 ml

Indication: Constipation, acid peptic disease

Contraindication/Precautions: Renal failure, acute abdomen, undiagnosed abdominal pain, known hypersensitivity reaction, renal insufficiency

Dosage schedule:

- *Constipation:* 30-60 ml/day per oral at bed time (400 mg/5ml)
- *Acid peptic disease:* 5-15 ml (400 mg/5ml) per oral in 4 divided doses, 2-4 tab/day chewable tables

Adverse effects: Abdominal cramp, electrolyte imbalance, hypotension

Patient information: Shake solution before use. Better to be taken in empty stomach

MAGNESIUM SULPHATE

Dosage form and strength: *Injectable:* 40 mg/ml, 80 mg/ml, 50%; *Infusion solution:* 1 g/10 ml, 2 g/100 ml

Indication: Constipation, hypomagnesemia, eclampsia/severe preeclampsia, preterm labor, torsades de pointes

Contraindication/Precautions: Renal impairment, abdominal pain, acute surgical abdomen/rectal bleeding, heart block

Dosage schedule:

- *Constipation:* 5-10 g dissolved in 24 ml of water

Adverse effects: Flaccid paralysis, circulatory collapse, nausea, vomiting, electrolyte and fluid disturbance

Drug and food interaction: Increases effects of neuromuscular blocker, increases hypotension-antihypertensives, decreases absorption of tetracyclines, fluoroquinolones

Patient information: Not to use laxative for long time; shake suspension well before use, not to given at bedtime as laxative may interfere with sleep

POLYETHYLENE GLYCOL 3350

Dosage form and strength: *Powder (in sachet):* 255 g, 527 g

Indication: Constipation

Contraindication/Precautions: Bowel obstruction, pregnancy category C, children

Dosage schedule: *Constipation:* 17 g, after reconstitution in a glass of water

Adverse effects: Nausea, abdominal bloating, cramping and flatulence, diarrhoea and excessive stool frequency

Patient's information: Report if unusual cramps, bloating or diarrhoea occurs

1.7 Drugs used in inflammatory bowel diseases (IBD)**ADALIMUMAB**

Dosage form and strength: *Injection:* 40 mg/0.8 ml prefilled syringe/pen

Indication: Crohn's disease, ulcerative colitis, rheumatic and psoriatic arthritis, ankylosing spondylitis, plaque psoriasis

Dosage schedule: *Crohn's disease and ulcerative colitis:* subcutaneous, initial: 160 mg (given on day 1 or split and given over 2 consecutive days), then 80 mg 2 weeks later (day 15), maintenance: 40 mg every other week beginning day 29

BUDESONIDE

Dosage form and strength: *Tablet (enteric coated):* 3 mg

Indication: Treatment of mild to moderate active Crohn's disease,

Contraindication/Precautions: Hypersensitivity, pregnancy cat (C), hepatic impairment

Dosage schedule:

- *Treatment of mild to moderate active Crohn's disease:* 9 mg orally once daily for up to 8 weeks;
- *Maintenance of clinical remission of mild to moderate Crohn's disease:* 6 mg orally once daily for maintenance of clinical remission up to 3 months (if symptom control maintained, taper doses to complete cessation)

Adverse effects: Increased risk of infection, abdominal pain, flatulence, vomiting and other corticosteroid related systemic adverse effects

Drug and food interaction: Avoid using CYP3A4 inhibitors concomitantly

HYDROCORTISONE ACETATE

Dosage form and strength: *Suppository:* 25 mg

Indication: Ulcerative colitis, proctitis, proctosigmoiditis

Contraindication/Precautions: Avoid in bowel obstruction preparation, and untreated infection. Proctoscopic examination required before treatment, avoid prolonged use

Dosage schedule: Suppository 25 mg twice daily for 2 weeks – can be increased up to 25 mg 3 times daily or 50 mg twice daily

Adverse effects: Local pain/burning sensation, rectal bleeding, exacerbation of untreated infections

INFLIXIMAB

Dosage form and strength: *Injection:* 100 mg

Indication: Crohn's disease, ulcerative colitis

Contraindications/Precautions: Discontinue if serious infection/sepsis, pregnancy (B). Consider premedication with antihistamines, acetaminophen, and/or corticosteroids. Increases risk of lymphoma and other malignancy in children and adolescents

Dosage schedule:

- *Crohn disease:* adult, IV: 5 mg/kg at 0, 2, and 6 weeks, followed by 5 mg/kg every 8 weeks thereafter; dose may be increased to 10 mg/kg in patients who respond but then lose their response. If no response by week 14, consider discontinuing therapy, Children ≥ 6 years and adolescents, IV: 5 mg/kg at 0, 2, and 6 weeks, followed by 5 mg/kg every 8 weeks thereafter;
- *Ulcerative colitis:* IV: 5 mg/kg at 0, 2, and 6 weeks, followed by 5 mg/kg every 8 weeks thereafter, children ≥ 6 years and adolescents, IV, 5 mg/kg at 0, 2, and 6 weeks, followed by 5 mg/kg every 8 weeks thereafter

Adverse effects: Hypersensitivity, abdominal pain, increased serum ALT, infection, infusion related reaction

Drug and food interaction: Adalimumab, etanercept (increases immunosuppressive effect of infliximab)

MESALAZINE

Dosage form and strength: *Tablet:* 1.2 g; *Suppository:* 500 mg; *Enema:* 5 ml

Indication: Ulcerative colitis (acute attack, maintenance of remission). maintenance of remission of Crohn's ileo-colitis

Contraindication/Precautions: Hypersensitivity to salicylates, breast feeding mother, children with chickenpox or flu like symptoms, active peptic ulcer disease, severe renal failure. Empty stomach prior rectal administration of drug; instruct patient on correct method of administration

Dosage schedule:

- *Maintenance of remission of ulcerative colitis (UC) and Crohn's ileo-colitis:* Adult 1.2-2.4 g daily in divided dosage, child 12-17 years 400-800 mg 3 times/day
- *Treatment of mild to moderate UC and acute attack:* Adult 2.4 g daily in divided dosage, child 12-17 years 800 mg 3 times a day

Adverse effects: Dizziness, oligospermia, abdominal pain, flatulence and headache

Drug and food interaction: Preparation that lower stool pH (e.g. lactulose) may prevent release of mesalazine

SULFASALAZINE

Dosage form and strength: *Tablet:* 0.5 g, 1 g; *Suppository:* 500 mg

Indication: Ulcerative colitis, active Crohn's disease, active rheumatoid arthritis

Contraindication/Precautions: Avoid in cases of hypersensitivity to salicylates or sulfonamides, child under 2 years, porphyria, intestinal or urinary obstruction, severe renal impairment. Use with caution in renal, hepatic impairment, G6PD deficiency, blood related disorder, child

Dosage schedule:

- *Ulcerative colitis:* adult (oral) - 1-2 g QID in acute attack until remission maintenance dose 500 mg QID, child > 2 yrs 40-60 mg/kg in acute attack, reducing to maintenance dose 20-30 mg/kg daily;
- *Active Crohn's disease:* adult (oral) 1-2 g QID in acute attack until omission occurs, child >2 year 40-60 mg/kg daily in acute attack;
- *Ulcerative colitis, Crohn's disease:* by reactive suppositories, 0.5-1 g morning & evening after bowel movement, by rectum (retention enema), 3 gm at night for at least an hour

Adverse effects: Nausea, vomiting, exacerbation of colitis, diarrhoea, loss of appetite, fever, blood disorders, hypersensitivity, lung complications (eosinophilia, fibrosing alveolitis), periorbital edema

Patient information: Take each oral dose with full glass of water to prevent crystalluria, urine, skin may be coloured yellow orange.

1.8 Drug used in esophageal varices**OCTREOTIDE**

Dosage form and strength: *Injection:* 0.05 mg/ml, 0.1 mg/ml, 0.2 mg/ml, 0.5 mg/ml and 1 mg/ml

Indication: Esophageal variceal bleeding, acromegaly, carcinoid tumor, VIPoma

Dosage schedule: *Esophageal variceal bleeding:* 50 mcg IV bolus, then 25-50 mcg/hr for 1-5 days

Adverse effects: *See under section 12.6*

Drug and food interaction: *See under section 12.6*

TERLIPRESSIN

Dosage form and strength: *Injection:* 200 mg/2 ml

Indication: Bleeding from esophageal varices

Contraindication/Precautions: Avoid in seizure, migraine, asthma, heart failure and renal disease. Use in pregnant women only if clearly needed

Dosage schedule: Initially 2 mg every 4-6 hours until bleeding is controlled, then 1 mg every 4-6 hour for maximum up to 48 hours

Adverse effects: Abdominal cramps, headache, cardiac arrhythmias

1.9 Drugs affecting biliary composition and flow**URSODEOXYCHOLIC ACID**

Dosage form and strength: *Tablets:* 150 mg; *Capsules:* 250 mg

Indication: Used in dissolution of gallstones, primary biliary cirrhosis

Contraindication/Precautions: Pregnant and lactating mothers. Avoid aluminium containing antacids during therapy, may impair absorption

Dosage schedule:

- *Dissolution of gall stones:* 8-12 mg/kg daily as a single dose at bedtime or in two divided doses, for up to 2 years; treatment is continued for 3-4 months after stones dissolve
- *Primary biliary cirrhosis:* 10-15 mg/kg daily in 2-4 divided doses

Adverse effects: Nausea, vomiting, diarrhoea, gallstone calcification, pruritus

1.10 Probiotics

They are combination of microbial cell preparation (live cultures or lyophilised powders) usually containing *Lactobacillus sp.*, *Bifidobacterium*, *Streptococcus faecalis*, *Enterococcus sp.* and the yeast *Saccharomyces boulardii*, etc.

Dosage form and strength: *Capsule/sachet (organisms vary from 15 million cells to 2.5 billion cells of lactobacillus acidophilus)*

Indication: Infective diarrhoea, antibiotic associated diarrhoea, risk of traveller's diarrhoea

Contraindication/Precautions: Immunocompromised patients.

Dosage schedule: Since there are so many different probiotic organisms, there is no set dosage. Probiotics are dosed by number of live organisms (cells) they contain. Typical dosage of lactobacillus ranges between 1-10 billion cells divided into 3 or 4 doses

Adverse effects: Infection, acidosis (rare)

Patient's information: Natural curd/yoghurt are rich source of beneficial bacteria

Section II - Chapter 2

Drugs used in Cardiovascular Disorders

2.1 *Anti-anginal agents*

2.1.1 *Nitrates*

Glyceryl trinitrate
Isosorbide dinitrate
Isosorbide mononitrate

2.1.2 *Beta-blocker*

Atenolol
Bisoprolol
Carvedilol
Metoprolol
Propranolol

2.1.3 *Calcium channel blockers*

Diltiazem
Verapamil

2.2 *Antiarrhythmic agents*

Adenosine
Amiodarone
Atenolol
Digoxin
Disopyramide
Isoprenaline
Lignocaine
Metoprolol
Procainamide
Propranolol
Verapamil

2.3 *Antihypertensive agents*

2.3.1 *Angiotensin converting enzyme inhibitor (ACEI)*

Captopril
Enalapril
Lisinopril
Ramipril

2.3.2 *Angiotensin receptor blockers*

Irbesartan
Losartan
Telmisartan
Valsartan

2.3.3 *Beta blockers*

Atenolol
Bisoprolol
Metoprolol
Labetalol
Nebivolol

Propranolol

2.3.4 Calcium channel blockers

Amlodipine

Felodipine

Nifedipine

2.3.5 Centrally acting antihypertensive

Clonidine

2.3.6 Diuretics

Chlorthalidone

Furosemide:

Hydrochlorothiazide

Indapamide

Metolazone

Spirolactone

Torsemide

2.3.7 Others

Hydralazine hydrochloride

Methyldopa

Prazosin

Reserpine

Sodium nitroprusside

Tamsulosin

Terazosin

2.4 Drugs used in cardiovascular shock

Dopamine hydrochloride

Dobutamine

Epinephrine/Adrenaline

Norepinephrine/Noradrenaline

Phenylephrine

Vasopressin

2.5 Drug used in heart failure

Bisoprolol

Carvedilol

Dobutamine

Digoxin

Dopamine

Epinephrine /adrenaline

Furosemide

Losartan

Metoprolol

Milrinone

Norepinephrine/noradrenaline

Ramipril

Spirolactone

Valsartan

2.6 *Drugs used in pulmonary hypertension*

Bosentan
Sildenafil

2.7 *Drugs used in dyslipidemia*

Atorvastatin
Cholestyramine
Clofibrates
Ezetimide
Fenofibrate
Gemfibrozil
Nicotinic acid
Simvastatin
Rosuvastatin

2.1 Anti-angina agents

2.1.1 Nitrates

GLYCERYL TRINATRE (Nitroglycerine)

Dosage form and strength: *Solution (infusion):* 25 mg/250 ml, 50 mg/250 ml, 100 mg/250 ml; *Solution (injection):* 5 mg/ml

Indications: Prophylaxis and acute attack of angina pectoris, Hypertensive emergencies, acute decompensated heart failure

Contraindications/Precautions: Avoid in hypersensitivity to nitrates, hypotension, hypovolemia, hypertrophic obstructive cardiomyopathy, aortic stenosis, cardiac tamponade, constrictive pericarditis, mitral stenosis, marked anemia, head trauma, cerebral hemorrhage, angle-closure glaucoma. Use caution in severe hepatic impairment, hypothyroidism, malnutrition, hypothermia, recent history of myocardial infarction. Renal impairment: 10-50 ml/min: never administer. Uninterrupted infusion > 24 hours produces tolerance.

Dosage schedule:

- *Angina (acute attack):* Intravenous infusion, adult: initially 5–10 mcg/min. The rate of the infusion may be increased by 10 mcg/min every 3–5 min until symptoms are relieved, systolic arterial pressure falls to <100 mm Hg, or the dose reaches 200 mcg/min
- *Hypertensive emergencies:* Intravenous infusion, adult: 5-10 mcg/min initial dose and up to 200 mcg/min as long as hemodynamic stability is maintained) for the first 24–48 h after the onset of infarction.
- *Acute decompensated heart failure:* Intravenous infusion, adult: 10–20 mcg/min, increase up to 200 mcg/min. *Intravenous infusion, Children:* Initially 0.25- 0.5 mcg/kg/min to titrate to 0.5-1.0 mcg/kg/min. Maximum dose 20 mcg/kg/min
- Start with the lowest dose. Subsequent doses and intervals of administration should be adjusted according to the blood pressure response and duration of action.

Adverse effects: Throbbing headache (most frequent in early therapy), flushing, dizziness, postural hypotension, Tachycardia, syncope, paradoxical bradycardia

Drug and food interaction: Increases the effect of beta-blockers, ACE inhibitors, angiotensin receptor blockers, calcium channel blockers. Avoid in concomitant/recent use of erectile dysfunction products (sildenafil, tadalafil, vardenafil) - may cause severe hypotension and death. Avoid alcohol intake.

ISOSORBIDE DINITRATE

Dosage form and strength: *Tablet (sublingual):* 5 mg, 10 mg

Indications: Prophylaxis and treatment of angina, left ventricular failure.

Contraindications/Precautions: See under glyceryl trinitrate

Patients taking isosorbide dinitrate for the long-term management of angina may often develop tolerance to the antianginal effect; avoid by giving the second of 2 daily doses of longer-acting oral preparations after an 8-hour rather than a 12-hour interval, thus ensuring a nitrate-free interval each day.

Dosage schedule:

- *Angina (acute attack)*: Sublingual, adult: 5–10 mg repeated as required.
- *Angina (prophylaxis)*: Oral, adult: 30-120 mg daily in divided doses. Intravenous infusion: 2-10 mg daily, maximum dose 20 mg/hour.
- *Left ventricular failure*: Oral, adult 40-160 mg daily in divided doses, maximum dose 240 mg daily in divided doses. Intravenous infusion: 2-10 mg daily, maximum dose 20 mg/hour.

Adverse effects: See under glyceryl trinitrate, tolerance (in long term, uninterrupted use)

ISOSOBIDE MONONITRATES

Dosage form and strength: *Tablet:* 10 mg, 20 mg, 40 mg; *Sustained release tablets:* 30 mg.

Indications: Prophylaxis of angina pectoris, adjunct in congestive heart failure.

Contraindications/Precautions: See under glyceryl trinitrate

Dosage schedule: *Prophylaxis for angina:* Oral(immediate release), adult: initially 20 mg 2-3 times daily or 40 mg twice daily or 10 mg twice daily (in those who have not previously received nitrates) maximum dose 120 mg in 2-3 divided doses daily.

Adverse effects: See under glyceryl trinitrate

2.1.2 Beta blocker**ATENOLOL**

Dosage form and strength: *Tablet:* 25 mg, 50 mg, 100 mg; *Solution:* 500 mcg/ml in 10ml vial.

Indications: Chronic stable angina, secondary prevention after myocardial infarction, supra ventricular arrhythmia, mild CHF, hypertension, migraine prophylaxis.

Contraindications/Precautions: Avoid in history of asthma or bronchospasm (if no alternative, then use with extreme caution and under specialist supervision), uncontrolled heart failure, Prinzmetal angina, bradycardia (heart rate <50 bpm), hypotension, sick sinus syndrome, second and third degree atrioventricular block, cardiogenic shock, metabolic acidosis, severe peripheral arterial disease, pheochromocytoma (unless used with an alpha blocker). Use caution in patients with first -degree atrioventricular block, portal hypertension, renal impairment (reduce dose), diabetes mellitus (small decrease in glucose tolerance, which can mask symptoms of hypoglycemia), history of hypersensitivity and myasthenia gravis, obstructive airway disease, portal hypertension, psoriasis. Pregnancy- avoid (IUGR, neonatal hypoglycemia and bradycardia). Breast feeding: avoid. Monitor lung function in inadequate cardiac function and bronchospasm disease. Symptoms of hypoglycemia and thyrotoxicosis may get masked. Assess weight daily, watch for CHF (rales/crackles, jugular vein distension, weight gain, and edema). Abrupt withdrawal of drug may exacerbate angina symptoms or precipitate myocardial infarction in patients with coronary artery disease.

Dosage schedule:

- *Hypertension*: Oral, adult: 25 – 50 mg daily. Oral, child: 0.5-1.0 mg/kg/dose in 1-2 divided doses daily. Maximum dose- 2mg/kg/day or 100 mg/day
- *Angina*: Oral, adult: 100 mg, maximum dose 200 mg daily 1 or 2 doses.
- *Arrhythmias*: Oral, adult: 50-100 mg daily. Intravenous, adult: 2.5 mg at rate of 1 mg/min repeated at 5 min interval to a maximum of 10 mg/dose. Intravenous infusion, adult: 150 mcg/kg every 12 hourly over 20 minutes, repeated every 12 hours if required.
- *Early intervention Myocardial infarction (within 12 hour)*: slow intravenous infusion, adult: 5 mg by then oral 50 mg after 15 minutes then oral 50 mg after 12 hours then 100 mg daily.
- *Migraine prophylaxis*: Oral, adult: 50–200 mg daily in divided doses

Adverse effects: Bradycardia, gastrointestinal disturbances including nausea, vomiting, diarrhea, constipation, abdominal cramp, fatigue, cold hands and feet, hypertriglyceridemia.

Drug and food interaction: Avoid with verapamil. Hypotensive effect increases with diuretics, ACE inhibitors, Angiotensin II receptor antagonist, calcium channel blocker. Atenolol may enhance bradycardia produced by cardiac glycosides.

BISOPROLOL

Dosage form and strength: *Tablet:* 2.5 mg, 5 mg, 10 mg

Indications: Hypertension, angina, adjunct in heart failure

Contraindications/Precautions: See under atenolol

Dosage schedule:

- *Hypertension and angina*: Oral, adult: 5-10 mg once daily, 20 mg daily (maximum).
- *Adjunct in heart failure*: Oral, adult: initially 1.25 mg once daily (in the morning) for 1 week then, if well tolerated, increased to 2.5 mg once daily for 1 week, then 3.75 mg once daily for 1 week, then 5 mg once daily for 4 weeks, then 7.5 mg once daily for 4 weeks, then 10 mg once daily, maximum 10 mg daily.

Adverse effects: See under atenolol

Drug and food interaction: See under atenolol

CARVEDILOL

Dosage form and strength: *Tablet:* 3.125 mg, 6.25 mg, 12.5 mg, 25 mg

Indications: Angina, hypertension, adjunct to diuretics/digoxin/ACE inhibitors in heart failure

Contraindications/Precautions: See under atenolol. Avoid in acute decompensated heart failure requiring intravenous inotropes. Check for edema in feet, legs daily. Rise slowly from sitting or lying position to minimize orthostatic hypotension

Dosage schedule:

- *Hypertension*: Oral, adult: Initially 12.5 mg once daily for 2 days, then increased to 25 mg once daily; increased if necessary up to 50 mg daily, dose to be increased at intervals of at least 2 weeks and can be given as a single dose or in divided doses daily.

- *Angina*: Oral, adult: initially 12.5 mg once daily, increased after 2 days to 25 mg twice daily.
- *Adjunct in heart failure*: Oral, adult: initially 3.125 mg twice daily to 6.25 mg twice daily, then to 12.5 mg twice daily then to 25 mg twice daily. Dose increased at intervals of at least 2 weeks

Adverse effects: Allergic skin reactions, angina, AV block, changes in liver enzymes, depressed mood, disturbances of micturition, influenza-like symptoms, leucopenia, nasal stuffiness, postural hypotension, thrombocytopenia, wheezing, headache, dizziness, bradycardia and impotence

Drug and food interaction: Conduction disturbances increases with calcium channel blocker. Carvedilol increases the effect of antidiabetic drugs.

METOPROLOL

Dosage form and strength: *Tablets:* 50 mg, 100 mg; *Injection:* 1 mg/ml

Indications: Angina, hypertension, arrhythmias, migraine prophylaxis, hyperthyroidism adjunct, early intervention in myocardial infarction.

Contraindications/Precautions: See under atenolol. Abrupt withdrawal may cause MI, ventricular arrhythmias, myocardial ischemia; taper dose over 7-14 days.

Dosage schedule:

- *Angina*: Oral, adult: 50- 100 mg, 2-3 times daily.
- *Hypertension*: Oral, adult: initially 100 mg daily, maximum dose 400 mg daily in 1-2 doses.
- *Arrhythmias*: Oral, adult: 50-100 mg, 2-3 times daily, maximum dose 300 mg daily in divided doses. Intravenous, adult: up to 5 mg at rate 1-2 mg/minute repeated after 5 minutes if necessary, total dose 10-15 mg.
- *Migraine prophylaxis*: Oral, adult: 100 -200 mg daily in divided doses.
- *Early intervention in myocardial infarction (within 12 hours)*: Intravenous, adult: 5 mg every 2 minutes to a maximum dose of 15 mg, followed after 15 minutes by oral 50 mg every 6 hours for 48 hours; maintenance oral 200 mg daily in divided doses.
- *Hyperthyroidism (adjunct)*: Oral, adult: 50 mg 4 times a day
- *In surgery*: intravenous 2-4 mg by slow injection to control arrhythmias developing during anesthesia; 2 mg doses may be repeated, maximum dose 10 mg.
- *Oral, child*: 1-2 mg/kg/day in 2 divided doses daily. Maximum dose 6 mg/kg/day up to 200 mg/day

Assess ECG directly when giving IV during initial treatment.

Adverse effects: See under atenolol

Drug and food interaction: See under atenolol

PROPRANOLOL

Dosage form and strength: *Tablet:* 10 mg, 20 mg, 40 mg, 80 mg. *Injection:* 1 mg/ml

Indications: Chronic stable angina, hypertension, secondary prevention after acute myocardial infarction, anxiety, thyrotoxicosis, migraine prophylaxis, pheochromocytoma (only with alpha blocker), prophylaxis of variceal

bleeding in portal hypertension, hypertrophic obstructive cardiomyopathy, mitral valve prolapse, essential tremor, child with cyanotic spells or hypertension or infantile hemangioma

Contraindications/Precautions: See under atenolol. Use caution in inadequate cardiac function and bronchospastic disease. Reduce oral dose in renal and hepatic impairment. Pregnancy (C) breast feeding: safety not established. Do not discontinue abruptly; as dysrhythmia, angina, myocardial ischemia may occur so taper over at least a few weeks. Symptoms of hypoglycemia may get masked- monitor blood glucose.

Dosage schedule:

- *Hypertension:* Oral, adult: initially 80 mg twice daily, increased at weekly intervals as required; maintenance dose 160-320 mg daily. Oral, *child:* 1-4 mg/kg/day in 3-4 divided doses.
- *Prophylaxis of variceal bleeding in portal hypertension:* Oral, adult: initially 40 mg twice daily increased to 80 mg twice daily according to heart rate; maximum dose 160 mg twice daily.
- *Pheochromocytoma (only with an alpha blocker):* Oral, adult: 60 mg daily for 3 days before surgery. 30 mg daily for patients not fit for surgery
- *Angina:* Oral, adult: initially 40 mg 2-3 time daily; maintenance 120-240 mg daily.
- *Arrhythmias, hypertrophic obstructive cardiomyopathy, anxiety, tachycardia and thyrotoxicosis (adjunct):* Oral, adult: 10-40 mg in 3-4 divided doses daily
- *Anxiety (with symptoms such as palpitation, sweating, tremor):* Oral, adult: 40 mg once daily; may increase to 40 mg 3 times daily, if necessary.
- *Prophylaxis after infraction:* Oral, adult: 40 mg 4 times daily for 2-3 days, then 80 mg twice daily, beginning 5-21 days after infraction.
- *Essential tremor:* Oral, adult: initially 40 mg 2-3 times daily; maintenance 80-160 mg daily.
- *Migraine prophylaxis:* Oral, adult: 80-240 daily divided doses.
- *Arrhythmias and thyrotoxic crisis:* Intravenous injection; 1 mg over 1 minute.
- *Cyanotic spells: Child, intravenous:* 0.15-0.25 mg/kg/day in 4 divided dose, not to exceed 1 mg for infants and 3 mg for children. Oral, *child:* 2-4 mg/kg/day in 4 divided doses
- *Infantile hemangioma:* Oral, *child:* 1-2 mg/kg/day in 3 divided doses

Adverse effects: See under atenolol. Hallucination, nightmare, sexual dysfunction.

Drug and food interaction: See under atenolol. Hypersensitivity to catecholamine during withdrawal

2.1.3 Calcium channel blockers

DILTIAZEM

Dosage form and strength: *Tablet:* 30 mg, 60 mg

Indications: Angina pectoris

Contraindications/Precautions: Avoid in acute porphyria, left ventricular failure with pulmonary congestion, second- or third-degree AV block (unless pacemaker fitted), severe bradycardia, sick sinus syndrome. Use caution

bradycardia (avoid if severe), first degree AV block, heart failure, prolonged PR interval, significantly impaired left ventricular function. Pregnancy: avoid. Hepatic impairment reduce dose. Renal impairment, start with smaller dose.

Dosage schedule:

- *Angina*: Oral, adult: Initially 60 mg 3 times a day, adjusted according to response; maximum 360 mg/day. Elderly: Initially 60 mg twice daily, adjusted according to response; maximum 360 mg per day
- *Oral, child*: 1.5-2 mg/kg/day in 3-4 divided doses (maximum dose: < 6mg/kg/day up to 360 mg/day)

Adverse effects: Asthenia, AV block, bradycardia, dizziness, gastro-intestinal disturbances, headache, hot flushes, hypotension, malaise, edema (notably of ankles), palpitation, Sino-atrial block

VERAPAMIL

Dosage form and strength: *Verapamil Hydrochloride: Tablet (immediate release):* 40 mg, 80 mg, 240 mg. *Solution:* 2.5 mg/ml

Verapamil injection should be protected from light.

Indications: Angina pectoris, supra ventricular arrhythmias, hypertension, migraine prophylaxis, supraventricular tachycardia in children

Contraindications/Precautions: Hypotension, bradycardia, second- and third-degree heart block, sick sinus syndrome; cardiogenic shock, history of heart failure, atrial flutter or fibrillation complicating Wolff-Parkinson-White syndrome, acute porphyria. First-degree atrioventricular block, acute phase of myocardial infarction (avoid if bradycardia, hypotension, or left ventricular failure present), hepatic impairment; children (specialist advice only); Pregnancy and breastfeeding: Avoid use in neonate and young infants. Not to discontinue abruptly, chest pain may occur.

Dosage schedule:

- *Angina, supraventricular arrhythmia*: Oral, adult: 40-120 mg 3 times daily
- *Hypertension*: Oral, adult: 240-480 mg daily in 2- 3 divided doses. By slow intravenous injection over 2 minutes (3 minutes in elderly), 5 - 10 mg (preferably with ECG monitoring)
- *Paroxysmal tachyarrhythmia*: slow intravenous injection, adult: initially 5-10 mg further 5 mg after 5-10 minutes if required over 2 minutes (over 3 minutes in elderly) under ECG monitoring.
- *Supraventricular tachycardia: Child, intravenous*: 0.1-0.3 mg/kg/dose may be repeated in 30 min. Maximum first dose 5 mg, and second dose 10 mg
- *Supraventricular arrhythmias*: slow intravenous injection, adult: 5-10 mg, over 2 minutes (over 3 minutes in elderly) under ECG monitoring

Adverse effects: Constipation; less commonly nausea, vomiting, flushing, headache, dizziness, fatigue, and ankle edema; rarely allergic reactions including pruritus, urticaria, angioedema, and erythema multiforme (Stevens-Johnson syndrome); myalgia, arthralgia, paresthesia, erythromelalgia; increased prolactin concentration; gynecomastia and gingival hyperplasia on long-term treatment; hypotension, heart failure, bradycardia, heart block, and asystole (due to negative inotropic effect) with high doses.

2.2 Antiarrhythmic agents

ADENOSINE

Dosage form and strength: *Injection:* 6 mg/2 ml vial

Indications: Paroxysmal supraventricular tachycardia (including Wolff-Parkinson-White syndrome)

Contraindications/Precautions: Pre-existing second or third degree AV block, asthma and sick sinus syndrome. Use cautiously in arterial fibrillation or flutter and heart transplant.

Dosage schedule:

- *Rapid intravenous injection into central or large peripheral vein:* 3 mg over 2 seconds with cardiac monitoring; if necessary followed by 6 mg after 1-2 minutes and then by 12 mg after a further 1-2 minutes.
- *Neonate, intravenous:* 0.05 mg/kg over 1-2 sec may increase dose by 0.05 mg/kg every 2 mins. Maximum dose 0.25 mg/kg
- *Child, intravenous:* 0.1-0.2 mg/kg (initial maximum dose 6 mg) over 1-2 sec. May increase dose by 0.05mg/kg every 2 mins to maximum of 0.25 mg/kg. Follow each dose with normal saline flush. Assess the cardiopulmonary and respiratory status.

Adverse drug reactions: Chest pain, transient facial flush, bronchospasm, nausea and severe bradycardia, difficult or labored breathing, chest tightness

Drug and food interactions: Increased risk for higher degree of heart block: carbamazepine. Increased risk of ventricular fibrillation with digoxin, verapamil. Increased effects with dipyridamole. Methylxanthines decrease the activity of adenosine

Patient's information: Patient should report facial flushing, dizziness, sweating, palpitations, and chest pain (usually transient).

AMIODARONE

Dosage form and strength: *Tablet:* 100 mg, 200 mg; *Solution:* 25 mg/ml, 30 mg/ml, 50 mg/ml

Indications: Paroxysmal supraventricular, nodal and ventricular tachycardia, atrial fibrillation or flutter, ventricular arrhythmia (unresponsive to others) and ventricular fibrillation, all atrial and ventricular tachycardia

Contraindications/Precautions: Avoid in sinus bradycardia, SA heart block, iodine sensitivity, cardiogenic shock, second or third degree AV block, thyroid dysfunctions, severe hepatic, pneumonitis, pulmonary fibrosis, hypokalemia, CHF (with inadequate compensation). Pregnancy: risk of neonatal goiter. Breast feeding: avoid. Clinical monitoring (baseline and every 3 to 6 months) of serum potassium; chest X-ray, pulmonary function tests (with diffusion capacity), liver function test and thyroid function tests is recommended. Toxicity is reversible when managed early.

Dosage schedule:

- *Arrhythmias:* Oral, adult: 200 mg 3 times daily for 1 week reduced to 200 mg twice daily
- *Ventricular fibrillation: intravenous infusion, adult:* 300 mg over at least 3 minutes.
- *Drug resistant refractory cardiac arrhythmia: Oral, child:* < 1 year: 600-

800 mg/1.73m²/day in 1-2 divided dose for 1-14 days. > 1 years: 10-15 mg/kg/day in 1-2 divided doses for -14 days and/or until adequate control is achieved, then reduce to 5 mg/kg/day. *Child, intravenous*: 5 mg/kg over 30 min followed by continuous infusion at the rate of 5 mcg/kg/min. Maximum dose: 15 mcg/kg/min or 20 mg/kg/day

• Infusion should be diluted in glucose 5%, concentration should not exceed 2 mg/ml.

Marked hypotension on IV administration.

Adverse effects: Nausea, vomiting, raised serum transaminases, bradycardia, ventricular arrhythmia, ventricular fibrillation. Neurologic dysfunction (dizziness, paresthesia, tremor and involuntary movements, lack of co-ordination, abnormal gait and ataxia), thyroid dysfunction, pulmonary toxicity (pneumonitis and fibrosis) on long term use.

Drug and food interactions: Inhibits CYP450 enzymes and may increase concentrations of Digoxin, Methotrexate, Theophylline, Procainamide. Increase risk of myopathy with simvastatin. Increased risk of bradycardia with beta-blockers, calcium channel blockers. Increased risk of QT prolongation with azoles, fluoroquinolones, macrolides

Patient's information: Do not discontinue abruptly. Use sunscreen or stay out of sun to prevent burns, use dark glasses to prevent photophobia. Skin discoloration is usually reversible

ATENOLOL: See under section 2.1 Antianginal agents

DIGOXIN

Dosage and strength: *Injection*: 250 mcg/ml in 2-ml ampoule; *Oral liquid*: 50 mcg/ml; *Tablet*: 62.5 mcg, 250 mcg

Indications: Supraventricular arrhythmias, particularly atrial fibrillation; heart failure

(considered for selected patients who remain symptomatic despite treatment with an ACE inhibitor, a diuretic, and a suitable beta-blocker)

Contraindications/Precautions: Avoid in hypertrophic obstructive cardiomyopathy (unless also atrial fibrillation and heart failure); Wolff-Parkinson-White syndrome or other accessory pathway, particularly if accompanied by atrial fibrillation; ventricular tachycardia or fibrillation; intermittent complete heart block; second-degree atrioventricular block. Use caution in recent myocardial infarction; sick sinus syndrome; severe Pulmonary disease; thyroid disease; the elderly (reduce dose); renal impairment; avoid hypokalemia; avoid rapid intravenous administration (nausea and increased risk of arrhythmias); Pregnancy (C) Breastfeeding: use with caution. Obtain ECG after 6 hours to assess toxicity. Monitor apical pulse for 1 full minute before administration. Withhold dose if pulse rate is <60 bpm in an adult, <70 bpm in a child or <90 bpm in an infant. Monitor blood pressure periodically, monitor ECG throughout IV administration and 6 hrs. after each dose. Therapeutic drug monitoring is advised in patient receiving digoxin. Take missed doses within 12 hrs. of scheduled dose. Do not double the dose.

Digoxin has been associated with an increased risk of falls in the elderly, so

patient and family should be advised for monitoring.

Dosage schedule:

- *Atrial fibrillation:* Oral, adult: initially 1–1.5 mg in divided doses over 24 hours for rapid digitalization (or 250 mcg once or twice daily if digitalization less urgent) followed by: 62.5–500 mcg daily (higher dose may be divided), according to renal function and heart rate response; usual maintenance dose: 125–250 mcg daily (lower dose more appropriate in the elderly).
- *Emergency control of atrial fibrillation:* intravenous infusion over at least 2 hours, adult: 0.75–1 mg.

NOTE. Infusion dose may need to be reduced if digoxin or other cardiac glycoside has been given in previous 2 weeks.

Child: doses unit is mcg/kg/day

	Total daily dose (mcg)		Daily maintenance (mcg)	
	PO	IV/IM	PO	IV/IM
Premature neonate	20	15	5	3-4
Full Term Neonate	30	20	8-10	6-8
1 month-2 years	40-50	30-40	10-12	7.5-9
2-10 years	30-40	20-30	8-10	6-8
> 10 years	10-15	8-12	2.5-5	2-3

Initially, half of the total daily dose, then other half total daily dose every 8 hours in 2 divided doses

Adverse effects: Usually only with high doses; gastrointestinal disturbances including anorexia, nausea, vomiting, diarrhea, and abdominal pain; visual disturbances, headache, fatigue, drowsiness, confusion, dizziness, delirium, hallucinations, depression; all arrhythmias except for rapidly conducted atrial arrhythmias (atrial fibrillation and atrial flutter) and except Mobitz type II second degree heart block; rarely rash, and intestinal ischemia; gynecomastia on long-term use; thrombocytopenia reported.

Drug and food interactions: When digoxin is administered with beta blockers and verapamil, there is increased risk of AV block and bradycardia.

DISOPYRAMIDE

Dosage form and strength: *Capsules:* 100 mg, 150 mg; *Injection:* 10 mg in 5 ml ampoule.

Indication: Atrial and ventricular arrhythmias including those resistant to lignocaine.

Contraindications/Precautions: Avoid in preexisting second or third degree AV block, cardiogenic shock, heart failure (can produce severe hypotension due to negative inotropic properties). Renal or hepatic insufficiency, third trimester of pregnancy, glaucoma, myasthenia gravis or urinary retention. Use caution in the elderly and children because they may be more sensitive to its effects.

Dosage schedule: Oral (immediate release), adult: 300-800 mg daily in divided doses. Slow intravenous injection, adult: 2 mg/kg over at least 5 minutes to a maximum of 150 mg with ECG monitoring.

Take disopyramide on a regular schedule around the clock, unless otherwise

directed by your doctor. If you miss a dose of disopyramide, take it if you remember within 4 hours. If it has been more than 4 hours since your missed dose, skip the missed dose and go back to your regular doses schedule. Do not take 2 doses at once.

Adverse effects: Angle-closure glaucoma, antimuscarinic effects, AV block, blurred vision, cholestatic jaundice, dry mouth, gastro-intestinal irritation, hypoglycemia, hypotension, myocardial depression, psychosis, urinary retention, ventricular tachycardia, ventricular fibrillation or torsade de pointes (usually associated with prolongation of QRS complex or QT interval).

Drug and food interactions: The effects of disopyramide can increase with metoprolol and alcohol (minor).

Patient's information: Do not drive, operate machinery. Do not stop the drug suddenly.

ISOPRENALINE

Dosage form and strength: *Injection:* 0.2 mg/ml. *Tablet:* 20 mg

Indications: Torsade de pointes, bradycardia in patients with heart block, control attacks of Stokes Adam syndrome.

Contraindications/Precautions: Preexisting cardiac arrhythmia (especially tachycardia).

Dosage schedule:

- *Intravenous injection, adult:* 0.5-10 mcg/minute
- *Oral, adult:* initially 30 mg every 6hours, range, 90-840 mg daily (but oral route is rarely used).

Adverse effect: Tachycardia, hypotension, arrhythmia, tremor, sweating

LIDOCAINE/ LIGNOCAINE

Dose form and strength: *Injection:* 20 mg/ml in 5 ml ampoule

Indication: Ventricular arrhythmias (especially after myocardial infarction), local anesthesia

Contraindications/Precautions: Avoid in Sino atrial nodal disorder, any grade of atrioventricular block or any other type of conduction disturbances, severe myocardial depression, acute porphyria or hypovolemia, Wolff-Parkinson-White syndrome, Stokes Adams syndrome. Lower dosage in congestive heart failure and following cardiac surgery, bradycardia, hepatic impairment, severe respiratory depression, the elderly, pregnancy and breastfeeding, hypothermia, electrolyte imbalance (potassium and magnesium imbalance). Monitor for ECG

Dosage schedule:

- *Ventricular arrhythmias:* intravenous injection, adult: loading dose of 50-100 mg (or 1-1.5 mg/kg) at a rate of 25-50 mg/minute, followed immediately by intravenous infusion of 1-4 mg/minute, with ECG monitoring of all patients (reduce infusion dose if required for longer than 24 hours).
- *Intravenous, child:* 1 mg/kg/dose slow IV, may repeat 10-15 min. Maximum total dose: 3-5 mg/kg within first hour.

Lidocaine has a short duration of action (15-20 minutes), if the intravenous infusion cannot be given immediately, the initial intravenous injection of 50-100 mg can be repeated once or twice at intervals of not less than 10 minutes.

Adverse effects: Flushing or redness, dizziness, paresthesia, itching, drowsiness, confusion, apnea, respiratory depression, coma, seizure and convulsions, hypotension, arrhythmia, heart block, cardiovascular collapse, bradycardia (may lead to cardiac arrest), nystagmus (often an early sign of lidocaine overdose).

Drug and food interactions: Increased cardiac depression and toxicity with amiodarone, phenytoin, procainamide, propranolol. Increased neuromuscular blockade with neuromuscular blockers. Increased hypotensive effects with MAO inhibitors, antihypertensive. Increased effects of lorazepam (additive CNS depressants) and alprazolam effects (increase CNS side effects)

METOPROLOL: See under section 2.1 Antianginal agents

PROCAINAMIDE

Dosage form and strength: *Solution:* 100 mg /ml in 10 ml ampoule; *tablet:* 250 mg

Indications: Severe ventricular arrhythmias (especially those resistant to lidocaine or those appearing after myocardial infarction); atrial tachycardia, atrial fibrillation; maintenance of sinus rhythm after cardioversion of atrial fibrillation.

Contraindications/Precautions: Avoid in Torsade's de pointes, SLE, 2nd and 3rd degree heart block, heart failure, hypotension, elderly, renal impairment, hepatic impairment, asthma, myasthenia gravis, pregnancy, breastfeeding, electrolyte imbalance (hyperkalemia, hypokalemia, magnesium disorders). Discontinue treatment in case of drop in leukocyte and platelet count. Perform complete blood count twice a week for 3 months.

Dosage schedule:

- *Oral, adult:*, up to 50 mg/kg daily in divided doses every 3-6 hours, preferably controlled by monitoring plasma-procainamide concentration (therapeutic concentration usually within 3-10 mcg/ml); in atrial arrhythmia, higher doses may be required.
- *Slow intravenous injection, adult:* rate not exceeding 50 mg/minute, 100 mg repeated at 5 minute intervals until arrhythmia controlled; maximum 1g.
- *Intravenous infusion, adult:* 500-600 mg over 25-30 minutes, followed by maintenance at rate of 2-6 mg/minute, then if necessary oral anti-arrhythmic treatment as above, starting 3-4 hours after infusion.

When using IV, monitor continuously by ECG.

Adverse effects: Nausea, vomiting, diarrhea, anorexia, rash, pruritus, urticarial, flushing, fever, myocardial depression, heart failure, angioedema, depression, dizziness, psychosis; blood disorders including leukopenia, hemolytic anemia and agranulocytosis after prolonged treatment, SLE like syndrome, high plasma procainamide concentration may impair cardiac conduction.

Patient's information: A wax matrix may appear in stools. Do not discontinue without prescriber's approval. Notify prescriber if lupus-like symptoms appear, leucopenia (sore mouth, gums, and throat) or thrombocytopenia, bleeding, bruising). Avoid driving until product effect is known

PROPRANOLOL: See under section 2.1 Antianginal agents

VERAPAMIL: See under section 2.1 Antianginal agents

2.3 Antihypertensive agents

2.3.1 Angiotensin converting enzyme inhibitor (ACEI)

CAPTOPRIL

Dosage form and strength: Tablet: 25 mg, 50 mg

Indications: Mild to moderate essential hypertension, adjunctive treatment in congestive heart failure, severe hypertension resistant to other treatment, following myocardial infarction, diabetic nephropathy in insulin dependent diabetes.

Contraindications/ precautions: Avoid in bilateral renal artery stenosis, pregnancy, hyperkalemia, pre-existing cough. Use caution in severe or symptomatic aortic stenosis. Monitor renal function before and during treatment.

Dosage schedule: Hypertension: Oral, adult: initially 5 mg once daily, lower initial dose if used in addition to diuretic or in renal impairment; usual maintenance dose 20 mg once daily; maximum 40 mg once daily. Take 1-2 hours after meals.

Adverse effect: alopecia, rash, profound hypotension (usually with first dose, especially in patients taking high dose of diuretics on low sodium diet, dehydration, taste impairment, leucopenia, proteinuria, persistent dry cough, sleep disorder, dyspnea, pallor, neutropenia, Raynaud's syndrome.

Drug and food interaction: With potassium sparing diuretics hyperkalemia may result especially in existing renal impairment. With alcohol, alpha blocker, general anesthetic, angiotensin 2 receptor antagonist, beta blocker, calcium channel blocker, hypotensive effect is increased.

Patient's information: Avoid activities that require concentration, the person may feel dizziness, fainting, and light headedness. Not to discontinue product abruptly, if dose is missed, take as soon as remembered but do not double the doses. Rise slowly to sitting or standing position to minimize orthostatic hypotension.

ENALAPRIL

Dosage form and strength: Tablets: 2.5 mg, 5 mg, 10 mg

Indications: Hypertension, heart failure

Contraindications/Precautions: See under captopril. Avoid in renal impairment when GFR < 30 ml/1.73m²/min. use cautious in impaired liver function and neonates. Monitor renal function.

Dosage schedule:

• Hypertension: Oral, adult: 5 mg once daily, if used in addition to diuretic or in renal impairment or in elderly patient, 2.5 mg daily initially, maintenance dose 20 mg once daily; maximum 40 mg once daily. Oral, child: 0.1- 0.6 mg/kg/day in 1-2 divided doses. Maximum dose 40 mg/day

Adverse drug reaction: Dizziness, headache, nausea, diarrhea, dry cough,

fatigue, asthenia, angioedema, urticaria, rashes, hyperkalemia, impaired perspiration

Drug and food interaction: See captopril

Patient's information: Avoid activities requiring coordination, the drug may cause skin rash, or angioedema. Discontinue if angioedema occurs.

LISINOPRIL

Dosage form and strength: *Tablets:* 2.5 mg, 5 mg, 10 mg, 20 mg

Indications: Essential and renovascular hypertension, adjunctive treatment in congestive heart failure, following myocardial infarction in hemodynamically stable patients, diabetic nephropathy in normotensive insulin-dependent and hypertensive non-insulin dependent diabetes mellitus.

Contraindications/ precautions: Avoid in pregnancy, hereditary angioedema, breast-feeding. Also see under captopril

Dosage schedule:

- *Hypertension:* initially 10 mg daily, if used in addition to diuretic or in patient with renal impairment, initially 2.5-5 mg daily; usual maintenance dose 20 mg once daily (maximum 80 mg daily).
- *Heart failure (adjunct): Oral, adult:* initially 2.5 mg daily; usual maintenance dose 5-20 mg daily.
- *Diabetic nephropathy: Oral, adult:* initially 2.5 mg daily adjusted to achieve diastolic blood pressure below 75 mm Hg in normotensive insulin dependent diabetes and below 90 mm Hg in hypertensive non-insulin dependent diabetes; usual dose range 10-20 mg daily.
- *Prophylaxis after myocardial infarction: Oral, adult:* 5 mg within 24 hours if systolic blood pressure over 120 mm Hg, followed by further 5 mg 24 hours later, then 10 mg after a further 24 hours, and continuing with 10 mg once daily for 6 weeks; if systolic blood pressure 100-120 mm Hg, initially 2.5 mg, increasing to maintenance dose of 5 mg once daily.

Adverse effects: Profound hypotension, hyperkalemia, rash, tachycardia, myocardial infarction, sweating, impotence, dizziness, upper respiratory tract infection, fatigue, diarrhea.

Patient's information: Drink plenty of water each day while taking the medication. Avoid potassium rich diet.

RAMIPRIL

Dosage form and strength: *Tablets/Capsules:* 1.25 mg, 2.5 mg, 5 mg, 10 mg

Indication: Hypertension, congestive heart failure, prophylaxis after myocardial infarction, prophylaxis of cardiovascular events or stroke.

Contraindications/Precautions: Also See under Lisinopril, Enalapril

Dosage schedule:

- *Hypertension: Oral, adult:* initially 1.25 mg once daily, increased at intervals of 1-2 weeks; usual range 2.5-5 mg once daily; maximum 10 mg once daily.
- *Congestive heart failure (adjunct): Oral, adult:* initially 1.25 mg once daily under close medical supervision, increased if necessary at intervals of 1-2 weeks; maximum 10 mg daily.
- *Prophylaxis after myocardial infarction: Oral, adult:* initially 2.5 mg twice daily, increased after 2 days to 5 mg twice daily; maintenance 2.5-5 mg

twice daily.

- *Prophylaxis of cardiovascular events or stroke*: initially 2.5 mg once daily, increased after 1 week to 5 mg once daily, then increased after a further 3 weeks to 10 mg once daily.

Adverse effects: See under Enalapril

2.3.2 Angiotensin receptor blockers (ARBs)

IRBESARTAN

Dosage form and strength: Tablet: 75 mg, 150 mg

Indications: Hypertension, hypertension in patients receiving hemodialysis, renal disease in hypertensive with type 2 diabetes mellitus

Contraindication/ Precautions: Avoid in renal artery stenosis, moderate to severe renal impairment or liver impairment, aortic or mitral valve stenosis.

Dosage schedule:

- *Hypertension: Oral, adult (18–74 years)*: Initially 150 mg once daily, increased if necessary to 300 mg once daily.
- *Hypertension: Oral, adult (>75 years)*: Initially 75–150 mg once daily, increased if necessary to 300 mg once daily.
- *Hypertension in patients receiving hemodialysis*: Oral, adult: Initially 75–150 mg once daily, increased if necessary to 300 mg once daily.
- *Renal disease in hypertensive type 2 diabetes mellitus*: Oral, adult (18–74 years): Initially 150 mg once daily, increased if tolerated to 300 mg once daily.
- *Renal disease in hypertensive type 2 diabetes mellitus*: Oral, adult (>75 years): Initially 75–150 mg once daily, increased if tolerated to 300 mg once daily

Adverse effects: Fatigue, musculoskeletal pain, nausea, vomiting

LOSARTAN

Dosage form and strength: Tablet: 25 mg, 50 mg

Indications: Hypertension, congestive heart failure, diabetic nephropathy in type 2 diabetes mellitus

Contraindications/Precautions: Avoid in pregnancy and breast feeding, children of 6 years or younger, CHF, renal impairment (GFR < 30 ml/min/1.73m², renal artery stenosis. Use caution in moderate to severe renal impairment or liver impairment, aortic or mitral valve stenosis.

Dosage schedule:

- *Hypertension*: Oral, adult: 50 mg (in intravascular volume depletion initially/ elderly >75 years: initially 25 mg) once daily for several weeks, then increase up to 150 mg in weekly interval if necessary and tolerated. Oral, Child: 0.75 mg/kg/dose once daily up to 50 mg/day. Maximum dose: 1.4 mg/kg/day or 100 mg/day
- *Diabetic nephropathy in DM type II*: Oral, adult: initially 50 mg (elderly >75 years: 25 mg) once daily for several weeks then increase up to 100 mg in weekly interval if necessary and tolerated.
- *CHF with ACE inhibitors unsuitable or contraindicated*: Oral, adult: Initially 12.5 mg once daily, increase if tolerated to up to 150 mg once daily, to be

increased daily.

Adverse effects: Hypotension, dizziness, diarrhea, pruritus, rash, taste disturbance, thrombocytopenia, photosensitivity

Drug and food interactions: With lithium, increases lithium toxicity. With hypertensive agents, increases antihypertensive effect. Avoid use in Aliskiren. Patient's information: Rise slowly from sitting or standing position to minimize orthostatic hypotension. Avoid sunlight, salt substitutes, alcohol, over the counter products unless approved by prescriber.

TELMISARTAN

Dosage form and strength: *Tablet:* 20 mg, 40 mg, 80 mg

Indications: Hypertension, prevention of cardiovascular events in patients with established atherosclerotic cardiovascular disease or type 2 diabetes mellitus with target-organ damage.

Contraindication: Avoid in bilateral renal artery stenosis, pregnancy and breast feeding, in severe impairment or biliary obstruction.

Dosage schedule:

- *Hypertension:* Oral, adult: Initially 20–40 mg once daily for at least 4 weeks, increased if necessary up to 80 mg once daily
- *Prevention of cardiovascular events in patients with established atherosclerotic cardiovascular disease or type 2 diabetes mellitus with target-organ damage:* Oral, adult: 80 mg once daily
- *Severe renal impairment:* Oral, adult: Initial dose of 20 mg once daily.

Adverse effects: Arthralgia, back pain, chest pain, eczema, gastro-intestinal disturbances, influenza like symptoms, leg cramps, myalgia, pharyngitis, sinusitis, urinary-tract infection, abnormal vision, anxiety, dry mouth, increased sweating, tendonitis- like symptoms, vertigo

Drug and food interactions: Avoid use with ACE inhibitor, aspirin, acebutolol, aceclofenac, amiloride, atenolol, chlorthiazide, digoxin, enoxaparin, furosemide, ibuprofen, insulin, irbesartan, ketorolac, piroxicam, potassium chloride, spironolactone, sulfasalazine, toseamide, trimethoprim.

VALSARTAN

Dosage and strength: *Tablet:* 40 mg, 80 mg, 160 mg

Indications: Hypertension, myocardial infarction with left ventricular failure or left ventricular systolic dysfunction.

Contraindications/Precautions: See under Losartan. Avoid in biliary cirrhosis, cholestasis, severe hepatic impairment, renal impairment when eGFR <10 ml/min/1.73m². Use caution in mild to moderate renal and hepatic impairment.

Dosage schedule:

- *Hypertension:* Oral, adult: 80 mg once daily (initially 40 mg once daily in intravascular volume depletion); if necessary increased after at least 4 weeks to 160 mg daily.
- *Myocardial infarction:* Oral, adult: initially 20 mg twice daily increased over several weeks to 160 mg twice daily if tolerated.
- *Mild to moderate hepatic impairment:* maximum dose of 80 mg daily.

Take medicine before meal.

Adverse effects: See under losartan.

Drug and food interactions: Food interferes with absorption.

2.3.3 Beta blockers

ATENOLOL: See under section 2.1 Antianginal agents

BISOPROLOL: See under section 2.1 Antianginal agents

LABETALOL

Dosage form and strength: *Tablet:* 100 mg, 200 mg; *Solution:* 100 mg/20ml

Indications: Hypertension, Hypertensive emergencies, hypertension following myocardial infarction, hypertension of pregnancy

Contraindication/ Precautions: See under contraindication in Atenolol under Antianginal of this chapter. Avoid in severe liver damage. Hepatic impairment: avoid as reported. Renal impairment: Dose reduction may be required. Pregnancy: possibly harmful in the first trimester. If labetalol used close to delivery, monitor infants for signs of alpha-blockade (as well as beta blockade). Breast feeding: monitor infants for possible toxicity due to alpha-blockade (in addition to beta-blockade. Laboratory testing needed at first symptom of liver dysfunction and if laboratory evidence of damage (or if jaundice) labetalol should be stopped and not restarted.

Dosage schedule:

- *Hypertension:* Oral, adult: Initially 100 mg (50 mg for elderly) twice daily, dose to be increased at intervals of 14 days; usual dose 200 mg twice daily, increased if necessary up to 800 mg daily in 2 divided doses, higher doses to be given in 3–4 divided doses; maximum 2.4 g per day. To be taken with food
- *Hypertension/ hypertensive emergencies:* *Intravenous injection:* adult: 50 mg, administer over at least 1 minute, then 50 mg after 5 minutes if required; maximum 200 mg per course.
- *Hypertension/ hypertensive emergencies:* *Intravenous infusion:* adult: Initially 2 mg/minute until a satisfactory response is achieved, then discontinue; usual dose 50–200 mg
- *Hypertension following myocardial infarction:* *Intravenous Infusion,* adult: 15 mg/hour, maximum dose 120 mg/hour, dose to be increased gradually.
- *Hypertension of pregnancy:* *Intravenous infusion,* adult: Initially 20 mg/hour, then increased if necessary to 40 mg/hour after 30 minutes, then increased if necessary to 80 mg/hour after 30 minutes, then increased if necessary to 160 mg/hour after 30 minutes, adjusted according to response. Maximum 160 mg/hour.
- *Hypertension:* Oral, *child:* 4 mg/kg/day in 2 divided doses. Maximum dose up to 40 mg/kg/day.
- *Hypertensive emergencies:* *Child, intravenous:* 0.2–1.0 mg/kg/dose every 10 min as required. Maximum dose: 20 mg/dose
- *Hypertensive emergencies:* *Child, infusion:* 0.4–1.0 mg/kg/hr. Maximum dose 3mg/kg/hr.

Adverse effects: Difficulty in micturition, epigastric pain, liver damage,

nausea, postural hypotension, vomiting, weakness, severe hepatocellular injury (with short or long term use)

Drug and food interaction: Interferes with laboratory tests for catecholamine. Concurrent use of digitalis increases the risk of bradycardia
 Patient's information: For oral formulation, take medicine after food. Patient should remain supine up to 3 hrs. after intravenous administration.

METOPROLOL: See under section 2.1 Antianginal agents

NEBIVOLOL

Dosage form and strength: *Tablets:* 2.5 mg, 5 mg

Indications: Essential hypertension, hypertension in patient with renal impairment, adjunct in stable mild to moderate heart failure

Contraindication: See under contraindication Atenolol in Antianginal agents. Avoid in acute or decompensated heart failure requiring intravenous inotropes, decompensated heart failure, severe hepatic impairment (Child-Pugh class C). Pregnancy (C). Breast feeding: avoid. Renal impairment: avoid in heart failure if serum creatinine greater than 250 micromole/liter

Dosage schedule:

- *Essential hypertension:* Oral, adult: 5 mg daily; elderly: Initially 2.5 mg daily, then increased if necessary to 5 mg daily
- *Hypertension in patient with renal impairment:* Oral, adult: Initially 2.5 mg once daily, then increased if necessary to 5 mg once daily.
- *Adjunct in stable mild to moderate heart failure:* Oral, elderly (≥ 70 years): Initially 1.25 mg once daily for 1–2 weeks, then increased if tolerated to 2.5 mg once daily for 1–2 weeks, then increased if tolerated to 5 mg once daily for 1–2 weeks, then increased if tolerated to 10 mg once daily.

Adverse effects: See under adverse effect Atenolol in Antianginal agents. Depression, edema.

METOPROLOL: See under section 2.1 Antianginal agents

PROPRANOLOL: See under section 2.1 Antianginal agents

2.3.4 Calcium channel blockers

AMLODIPINE

Dosage form and strength: *Tablet:* 2.5 mg, 5 mg, 10 mg

Indications: Hypertension, angina pectoris

Contraindication/ Precautions: Cardiogenic shock, unstable angina, significant aortic stenosis. In hepatic impairment: dose reduction. Try to avoid large amount of alcohol. Pregnancy and breastfeeding: avoid.

Dosage schedule:

- *Hypertension or angina:* Oral, adult: initially 5 mg once daily; maximum dose 10 mg once daily.
- *Oral, child:* 0.1–0.6 mg/kg/day in 1–2 divided doses. Maximum dose: 20 mg/day

Adverse effects: Abdominal pain, nausea, flushing, edema (ankle edema),

headache, dizziness, sleep disturbances, fatigue, alopecia, arthralgia, asthenia, back pain, dry mouth, dyspnea, impotence, gynecomastia, myalgia, muscle cramp, skin discoloration.

Drug and food interaction: See under verapamil

FELODIPINE

Dosage form and strength: *Tablet:* 2.5 mg, 10 mg

Indications: Angina, hypertension

Contraindication/Precautions: Avoid in Cardiac outflow obstruction, aortic stenosis uncontrolled heart failure, unstable angina, within 1 month of myocardial infarction. Predisposition to tachycardia, severe left ventricular dysfunction, withdraw if cardiogenic shock develops, if ischemic pain occurs shortly after initiating treatment. Pregnancy- avoid. Breast feeding- safe. In hepatic impairment, reduce dose.

Dosage schedule:

- *Angina:* Oral, adult: 5 mg/day, maximum dose 10 mg/day. Oral, elderly: 2.5 mg/day, maximum dose 10 mg/day.
- *Hypertension:* initially 5 mg (elderly 2.5 mg) daily in the morning; usual maintenance dose 5-10 mg once daily.

Adverse effects: flushing, headache, peripheral edema.

Drug and food interaction: See under verapamil

NIFEDIPINE

Dosage form and strength: *Capsule:* 5 mg, 10 mg; *Tablet:* 30 mg

Indications: prophylaxis of angina, hypertension, Raynaud's phenomenon, pulmonary hypertension.

Contraindication/ Precautions: Avoid in congestive heart failure or aortic stenosis, especially in those receiving concomitant beta blocking agents. In patients with angina, the drug may cause increased angina. Pregnancy (D)

Dosage schedule:

- *Hypertension and angina prophylaxis:* Oral, adult: 20 mg twice daily. Usual maintenance 10-40 mg twice daily.
- *Raynaud's phenomenon:* Oral, adult: initially 5 mg 3 times daily with or after food; usual maintenance 5-20 mg 3 times daily.
- *Pulmonary hypertension:* Oral, adult: 120 to 240 mg once daily dose.
- *Hypertension: Child, sublingual:* 0.25-0.5 mg/kg/dose may be repeated 6 hourly. Maximum dose 10 mg/dose.
- *Hypertension: Child, sustained release tablet:* 0.25-3 mg/kg/day in 1-2 divided dose. Maximum dose 120 mg/day

To be taken with or after food.

Adverse effects: dizziness, giddiness, flushing, light headedness, peripheral edema and palpitation.

Drug and food interaction: See under verapamil

2.3.5 Centrally acting antihypertensives

CLONIDINE

Dosage form and strength: *Tablet:* 25 mcg, 100 mcg.

Indications: Hypertension, prevention of recurrent migraine, prevention of vascular headache, treatment for acute withdrawal in opioid dependent patients.

Contraindication/Precautions: Avoid in severe bradyarrhythmia secondary to second- or third-degree AV block or sick sinus syndrome. Use caution in cerebrovascular disease, constipation, heart failure, history of depression, mild to moderate bradyarrhythmia, polyneuropathy, Raynaud's syndrome or other occlusive peripheral vascular disease. In hypertension, must be withdrawn gradually to avoid severe rebound hypertension. Pregnancy: use caution, may lower fetal heart rate. Breast feeding: avoid. Renal impairment: Use with caution in severe impairment, reduce initial dose and increase gradually.

Dosage schedule:

- *Hypertension:* Oral, adult: Initially 50–100 mcg 3 times a day, increase initial dose every second or third day, usual maximum dose 1.2 mg daily
- *Prevention of recurrent migraine/Prevention of vascular headache:* Oral, adult: Initially 50 micrograms twice daily for 2 weeks, then increased if necessary to 75 micrograms twice daily
- *Treatment for acute withdrawal in opioid dependent patients:* Oral, adult: 0.1-0.3 mg every 4-6 hours; increase by 0.1 mg/day; 0.15-0.75 mg/day if required; do not exceed 2.4 mg/day

Adverse effects: Constipation, depression, dizziness, drowsiness, dry mouth, headache, malaise, nausea, postural hypotension, salivary gland pain, sexual dysfunction, sleep disturbances, vomiting. Uncommon: bradycardia, delusion, hallucination, paresthesia, pruritus, rash, Raynaud's syndrome, urticarial

Drug and food interaction: concomitant use of alcohol may enhance effects of alcohol

Patient's information: Drowsiness may affect performance of skilled tasks (e.g. driving)

2.3.6 Diuretics

CHLORTHALIDONE

FUROSEMIDE

HYDROCHLOROTHIAZIDE

METOLAZONE

SPIRONOLACTONE

TORSEMIDE

See under section 5.1 Diuretics in drugs used in Renal Disorders, Chapter 5

2.3.7 Others

HYDRALAZINE HYDROCHLORIDE

Dosage form and strength: Powder for injection: 20 mg in ampoule; Tablet: 25 mg, 50 mg

Indication: Moderate and severe hypertension (adjunct), hypertensive emergencies in pregnant (not a first line agent), hypertension with renal

complication and children

Contraindications/Precautions: Avoid in severe tachycardia, high output heart failure, myocardial insufficiency due to mechanical obstruction, cor pulmonale, dissecting aortic aneurysm, porphyria, idiopathic systemic lupus erythematosus. Use caution in hepatic impairment, renal impairment, coronary artery disease (may provoke angina, avoid after myocardial infarction), pregnancy, elderly, cerebrovascular disease. Complete blood count, LE cell preparation, antinuclear antibody should be performed before and periodically during prolonged hydralazine therapy. Intravenous hydralazine is not advisable in older patients, hypertensive patient with coronary artery disease or cardiovascular risk factors. Monitor blood glucose regularly in diabetics.

Dosage schedule:

- *Mild or moderate hypertension (as adjunct): Oral, adult:* 25 mg twice daily, increased to a maximum of 50 mg twice daily.
- *Hypertensive emergencies (including pregnancy/ hypertension with renal complications): intravenous infusion, adult:* initially 200-300 mcg/minute, maintenance usually 50-150 mcg/minute. *Slow intravenous injection, adult:* 5-10 mg, to be diluted with 10 ml of 0.9% saline, dose may be repeated after 20-30 min.
- *Hypertension: Oral, child:* 0.75-1.0 mg/kg/day in 2-4 divided doses. Maximum dose: 25 mg/dose. May increase to infants: 5mg/kg/day-, Children: 7.5 mg/kg/day or 200mg/day
- *Hypertension: Child, intravenous or intramuscular: Hypertensive crisis:* 0.1-0.2 mg/kg/dose every 4-6 hours. Maximum dose: 20 mg/dose. Usual IV/IM dose: 1.7-3.5 mg/kg/day

Adverse effect: Tachycardia, palpitation, hypotension, nausea, vomiting, systemic lupus erythematosus like syndrome, weight gain and headache, muscle weakness, cramps, dizziness. Patients who are slow acetylators of hydralazine may have high risk of developing SLE.

Drug and food interaction: With diuretic or other antihypertensives, the hypotensive effect increases.

Patient's information: Take drug early in day to avoid nocturia. Rise slowly from sitting or lying position.

METHYLDOPA

Dosage form and strength: Tablet: 250 mg

Indication: Hypertension, hypertension in pregnancy

Contraindications/Precautions: Avoid in acute porphyria, depression, pheochromocytoma. Use cautiously in patients with history of liver disease and renal impairment, Sino atrial dysfunction; May precipitate severe bradycardia and sinus arrest. Screening for hepatotoxicity (e.g. with determination of gamma-glutamyl transpeptidase or alanine aminotransferase) at 3 weeks then at 3 months following initiation of treatment. Coomb's test may be positive in up to 30% of patients, but discontinue only if hemolysis develops. Pregnancy and breast feeding: safe.

Dosage schedule: *Hypertension, Hypertension in pregnancy:* Oral, adult: 250 mg, 2-3 times a day. Single dose administration at bedtime minimizes

sedative effect but it is not sufficient for some patients, dose can be gradually increased up to 3 g daily (maximum).

Protect the medication from light. Oral, elderly: initially 125 mg twice daily, increase gradually up to maximum dose of 2 gm daily.

Adverse effects: Sedation, dryness of mouth, decreased libido, parkinsonian signs, hyperprolactinemia, gynecomastia, hepatitis and hepatotoxicity, hemolytic anemia, leucopenia, lupus like syndrome, myocarditis, retroperitoneal fibrosis, pancreatitis, malabsorption, diarrhea, amenorrhea, Bell's palsy, bone marrow depression, depression, eosinophilia, drug fever, nasal congestion, nightmares, sialadenitis, toxic epidermal necrolysis.

PRAZOSIN

Dosage form and strength: Tablet: 1 mg, 2.5 mg, 5 mg

Indications: Hypertension, benign prostatic hyperplasia.

Contraindications/Precautions: Avoid in history of micturition syncope and postural hypotension, congestive heart failure due to mechanical obstruction (e.g. aortic stenosis). Use caution cataract surgery (risk of intra-operative floppy iris syndrome), elderly, renal or hepatic impairment. Pregnancy (C), Breast feeding: use caution.

Dosage schedule:

- *Hypertension:* Oral, adult: 500 mcg 2-3 times daily for 3-7 days, the initial dose on retiring to bed at night; increased to 1 mg 2-3 times daily for further 3-7 days then increased if necessary. Maximum dose 20 mg daily in divided doses
- *Benign prostatic hyperplasia:* Oral, adult: Initially 500 mcg twice daily for 3-7 days, subsequent doses should be adjusted according to response, maintenance 2 mg twice daily, initiate with lowest possible dose in elderly patients.

Adverse effects: Postural hypotension, dizziness, headache, palpitation, nervousness, drowsiness, priapism, blurred vision, depression, dry mouth, dyspnea, gastrointestinal disturbances, nasal congestion, edema, palpitations, syncope, urinary frequency, vertigo, weakness.

Drug and food interactions: Concomitant use with diuretics or other antihypertensive drug may cause an additive hypotensive effect.

Patient's information: First dose may cause collapse due to hypotension, take first dose at bedtime; do not to drive/operate machine for 4 hr. after first dose.

SODIUM NITROPRUSSIDE

Dosage form and strength: Intravenous solution: 10 mg/ml

Indication: Hypertensive crisis, controlled hypotension in anesthesia, acute or chronic heart failure.

Contraindications/Precautions: Severe hepatic impairment, compensatory hypertension, severe vitamin B12 deficiency, Leber optic atrophy. Elderly, hyponatremia, hypothermia, hypothyroidism, impaired cerebral circulation, ischemic heart disease. Impaired pulmonary function; hypothyroidism; renal impairment, ischemic heart disease, impaired cerebral circulation; hyponatremia; raised intracranial pressure; Monitor blood pressure and

blood cyanide concentration; monitor blood. Thiocyanate concentration if given for more than 3 days; avoid sudden withdrawal (reduce infusion over 15–30 minutes to avoid rebound effects); Pregnancy: Avoid prolonged use, potential for accumulation of cyanide in fetus. Breast feeding: safety information not available. Caution advised due to thiocyanate metabolite.

Dosage schedule:

- *Hypertensive crisis:* Intravenous infusion, adult: initially 0.5–1.5 mcg/kg/minute, increased gradually to 0.5–6 mcg/kg/minute; (lower doses in patients already being treated with antihypertensives); maximum, 8 mcg/kg/minute. Stop infusion, if response is unsatisfactory after 10 minutes at the maximum dose.
- *Heart failure:* 10–15 mcg /minute, increased every 5–10 minutes as necessary, usual range 10–200 mcg/minute.

Adverse effects: severe hypotension; associated with over-rapid. Reduction in blood pressure include headache, dizziness; retrosternal discomfort, nausea, retching, abdominal pain; perspiration; palpitations, anxiety, perspiration; rarely reduced platelet count, and acute transient phlebitis.

TAMSULOSIN

Dosage form and strength: Capsule: 400 mg.

Indications: Benign prostatic hyperplasia

Contraindications/Precautions: Avoid in micturition syncope, postural hypotension, severe liver impairment. Use caution if eGFR <10 ml/min/1.73m².

Dosage schedule: Oral, adult: 400 mcg daily as once daily.

Adverse effects: Postural hypotension, dizziness, headache, palpitation, drowsiness, priapism, pruritus, angioedema, asthenia, blurred vision, rash, rhinitis, tachycardia, depression, intraoperative floppy iris syndrome, gastrointestinal disturbances.

Patient's information: Do not drive, use machinery, or do any activity that requires alertness until you are sure you can perform such activities safely. Not to crush, break, chew on oral intake.

TERAZOSIN

Dosage form and strength: Tablet: 1 mg, 2 mg, 5 mg.

Indication: Benign prostatic hyperplasia (BPH), mild to moderate hypertension

Contraindication /Precaution: See under Prazosin

Dosage schedule:

- *Hypertension (mild to moderate):* Oral, adult: Initially 1 mg once daily at bedtime, dose doubled after 7 days if necessary, usual maintenance dose 2–10 mg according to response.
- *BPH:* Oral, adult: Initially 1 mg orally once daily at a bedtime. If necessary dose may be doubled at intervals of 1–2 weeks according to response, maintenance 5–10 mg daily; maximum 10 mg per day.

Adverse effects: Postural hypotension and syncope (especially on the start of therapy), dizziness, drowsiness, dry mouth, chest pain, pedal edema, palpitation, headache, priapism, thrombocytopenia, decreased libido, erectile disorders, weight gain, dyspnea, Angioedema, pain in extremities,

blurred vision

Drug and food interactions: With Metoprolol causes additive hypotensive effect

2.4 Drugs used in cardiovascular shock

DOPAMINE HYDROCHLORIDE

DOBUTAMINE

EPINEPHRINE /ADRENALINE

NOREPINEPHRINE/ NORADRENALINE

See under section 2.5 in Drugs used in heart failure

PHENYLEPHRINE

Dosage form and strength: *Solution:* 10 mg/ml

Indications: Acute hypotension, Priapism

Contraindication: Avoid in hypertension, severe hyperthyroidism. Hypertensive response of Phenylephrine has a longer duration of action than noradrenaline (norepinephrine) and an excessive vasopressor response may cause a prolonged rise in blood pressure. Pregnancy: avoid

Dosage schedule:

- *Acute hypotension:* subcutaneous injection/ intramuscular injection, adult: Initially 2–5 mg, followed by 1–10 mg, after at least 15 minutes, if required. Slow intravenous injection, adult: 100–500 mcg, repeated as necessary after at least 15 minutes; 1 mg/ml solution to be used. Intravenous infusion, adult: Initially up to 180 mcg/minute, reduced to 30–60 mcg/min, adjusted according to response. Intravenous infusion give intermittently in Glucose 5% or Sodium chloride 0.9%. Dilute 10 mg in 500 mL infusion fluid.
- *Priapism:* Intracavernosal injection, adult: 100–200 mcg every 5–10 minutes; maximum 1 mg per course. For intracavernosal injection, if suitable strength of phenylephrine injection is not available, it may be specially prepared by diluting 0.1 mL of the phenylephrine 1% (10 mg/mL) injection to 5 mL with sodium chloride 0.9%.

Adverse effects: Arrhythmias, hypertension, palpitation, tachycardia, angle-closure glaucoma, anorexia, anxiety, bradycardia (also reflex bradycardia), confusion, dyspnea, headache, hypoxia, insomnia, nausea, peripheral ischemia, psychosis, tremor, urinary retention, vomiting, weakness

VASOPRESSIN: See under section 5.2 Antidiuretics Hormones in Drugs used in Renal Disorders, Chapter 5

2.5 Drugs used in heart failure

BISOPROLOL: See under section 2.1 Antianginal agents

CARVEDILOL: See under section 2.1 Antianginal agents

DIGOXIN: See under section 2.2 Antiarrhythmic agents

DOBUTAMINE

Dosage form and strength: *Injection solution:* 12.5 mg/ml in 20 ml vial.

Indications: Inotropic support in infarction, cardiac surgery, septic shock, cardiogenic shock and during positive end expiratory pressure ventilation.

Contraindications/Precautions: Avoid in hypersensitivity, pheochromocytoma. Use caution in severe hypotension, complicating cardiogenic shock, heart failure.

Dosage schedule: *Intravenous infusion, adult:* 2.5-10 mcg/kg/minute, adjusted according to response, alternatively 0.5-40 mcg/kg/min

Adverse effect: Tachycardia, increase in systolic blood pressure, phlebitis. Extravasation of the drug causes tissue necrosis

Drug and food interactions: Additive (synergistic) effective with Nitroprusside. Atenolol may negate the effect of dopamine. Do not mix with sodium bicarbonate, furosemide and other alkaline solutions.

DOPAMINE

Dosage form and strength: *Injection:* 40 mg/ml in 5ml, 10ml vial.

Indications: Cardiogenic shock including in myocardial infarction and cardiac surgery.

Contraindications/Precautions: Avoid in tachyarrhythmia, ventricular fibrillation, ischemic heart disease; pheochromocytoma, hyperthyroidism. Correct hypovolemia before, and maintain blood volume during the treatment; correct hypoxia, hypercapnia, and metabolic acidosis before or at same time as starting treatment; use low dose in cardiogenic shock due to myocardial infarction; history of peripheral vascular disease (increased risk of ischemia of extremities). Pregnancy: use only if potential benefit outweighs risk. Breast Feeding: May suppress lactation.

Dosage schedule: *Cardiogenic shock:* intravenous infusion, adult: initially 2-5 mcg/kg/minute into a large vein (preferably via central venous catheter), gradually increased by 5-10 mcg/kg/minute according to blood pressure, cardiac output, and urine output (seriously ill patients, up to 20-50 mcg/kg/minute)

Prepared immediately before use in accordance with the manufacture's instruction. Protect medication from light.

Adverse effects: Nausea, vomiting, peripheral vasoconstriction; hypotension with dizziness, fainting, flushing; tachycardia, ectopic beats, palpitations, anginal pain; headache, dyspnea; hypertension particularly in over dosage. Extravasation of the drug causes tissue necrosis.

Drug and food interaction: Propranolol and Metoprolol antagonize the cardiac effects of dopamine. Ventricular arrhythmias and hypertension may occur with halothane or cyclopropane anesthesia.

EPINEPHRINE /ADRENALINE

Dosage form and strength: *Injection:* 1 mg in 1000 ml

Indications: Cardiac arrest, adjunct with local anesthetics, acute anaphylaxis

Contraindications/Precautions: Shock (other than anaphylactic shock), second stage labor. Do not use the drug if the color of the injection is cloudy or brownish. While using this drug monitor blood pressure, heart rate.

Dosage schedule: *Acute anaphylaxis:* intramuscular injection, adult: 0.5-1 ml, to be repeated every 10 minutes according to blood pressure and pulse, until improvement occurs. Intramuscular injection, child (2-5 years): 0.2-0.4 ml; (6-12 years): 0.5 ml. Dosage to be repeated as in adult.

Acute hypotension: continuous intravenous infusion, neonate and child: 100 nanogram/kg/min (up to 1.5 mcg/kg/min) adjusted according to response.

Cardiopulmonary resuscitation: Intravenous injection, adult: 1 mg every 3-5 min as required, 1 in 10000(100 mcg/ml) solution is recommended.

Adverse effect: Tachycardia, hypertension, tremor, chest pain, irregular heartbeats, headache, nausea, vomiting, nervousness, restlessness, and weakness.

Drug and food interactions: It should be avoided in patients who are on tricyclic antidepressants as it may cause arrhythmias, hypertension or tachycardia.

Patient's information: Notify doctor if side effects (anaphylaxis) are seen.

FUROSEMIDE: See under section 5.2 Antidiuretics Hormones in Drugs used in Renal Disorders, Chapter 5

LOSARTAN: See under section 2.3 Antihypertensive agents

TELMISARTAN: See under section 2.3 Antihypertensive agents

METOPROLOL: See under section 2.1 Antianginal agents

MILRINONE

Dosage form and strength: Injection: 1 mg/ml, 10mg/10ml solution in ampoules.

Indications: Short-term treatment of severe congestive heart failure unresponsive to conventional maintenance therapy (not immediately after myocardial infarction), acute heart failure, including low output states following heart surgery

Contraindication/ Precautions: Avoid in severe hypovolemia. Use caution in hypokalemia, renal impairment, heart failure associated with hypertrophic cardiomyopathy, stenotic or obstructive valvular disease or other outlet obstruction. Pregnancy: use with caution- use only if potential benefit outweighs risk. Breast feeding: avoid.

Dosage schedule: *Short-term treatment of severe congestive heart failure unresponsive to conventional maintenance therapy (not immediately after myocardial infarction)/ acute heart failure, including low output states following heart surgery:* intravenous injection, adult: Initially 50 mcg/kg, given over 10 minutes, followed by intravenous infusion 375-750 nanogram/kg/minute usually given following surgery for up to 12 hours or in congestive heart failure for 48-72 hours; maximum dose: 1.13 mg/kg per day. Renal impairment: Reduce dose and monitor response if eGFR < 50 mL/min/1.73 m²

Adverse effects: Ectopic beats, headache, hypotension, supraventricular arrhythmias (more likely in patients with pre-existing arrhythmias), ventricular tachycardia. Less commonly seen: Chest pain, hypokalemia, thrombocytopenia, tremor, ventricular fibrillation.

NOREPINEPHRINE/NORADRENALINE

Dosage form and strength: Injection: 1 mg/ml. Noradrenaline (base) 4 mg/4 ml concentrate for solution for infusion ampoules.

Indications: Acute hypotension

Contraindication/ Precautions: Hypertension. Use caution in coronary vascular thrombosis, diabetes mellitus, elderly, following myocardial infarction, hypercapnia, hyperthyroidism, hypoxia, mesenteric vascular thrombosis, peripheral vascular thrombosis, variant angina, uncorrected hypovolemia. Pregnancy: Avoid, may reduce placental perfusion.

Dosage schedule: *Acute hypotension:* intravenous, adult: Initially 0.16–0.33 mL/minute, solution containing noradrenaline 40 mcg (base)/ml, adjusted according to response into large vein (preferably via central venous catheter). 1 mg of noradrenaline base is equivalent to 2 mg of noradrenaline acid tartrate. Doses expressed as the base. For treatment of acute hypotension in adults, use a solution containing noradrenaline 40 mcg (base)/ml. For intravenous infusion, give continuously in Glucose 5% or 0.9% saline and glucose via a controlled infusion device. For administration via syringe pump, dilute 2 mg (2 mL of solution) noradrenaline base with 48 mL infusion fluid. For administration via drip counter dilute 20 mg (20 mL of solution) noradrenaline base with 480 mL infusion fluid; preferably through a central venous catheter; incompatible with alkalis.

Adverse effects: Angle-closure glaucoma, anorexia, anxiety, arrhythmias, bradycardia, confusion, dyspnea, headache, hypertension, hypoxia, insomnia, nausea, palpitation, peripheral ischemia, psychosis, tachycardia, tremor, urinary retention, vomiting, weakness. Avoid extravasation, may cause pain and subcutaneous tissue ischemia at the site.

Drug and food interactions: incompatible with alkalis.

RAMIPRIL: See under section 2.3 Antihypertensive agents

SPIRONOLACTONE: See under section 5.2 Antidiuretics Hormones in Drugs used in Renal Disorders, Chapter 5

VALSARTAN: See under section 2.3 Antihypertensive agents

2.6 Drugs used in pulmonary hypertension**BOSENTAN**

Dosage form and strength: *Tablet:* 62.5 mg, 125 mg

Indications: Pulmonary arterial hypertension, systemic sclerosis with ongoing digital ulcer disease (to reduce number of new digital ulcers)

Contraindication/ Precautions: Avoid in acute porphyria, systemic systolic blood pressure is <85 mmHg. Pregnancy (X) Breast feeding: avoid. Hepatic impairment: avoid in moderate to severe impairment. Effective contraception required during administration (hormonal contraception not considered effective). Monthly pregnancy tests advised. Monitor: Hemoglobin before and during treatment (monthly for first 4 months then 3-monthly); Liver function before treatment, at monthly intervals during treatment and 2

weeks after dose increase (reduce dose or suspend treatment if liver enzymes raised significantly)—discontinue if symptoms of liver impairment.

Dosage schedule:

- *Pulmonary arterial hypertension*: Oral, adult: Initially 62.5 mg twice daily for 4 weeks, then increased to 125 mg twice daily; maximum 500 mg per day in 2 divided doses.
- *Systemic sclerosis with ongoing digital ulcer disease (to reduce number of new digital ulcers)*: Oral, adult: Initially 62.5 mg twice daily for 4 weeks, then increased to 125 mg twice daily

Avoid abrupt withdrawal.

Adverse effects: Anemia, diarrhea, flushing, gastro-esophageal reflux, headache, hypotension, edema, palpitation, syncope, liver cirrhosis, liver failure, leucopenia, neutropenia, thrombocytopenia.

SILDENAFIL

Dosage form and strength: *Tablet:* 25 mg, 50 mg, 100 mg

Indications: Pulmonary arterial hypertension (PAH), erectile dysfunction

Contraindication/ Precautions: Avoid in hypotension, myocardial infarction, unstable angina, not for use in children with PAH. Use caution in patients with anatomic deformation of penis, retinitis pigmentosa, ischemic heart disease.

Dosage schedule:

Erectile dysfunction: Oral, adult: 50 mg 1 hr. before sexual activity, maximum dose 100 mg or minimum dose 25 mg and maximum of 1 dose per day.

PAH: Oral, adult: 25 mg three times daily.

Adverse effects: headache, flushing, epistaxis, dyspepsia, insomnia, erythema, diarrhea, migraine, myalgia, nasal congestion, visual disturbance, back pain.

Drug and food interactions: Avoid concomitant use with nitrates. With alcohol may cause dizziness, fainting or blurred vision. With sildenafil, patient with heart problem, are at increased risk of heart related side effect.

2.7 Hypolipidemic / lipid lowering drugs**ATORVASTATIN**

Dosage form and strength: *Tablet:* 10 mg

Indications: Primary hypercholesterolemia, homozygous or heterozygous familial hypercholesterolemia or mixed hyperlipidemia in patients who have not responded adequately to diet and other appropriate measures.

Contraindications/Precautions: Avoid in pregnancy, breastfeeding, active liver disease (or in patients with persistently abnormal liver function tests). Use caution in patients with liver disease, elderly or with a high alcohol intake. Non serious and reversible cognitive side effects may occur. Liver function tests should be carried out before and within 1-3 months of starting treatment and thereafter at intervals of 6 months for 1 year, unless indicated sooner by signs or symptoms suggestive of hepatotoxicity.

Dosage schedule:

- *Primary hyperlipidemia and combined hyperlipidemia:* Oral, adult: 10 mg

once daily; if necessary may be increased at intervals of at least 4 weeks to maximum 80 mg once daily. Oral, child (10-13 years usually): 10 mg once daily.

- *Familial hypercholesterolemia*: Oral, adult: initially 10 mg daily, increased at intervals of at least 4 weeks to 40 mg once daily; if necessary, further increased to maximum 80 mg once daily. Oral, child (10-13 years): up to 20 mg once daily.

Adverse effects: reversible myositis, headache, angina, chest pain, arthralgia, anorexia, weight gain, epistaxis, back pain, nasopharyngitis, hyperglycemia.

Drug and food interactions: With clarithromycin increases plasma concentration of atorvastatin. Reduced dose required (max. 10 mg daily) with concomitant cyclosporine/ tipranavir combined with ritonavir. Maximum dose of 40 mg once daily when combined with anion-exchange resin for heterozygous familial hypercholesterolemia. Use with caution in patient with high alcohol intake.

CHOLESTYRAMINE RESINS

Dosage form and strength: Powder (*sachet*): 4 gm

Indications: Adjunct to dietary therapy to decrease elevated serum cholesterol and LDL concentrations, cholestasis induced pruritus.

Contraindications/Precautions: Avoid in severe hypertriglyceridemia.

Dosage schedule:

- *Lipid reduction (after initial introduction over 3-4 week)*: Oral, adult: 12-24 g daily in water in single or up to 4 divided doses, up to 36 g daily if necessary
- *Cholestasis induced pruritus*: Oral, adult: 4-8 g daily in water.

Adverse effects: Bloating, dyspepsia, constipation, abdominal pain and distention, anorexia, biliary colic, and skin rash.

Drug and food interactions: Long term high-dose cholestyramine therapy may impair the absorption of fat-soluble vitamins. Concomitant use causes reduced absorption of thyroid hormones, warfarin.

Patient's information: Adverse effects can be substantially reduced if the drug is completely suspended in liquid several hours before ingestion (e.g. evening doses can be mixed in morning and refrigerated similarly morning in previous evening)

EZETIMIBE

Dosage form and strength: Tablet: 10 mg.

Indications: Adjunct to dietary measures and statin treatment in primary hypercholesterolemia, adjunct to dietary measures and statin in homozygous familial hypercholesterolemia, Primary hypercholesterolemia (if statin inappropriate or not tolerated), Adjunct to dietary measures in homozygous sitosterolemia

Contraindication/Precautions: Avoid in moderate to severe hepatic impairment, myopathy, elevated hepatic transaminases, renal impairment (CrCl less than or equal to 30 ml/min/1.73 m²). Pregnancy (C) Breast feeding: avoid.

Dosage schedule: Oral, adult: 10 mg daily

Adverse effects: Fatigue, gastro-intestinal disturbances, headache, myalgia.

Rare: anaphylaxis, angioedema, arthralgia, hepatitis, hypersensitivity reactions, rash. Very rare: cholecystitis, cholelithiasis, myopathy, pancreatitis, raised creatine kinase, rhabdomyolysis, and thrombocytopenia

Drug and food interaction: An increased risk of rhabdomyolysis if Ezetimibe is used in combination with a statin. Avoid use with cyclosporine.

FENOFIBRATE

Dosage form and strength: *Capsule:* 160 mg

Indications: Severe hypertriglyceridemia.

Contraindications/Precautions: Avoid in gall bladder disease, hypoalbuminemia, nephrotic syndrome, during pregnancy, breast feeding, severe hepatic impairment. Use caution in mild to moderate renal and hepatic impairment. Monitor serum liver transaminases enzymes every 3 month for a year then periodically during therapy

Dosage schedule: Initially 160 mg once daily dose.

Adverse effects: Gastrointestinal disturbances, rash, urticaria, fatigue, headache, impotence.

Drug and food interactions: Avoid use with ketoprofen, other fibrates, photosensitivity seen.

Patient's information: Restrict fat diet during the therapy.

GEMFIBROZIL

Dosage form and strength: *Capsule:* 300 mg

Indications: Adjunct to dietary therapy in hyperlipidemias of types II a, II b, III, IV and V.

Contraindications/Precautions: Avoid in preexisting gallbladder disease, hepatic dysfunction, history of hypersensitivity to the drug. Risk for myopathy/ rhabdomyolysis increases with renal impairment. Assess the liver function test, CBC and electrolytes every 3-6 months and then yearly during therapy. Safety and efficacy in children younger than 18 years of age have not been established. Pregnancy (C). Breast feeding: Avoid

Dosage schedule: Oral, adult: 1.2 g daily usually in 2 divided doses; range 0.9-1.2 g daily.

Adverse effects: abdominal and epigastric pain, diarrhea, nausea, anorexia, headache, sexual dysfunction, myopathy, myositis, urticaria and pruritus.

Drug and food interactions: May potentiate the anticoagulant effects of oral anticoagulants, may increase the effects of sulfonylurea and oral hypoglycemia agents.

NICOTINIC ACID (NIACIN)

Dosage form and strength: *Tablet:* 50 mg, 250 mg

Indications: Adjunct to statin in hypertriglyceridemia and or used alone if statin not tolerated.

Contraindications/Precautions: Avoid in arterial hemorrhage, active peptic ulcer, and breast feeding. Use caution in liver disease, gout, diabetes mellitus, gallbladder disease, renal impairment. Pregnancy (A, C- for doses exceeding RDA). Breast feeding: use caution.

Dosage schedule: Oral, adult: Initially 100-200 mg 3 times daily, gradually

increased over 2-4 weeks to 1-2 g 3 times daily.

Adverse effects: diarrhea, nausea, vomiting, flushing, palpitations, dizziness, pruritus and rash.

Drug and food interactions: May potentiate the anticoagulant effects of oral anticoagulants. Increased risk of rhabdomyolysis and other toxicities with HMC co-A reductase inhibitors.

SIMVASTATIN

Dosage form and strength: Tablet: 5 mg, 10 mg, 20 mg, 40 mg

Indication: Primary and secondary prevention of atherosclerotic cardiovascular disease, in high risk individuals (e.g. with diabetes mellitus, post Myocardial infarction)

Contraindications/Precautions: Avoid in pregnancy(X), breast-feeding, active liver disease (or in patients with persistently abnormal liver function tests). Use caution in elderly (>65 years), hepatic or renal dysfunction, and uncontrolled hypothyroidism and perioperative periods and other factors inhibiting statin catabolism due to increased risk of myopathy. Dose should be reduced if the aforementioned drugs should be used concomitantly. As soon as myopathy is suspected, blood analysis should be done to document significant elevation of creatinine phosphokinase (CPK) levels (>3 times the upper limit of normal) then statin use should be discontinued.

Dosage schedule: For prevention of cardiovascular events: Oral, adult: initially 20-40 mg once daily at night (maximum 80 mg once daily at night- only for those with severe hypercholesterolemia and at high risk of cardiovascular complications).

Adverse effects: Upper respiratory tract infection, myalgia, myopathy (dose dependent), myositis, rhabdomyolysis, eosinophilia, eczema, vertigo, abdominal pain, dyspepsia, raised serum transaminases, hepatitis, jaundice, peripheral neuropathy, paresthesia, anemia, alopecia, and rashes, hypersensitivity reactions (angioedema and anaphylaxis), cognitive side effects (non serious and reversible), hyperglycemia (HbA1c and fasting glucose level increase), immune mediated necrotizing myopathy (rare)

Drug and food interactions: With gemfibrozil, cyclosporine, digoxin, warfarin, verapamil, diltiazem, macrolide antibiotics (erythromycin, clarithromycin), azole antifungals, niacin, HIV protease inhibitors, and amiodarone. These drug reduce the catabolism of statins and cause myopathy and rhabdomyolysis

ROSUVASTATIN

Dosage form and strength: Tablet: 5 mg

Indications: Primary hypercholesterolemia (type IIa including heterozygous familial hypercholesterolemia), mixed dyslipidemia (type IIb), or homozygous familial hypercholesterolemia in patients who have not responded adequately to diet and other appropriate measures with or without high cardiovascular risk, Prevention of cardiovascular events in patients at high risk of a first cardiovascular event and with risk factors for myopathy or rhabdomyolysis

Contraindication/Precautions: Avoid in pregnancy, breast feeding, severe renal impairment (eGFR less than 30 ml/minute/1.73 m²), hepatic

impairment. Use caution in mild to moderate renal impairment. In patients with high cardiovascular risk. Breast feeding: avoid.

Dosage schedule:

- *Primary hypercholesterolemia* (type IIa including heterozygous familial hypercholesterolemia), mixed dyslipidemia (type IIb), or homozygous familial hypercholesterolemia in patients who have not responded adequately to diet and other appropriate measures / Prevention of cardiovascular events in patients at high risk of a first cardiovascular event and with risk factors for myopathy or rhabdomyolysis: Oral, adult: Initially 5 mg once daily, then increased if necessary up to 20 mg once daily, dose to be increased at intervals of at least 4 weeks.
- *Severe primary hypercholesterolemia* in patients with high cardiovascular risk (under expert supervision): Oral, adult: Initially 5–10 mg once daily, increased if necessary to 20 mg once daily, then increased if necessary to 40 mg once daily, dose to be increased at intervals of at least 4 weeks
- *Dose adjustments with concomitant fibrate*: Initially 5 mg once daily increased if necessary to max. 20 mg daily.
- Renal impairment (eGFR 30–60 ml/minute/1.73 m²): Initially 5 mg once daily (do not exceed 20 mg daily)

Adverse effects: Flulike symptoms, constipation, urinary tract infection, proteinuria. Gynecomastia, hematuria, peripheral neuropathy, arthralgia.

Section II - Chapter 3

Drugs used in Blood Disorders

3.1 *Hematinics*

Ferrous fumarate
Ferrous fumarate with folic acid
Ferrous gluconate
Ferrous sulphate
Ferrous sulfate with ascorbic acid
Ferrous sulfate with folic acid
Iron dextran
Folic acid
Epoetin alfa

3.2 *Anticoagulants*

Heparin (unfractionated)
Low molecular weight heparins
 Dalteparin
 Enoxaparin
Warfarin
Acenocoumarol
Others
 Apixaban
 Bivalirudin
 Dabigatran
 Fondaparinux
 Rivaroxaban

3.3 *Antiplatelet drugs*

Aspirin
Clopidogrel
Prasugrel
Ticlopidine

3.4 *Fibrinolytic drugs*

Alteplase
Streptokinase
Tenecteplase
Urokinase

3.5 *Antifibrinolytic drugs*

Ethamsylate
Tranexamic acid
Protamine sulfate

3.6 *Antidote*

Phytomenadione (Vitamin K₁)

3.7 Plasma fractions for specific use

Human albumin

Factor IX complex

3.8 Other drugs

Desmopressin

Polygeline

3.1 Hematinics

FERROUS FUMARATE

Dosage form and strength: *Tablet:* 200 mg containing 65 mg of elemental iron

Indications: Iron-deficiency anemia

Contraindication/Precautions: Hemochromatosis, hemosiderosis, hemolytic anemia (unless iron deficiency state is also present), any form of anaemia not caused by iron deficiency; patients receiving repeated blood transfusions; parenteral iron therapy. The hemoglobin concentration should rise by about 100-200 mg/100 mL (1-2 g/L) per day or 2 g/100 mL (20 g/L) over 3-4 weeks. Although iron preparations are best absorbed on an empty stomach, they may be taken after food to reduce gastrointestinal adverse effects; they may discolour stools. **Dosage schedule:**

• *Iron deficiency anemia (prophylactic):* Oral, > 12 years: 210 mg elemental iron 1-2 times a day.

• *Iron deficiency anemia (therapeutic):* Oral, 12 years: 210 mg 2-3 times a day

Adverse effects: Diarrhea and constipation, nausea, epigastric pain and heart burn. Liquid preparations containing iron salts should be well diluted with water. If possible, swallowed through a drinking straw to prevent discoloration of teeth.

Drug and food interaction: Concurrent administration with antacids and tetracyclines with oral iron preparation will inhibit absorption of tetracyclines and iron. Citric acid and ascorbic acid increases the absorption of iron.

Patient information: Take missed dose as soon as remembered within 12 hr. Do not double the dose. Advise patient that stool may become dark green or black and this is harmless.

FERROUS FUMARATE with FOLIC ACID

The properties listed below are those particular to the combination only. For the properties of the components please consider, ferrous fumarate, folic acid.

Dosage form and strength: *Tablet:* Ferrous fumarate: 322 mg and Folic acid 350 mcg; *Capsule:* Ferrous fumarate 305 mg and Folic acid 350 mcg.

Indications: Iron deficiency anemia

Dosage schedule: Oral, adult: 1 tablet/capsule daily, to be taken before food

FERROUS GLUCONATE

Dosage form and strength: *Tablets:* 300 mg.

Indications: Prophylaxis and treatment of iron deficiency anemia,

Contraindication/Precautions: See under ferrous fumarate

Dosage schedule:

• *Prophylaxis of iron-deficiency anemia:* oral, child (6-11 years): 300-900 mg daily, child (12-17 years): 600 mg daily, dose to be taken before food, Adult: 600 mg daily, dose to be taken before food.

• *Treatment of iron-deficiency anemia:* oral, child (6-11 years): 300-900 mg daily, child (12-17 years): 1.2-1.8 g daily in divided doses, adult: 1.2-1.8 g

daily in divided doses, dose to be taken before food

Adverse effects: See under ferrous fumarate

Drug and food interaction: See under ferrous fumarate

FERROUS SULPHATE

Dosage form and strength: *Tablet:* 300 mg contains 60 mg of elemental iron, 200 mg contains 40 mg of elemental iron.

Indications: Iron deficiency anemia

Contraindications/Precautions: See under ferrous fumarate

Dosage schedule:

- *Prophylaxis:* 200 mg dried ferrous sulfate daily after food.
- *Treatment:* 400-600 mg daily in divided doses after food.

Adverse effects: Diarrhea, constipation, nausea, epigastric pain (dose related)

Drug and food interactions: See under ferrous fumarate

Patient information: See under ferrous fumarate

FERROUS SULFATE WITH ASCORBIC ACID

The properties listed below are those particular to the combination only.

Dosage form and strength: *Tablet:* Ferrous sulphate 325 mg and Sodium ascorbate 500 mg

Indications: Iron deficiency anemia

Dosage schedule: Oral, adult: 1 tablet daily, dose to be taken before food

FERROUS SULPHATE with FOLIC ACID

Dosage form and strength: *Tablet:* Elemental iron 60 mg and Folic acid 400 mcg

Indication: Prevention of iron and folic acid deficiencies in pregnancy

Contraindication/Precautions: Should never be given without vitamin B₁₂ in undiagnosed megaloblastic anaemia or other vitamin B₁₂ deficiency states because of the risk of precipitating subacute combined degeneration of the spinal cord; folate-dependent malignant disease. Also see under ferrous fumarate.

Dosage schedule:

- *Severe anaemia:* Oral, child <2 years, elemental iron, 25 mg + folic acid 100-400 mcg daily for 3 months. Child 2-12 years, elemental iron 60 mg + folic acid, 400 mcg daily for 3 months. Adult, elemental iron, 120 mg + folic acid 400 mcg daily for 3 months.
- *Prevention of iron and folate deficiencies in pregnancy:* Oral, adult: elemental iron, 100 mg + folic acid, 350-400 mcg daily throughout pregnancy.

Adverse effects: See ferrous sulfate

Drug and food interactions: See ferrous sulphate

IRON DEXTRAN

Dosage form and strength: Ferric hydroxide with dextran solution: contains 50 mg of elemental iron per ml (5% w/v of iron).

Indications: Iron deficiency anemia, only when oral administration has been

found unsatisfactory or impossible.

Contraindications/Precautions: Allergic disorders including asthma, infection, active rheumatoid arthritis. Caution in pregnancy and patients with hepatic or renal impairment. Contact physician if fever, chills, malaise, muscle and joint aches, nausea, vomiting, dizziness and backache occur.

Dosage schedule: *Iron deficiency anemia:* 25-100 mg IV or deep IM every day when necessary, not to exceed 100 mg (2 ml/day)

Adverse effects: Nausea, vomiting, abdominal pain, arthralgia, fever, urticaria, pain, anaphylactic reactions, headache and hypotension.

FOLIC ACID

Dosage form and strength: *Tablet:* 1 mg and 5 mg

Indication: Folate deficiency megaloblastic anemia; prevention of neural tube defect in pregnancy.

Contraindication/Precautions: Should never be given without vitamin B₁₂ in undiagnosed megaloblastic anaemia or other vitamin B₁₂ deficiency states because risk of precipitating subacute combined degeneration of spinal cord; folate dependent malignant disease. Women receiving antiepileptic therapy need counselling before starting folic acid. Monitor plasma folic acid levels, hemoglobin, hematocrit and reticulocyte count before and after therapy.

Dosage schedule:

- *Treatment of folate deficiency megaloblastic anemia:* Oral, adult: 5 mg daily for 4 months (in pregnancy continued to term); ≤15 mg daily may be necessary in malabsorption states.
- *Prevention of first occurrence of neural tube defect:* Oral, adult: 400-500 mg daily before conception and during the first twelve weeks of pregnancy.
- *Prevention of recurrence of neural tube defects:* Oral, adult: 5 mg daily (reduced to 4 mg daily) from at least 4 weeks before conception until twelfth weeks of pregnancy.

Adverse effect: Bronchospasm, erythema, malaise, pruritis, rash, slight flushing

Drug and food interactions: Pyrimethamine, methotrexate, trimethoprim and triamterene prevent the activation of folic acid. Absorption of folic acid is decreased by sulphonamide, antacids and cholestyramine. Folic acid requirements are increased by estrogens, phenytoin, phenobarbital, primidone, carbamazepine or corticosteroids. Folic acid may cause decrease in serum concentrations of other vitamin B complex when given in high continuous doses

Patient information: Urine may turn intensely yellow which is normal with therapy. Encourage females to take folic acid in early pregnancy as it prevents neural tube defects of children.

EPOETIN ALFA

(Recombinant human erythropoietin)

Dosage form and strength: *Solution:* 2000 units/ml, 3000 units/ml, 4000 units/ml, 10000 units/ml, 20000 units/ml and 40000 units/ml

Indications: Anemia associated with erythropoietin deficiency in chronic

renal failure, to increase the yield of autologous blood in normal individuals and to shorten the period of symptomatic anaemia in patients receiving cytotoxic chemotherapy, Myelodysplastic Syndrome

Contraindications/Precautions: Anemia due to concomitant myelosuppressive chemotherapy in patients with non-myeloid malignancies; uncontrolled hypertension; pure red cell aplasia (PRCA), Subcutaneous injection is contraindicated in patients with chronic renal failure. Myocardial infarction, stroke, thromboembolism, patients with inadequately treated or poorly controlled blood pressure, epilepsy, malignant disease, chronic liver failure. Pregnancy C, breast-feeding. Do not shake or vigorously agitate vial. Monitor hemoglobin concentrations weekly following initiation of therapy and after each dosage change until stable and sufficient to minimize RBC transfusions. At the time of administration, preservative-free epoetin alfa (single-use vial) can be admixed in a syringe with bacteriostatic 0.9% sodium chloride injection (preserved with benzyl alcohol) in a 1:1 ratio; presence of benzyl alcohol may ameliorate injection site discomfort. Because of risks of toxicity, do not admix with benzyl alcohol-preserved solutions in neonates, infants, or pregnant or nursing women. Refrigerate at 2–8°C; do not freeze or shake. Protect from light. Store unused portions of multidose vial at 2–8°C and discard 21 days after initial entry into vial.

Dosage schedule:

- *Symptomatic anaemia associated with chronic renal failure:* adult, subcutaneous injection: Initially 20 units/kg 3 times a week for 4 weeks, increased in steps of 20 units/kg 3 times a week, dose adjusted according to response at intervals of 4 weeks, total weekly dose may be divided into daily doses; maintenance, initially reduce dose by half, subsequent dose adjusted according to response at intervals of 1–2 weeks, total weekly maintenance dose may be given as a single dose or in 3 to 7 divided doses, subcutaneous route preferred in patients not on hemodialysis.
- *Intravenous injection, adult:* Initially 40 units/kg 3 times a week for 4 weeks, then increased to 80 units/kg 3 times a week, then increased in steps of 20 units/kg 3 times a week if required, dose to be increased at intervals of 4 weeks; maintenance, initially reduce dose by half, subsequent dose adjusted according to response at intervals of 1–2 weeks, intravenous injection to be administered over 2 minutes, subcutaneous route preferred in patients not on hemodialysis. Reduce dose by approximately 25% if rise in hemoglobin concentration exceeds 2 g/100 ml over 4 weeks or if hemoglobin concentration approaches or exceeds 12 g/100 ml; if hemoglobin concentration continues to rise, despite dose reduction, suspend treatment until hemoglobin concentration decreases and then restart at a dose approximately 25% lower than the previous dose; maximum 720 units/kg per week
- *Symptomatic anemia in adults with non-myeloid malignancies receiving chemotherapy:* subcutaneous injection, adult: Initially 450 units/kg once weekly for 4 weeks, dose to be given weekly as a single dose or in 3–7 divided doses, increase dose after 4 weeks (if a rise in hemoglobin of at least 1 g/100 ml not achieved), increased to 900 units/kg once weekly, dose to be

given weekly as a single dose or in 3–7 divided doses, if adequate response obtained reduce dose by 25–50% as per the guidelines given above, discontinue treatment if hemoglobin concentration does not increase by at least 1 g/100 ml after 8 weeks of therapy (response unlikely). Discontinue approximately 4 weeks after ending chemotherapy; maximum 60 000 units per week

Adverse effects: Hypertension, increased coagulability (thromboembolic events), pure red cell aplasia, seizures, flu like symptoms, anaphylactic reactions, pruritus, nausea, fever, cough, nausea, leukopenia, headache

Drug and food interactions: Androgens: Possible increase in the sensitivity of erythroid progenitors. Probenecid: Possible pharmacokinetic interaction. Desmopressin: Potential decrease in bleeding time

Patient information: Potential exists for abuse of the drug by athletes, especially those participating in high-aerobic demand, endurance-type events. Importance of women informing clinicians if they are or plan to become pregnant or plan to breast-feed.

3.2 Anticoagulants

HEPARIN (UNFRACTIONATED)

Heparin is an anticoagulant drug that acts by catalyzing the inhibition of coagulation factors including thrombin, IXa and Xa

Dosage form and strength: *Heparin Sodium Injection:* 1000 USP units per mL (preservative free), 1000 USP units per mL, 5 000 USP units per mL and 10 000 USP units per mL

Indications: Deep venous thrombosis, pulmonary embolism, patients who experience recurrent thromboembolism despite adequate oral anticoagulant therapy may benefit from long term heparin therapy. Initial management of patients with unstable angina, acute myocardial infarction, during and after coronary angioplasty or stent placement and during surgery requiring cardiopulmonary bypass.

Contraindication/Precautions: Active bleeding from any site, hemophilia, purpura and thrombocytopenia. Known hypersensitivity to heparin or pork products or to any ingredient in the formulation. Life threatening hemorrhage may occur that can be reversed quickly by slow infusion of Protamine sulfate (1 mg of protamine for every 1000 U of heparin remaining in patient, given I.V at slow rate up to 50 mg over 10 min.). Higher incidence of bleeding has been reported in patients over 60 years of age, especially women. Lower doses of heparin may be indicated in these patients. Heparin is not intended for intramuscular use. Heparin injection should be stored at a temperature not exceeding 25°C and should preferably be kept in a container sealed by fusion of the glass. Invert container and carefully inspect the solution in good light for cloudiness, haze or particulate matter. Any container which is suspect should not be used. Pregnancy Category C. Lactation: avoid. Use heparin sodium during pregnancy and lactation only if the potential benefit justifies the potential risk to the fetus.

Dosage schedule:

- *Prophylaxis of deep-vein thrombosis and pulmonary embolism:* adult, subcutaneous injection: 5000 units 2 hours before surgery, then every 8-12 hours for 7 days or until patient is ambulant; during pregnancy 5000–10000 units every 12 hours.
- *Treatment of deep-vein thrombosis and pulmonary embolism:* adult, intravenous injection: loading dose of 5000 units (75 units/kg) followed by continuous infusion of 18 units/kg/hour or by subcutaneous injection of 15000 units every 12 hours (laboratory monitoring essential - preferably on a daily basis).

Adverse effects: Hemorrhage, heparin-induced thrombocytopenia (HIT), alopecia, bleeding and osteoporosis. Heparin can inhibit the synthesis of aldosterone by adrenal gland and occasionally causes hyperkalemia. Allergic reactions are rare.

Heparin resistance: Resistance to heparin is frequently encountered in fever, thrombosis, thrombophlebitis, infections with thrombosing tendencies, myocardial infarction, cancer, in postsurgical patients, and patients with antithrombin III deficiency. Close monitoring of coagulation tests is recommended in these cases. Adjustment of heparin doses based on anti-Factor Xa levels may be warranted.

Drug and food interactions: Heparin action increases with concomitant use of oral anticoagulants, salicylates, dextran, NSAIDs, and heparin action decreases with digoxin, tetracycline, and nicotine. Oral anticoagulants: Heparin sodium may prolong the one-stage prothrombin time. Therefore, when heparin sodium is given with dicumarol or warfarin sodium, a period of at least 5 hours after the last intravenous dose or 24 hours after the last subcutaneous dose should elapse before blood is drawn if a valid prothrombin time is to be obtained. Platelet inhibitors: Drugs such as acetylsalicylic acid, dextran, phenylbutazone, ibuprofen, indomethacin, dipyridamole, hydroxychloroquine and others that interfere with platelet aggregation reactions (the main hemostatic defense of heparinized patients) may induce bleeding and should be used with caution in patients receiving heparin sodium.

Patient information: Store heparin at room temperature away from moisture and heat. Any unused heparin solution and intravenous administration apparatus be replaced at least once every 24 hours.

LOW MOLECULAR WEIGHT HEPARINS

Dalteparin, Enoxaparin, Ardeparin, Bemiparin are some examples of low molecular heparin. The pharmacokinetic properties of low molecular heparin are more predictable, so they can be administered by subcutaneous injection, in a fixed or weight adjusted dose regimen once or twice daily. Monitoring is not done routinely

Indications: Prophylaxis of deep vein thrombosis and pulmonary embolism

Contraindication/Precautions: Reports of congenital anomalies in infants born to women who received LMWHs during pregnancy, including cerebral anomalies, limb anomalies, hypospadias, peripheral vascular malformation, fibrotic dysplasia and cardiac defects. A causal relationship has not been

established nor has the incidence been shown to be higher than in the general population. Also see under heparin

Dosage schedule:**• Dalteparin:**

- *Prophylaxis of deep-vein thrombosis in surgical patients:* adult, subcutaneous injection: *moderate risk*, 2500 units 1-2 hours before surgery, then 2500 units every 24 hours for 5-7 days or longer; *high risk*, 2500 units 1-2 hours before surgery, then 2500 units 8-12 hours later (or 5000 units on the evening before surgery, then 5000 units on the following evening), then 5000 units every 24 hours for 5-7 days or longer.
- *Prophylaxis of deep vein thrombosis in medical patients:* adult, subcutaneous injection, 5000 units every 24 hours. Treatment of deep vein thrombosis and pulmonary embolism: adult, subcutaneous injection: as a single daily dose. body-weight <46 kg, 7 500 units daily; 46-56 kg 10 000 units daily; 57-68 kg, 12500 units daily.

• Enoxaparin:

- *Prophylaxis of deep-vein thrombosis especially in surgical patients:* adult, subcutaneous injection: *moderate risk*, 20 mg (2000 units) about 2 hours before surgery then 20 mg (2000 units) every 24 hours for 7-10 days; *high risk (e.g. orthopaedic surgery)*, 40 mg (4000 units) 12 hours before surgery, then 4000 units every 24 hours for 7-10 days.
- *Prophylaxis of deep-vein thrombosis in medical patients:* adult, subcutaneous injection: 4000 units every 24 hours for at least 6 days until patient ambulant (maximum 14 days).

Adverse effects: See under heparin

Drug and food interactions: See under heparin

WARFARIN

Dosage form and strength: Tablet: 1 mg, 2 mg, 5 mg

Indications: Prevention of progression and recurrence of deep venous thrombosis or pulmonary embolism following a initial course of heparin. It is effective in prevention of thromboembolism in patients undergoing gynecological and surgical procedure, acute MI, prosthetic heart valves or chronic atrial fibrillation.

Contraindications/Precautions: Patients with GI ulcers, severe hypertension, bacterial endocarditis, pregnancy. Pregnancy category X. Contraindicated in women who are or may become pregnant. Hepatic and renal impairment, recent surgery, breast feeding

Dosage schedule: Initial dose 10 mg for 2 days, subsequent doses 3-9 mg daily in accordance with the prothrombin activity of blood

Drugs and food interactions: Food in GI tract can decrease rate of absorption. Barbiturates, rifampicin, phenytoin, chronic alcohol ingestion, ingestion of large amount of Vit K rich food or supplements may cause decreased effects of warfarin. Decreased metabolism and/or displacement from protein binding site may be caused by phenylbutazone, metronidazole, allopurinol, cimetidine, amiodarone, thus enhancing risk of hemorrhage
Patient information: Avoid OTC preparation that may cause serious product

interaction unless directed by prescriber. Patients should report any sign of bleeding: gum, under skin, urine, and stool and avoid hazardous activities (e.g. hockey, football)

ACENOCOUMAROL

Dosage forms and strength: *Tablet:* 1 mg, 2 mg, 3 mg and 4 mg.

Indications: See warfarin

Contraindications/Precautions: See warfarin

Dosage schedule: 4-12 mg on first day, 4-8 mg on second day, maintenance dose usually 1-8 mg daily.

Adverse effects: See warfarin.

Safety in pregnancy: Pregnancy category X

APIXABAN

Dosage form and strength: *Tablet:* 2.5 mg, 5 mg

Indications: Stroke prophylaxis with atrial fibrillation, postoperative prophylaxis of deep vein thrombosis/pulmonary embolism, deep vein thrombosis or pulmonary embolism.

Contraindications/Precautions: Active bleeding, malignant neoplasms, oesophageal varices, recent brain surgery, recent gastro-intestinal ulcer, recent intracranial, haemorrhage, recent ophthalmic surgery, recent spine surgery, significant risk of major bleeding, vascular aneurysm. Anaesthesia with postoperative indwelling epidural catheter (risk of paralysis), prosthetic heart valve, risk of bleeding, pregnancy category B, lactation. Patients with nonvascular atrial fibrillation and or spinal or epidural hematoma.

Dosage schedule:

- *Stroke prophylaxis with atrial fibrillation:* adult, oral: 5 mg twice a day,
- *Postoperative prophylaxis of deep vein thrombosis/pulmonary embolism:* 2.5 mg per oral twice a day for 35 days,
- *Deep vein thrombosis or pulmonary embolism:* adult, oral: 10 mg twice a day for 7 day, then 5 mg twice a day.

Adverse effects: Anaemia, bruising, haemorrhage, nausea

Drug and food interactions: See under rivaroxaban

BIVALIRUDIN

Dosage forms and strength: *Injection, powder for reconstitution:* 250 mg/vial; *Injection, ready-to-use solution:* 5 mg/mL (250 mg/50 mL; 500 mg/100 mL)

Indication: Unstable angina/non-ST-segment elevation myocardial infarction in patients planned for urgent or early intervention, unstable angina/ non-ST-elevation myocardial infarction in patients proceeding to percutaneous coronary intervention without cardiopulmonary bypass.

Contraindications/Precautions: Active bleeding, bleeding disorders, severe hypertension, subacute bacterial endocarditis. Brachytherapy procedures, previous exposure to lepirudin. Discontinue bivalirudin if unexplained fall in blood pressure or hematocrit occurs. INR monitoring should be done during treatment. Also see under fondaparinux

Dosage schedule:

- *Unstable angina/non-ST-segment elevation myocardial infarction in patients planned for urgent or early intervention* : Intravenous injection Adult: Initially 100 micrograms/kg, then (by intravenous infusion) 250 micrograms/kg/hour (for up to 72 hours in medically managed patients)
- *Unstable angina/ non-ST-elevation myocardial infarction in patients proceeding to percutaneous coronary intervention without cardiopulmonary bypass*: Initially by intravenous injection Adult: Initially 100 micrograms/kg for 1 dose, then (by intravenous injection) 500 micrograms/kg for 1 dose, then (by intravenous infusion) 1.75 mg/kg/hour for duration of procedure; (by intravenous infusion) reduced to 250 micrograms/kg/hour for 4–12 hours as necessary following percutaneous coronary intervention, for patients proceeding to coronary artery bypass surgery with cardiopulmonary bypass, discontinue intravenous infusion 1 hour before procedure and treat with unfractionated heparin

Adverse effects: Bleeding (discontinue), ecchymosis, allergic reactions, anaemia, headache, hypotension, nausea, thrombocytopenia.

Drug and food interaction: Increase risk of haemorrhage when given with other analgesics and anticoagulants.

DABIGATRAN

Dosage form and strength: *Capsule:* 75 mg and 150 mg

Indication: Stroke prophylaxis with atrial fibrillation, DVT/pulmonary embolus treatment and or prophylaxis.

Contraindication/Precautions: Severe renal impairment (CrCl <15 mL/min) or haemodialysis, hypersensitivity, active pathologic bleeding, impairment of haemostasis. Increased bleeding risk during labor and delivery, discontinue 1-2 days (CrCl ≥50 mL/min) or 3-5 days (CrCl <50 mL/min) before invasive or surgical procedure to decrease bleeding risk, monitor Ecarin clotting time (ECT), if unavailable than monitor aPPT, PT, or TT; aPPT. Also see under apixaban and fondaparinux.

Dosage schedule:

- *Stroke prophylaxis with atrial fibrillation*: adult, oral: CrCl >30 mL/min: 150 mg twice a day, CrCl 15-30 mL/min: 75 mg PO twice a day,
- *DVT/pulmonary embolus treatment*: adult, oral: CrCl >30 mL/min: 150 mg twice a day,
- *DVT/pulmonary embolus treatment prophylaxis*: adult, oral: CrCl >30 mL/min: 110 mg 1-4 hr after surgery and after haemostasis has been achieved on first day, then 220 mg taken once a day for 28-35 days.

Adverse effects: Dyspepsia, gastritis, intracranial hemorrhage, hypersensitivity including urticaria, rash, pruritic.

FONDAPARINUX

Dosage forms and strengths: *Prefilled syringe:* 2.5 mg/0.5 mL, 5 mg/0.4 mL, 7.5 mg/0.6 mL, 10 mg/0.8 mL

Indication: Deep vein thrombosis, heparin induced thrombocytopenia, superficial vein thrombosis, unstable angina, ST-segment elevation and non-

ST-segment elevation myocardial infarction, pulmonary embolism.

Contraindications/Precautions: Active bleeding, bacterial endocarditis. Active gastro-intestinal ulcer disease, bleeding disorders, brain surgery, elderly patients, low body weight, ophthalmic surgery, recent intracranial haemorrhage, spinal or epidural anaesthesia, spinal surgery. Epidural or spinal hematomas, monitored for sign and symptoms of neurologic impairment.

Dosage schedule:

- *Deep vein thrombosis/acute pulmonary embolism:* <50 kg: 5 mg SC once a day, 50-100 kg: 7.5 mg SC once daily, >100 kg: 10 mg SC once daily- Administer for 5-9 days
- *Heparin-induced thrombocytopenia:* 2.5 mg SC once daily

Adverse effects: Anaemia, bleeding, purpura, chest pain, dyspnoea, gastro-intestinal disturbances, hepatic impairment, oedema, pruritic, rash, thrombocythemia.

Drug and food interactions: Analgesics- risk of haemorrhage when anticoagulants given with IV, risk of haemorrhage with other anticoagulants.

RIVAROXABAN

Dosage form and strength: *Tablets:* 10 mg, 15 mg and 20 mg

Indication: Prophylaxis of venous thromboembolism (orthopaedic surgery), deep vein thrombosis, pulmonary embolism, nonvalvular atrial fibrillation.

Contraindication/Precautions: Hypersensitivity, active bleeding, malignant neoplasms, oesophageal varices, recent brain surgery, GI ulcer, vascular aneurysm. Anaesthesia with postoperative indwelling epidural catheter (risk of paralysis), bronchiectasis, prosthetic heart valve, risk of bleeding, pulmonary embolism in patients with haemodynamic instability, severe hypertension, vascular retinopathy. Also see under apixaban and fondaparinux.

Dosage schedule:

- *Prophylaxis of venous thromboembolism (orthopaedic surgery): oral, adult:* 10 mg once a day for 12 days,
- *Deep vein thrombosis or pulmonary embolism: oral, adult:* 15 mg twice a day for 21 days then 20 mg per oral once a day for 6 months.

Adverse effects: Abdominal pain, constipation, diarrhoea, dizziness, dyspepsia haemorrhage, headache, hypotension, nausea, pain in extremities, pruritus, rash, renal impairment, vomiting

Drug and food interactions: Analgesics and anticoagulants (increases risk of haemorrhage), antibacterial, antidepressants, antiepileptics (decreases plasma concentration of rivaroxaban), antifungal and antiviral (increases plasma concentration of rivaroxaban).

3.3 Antiplatelet drugs

ASPIRIN

Dosage form and strength: *Tablet:* 50 mg, 75 mg and 300 mg.

Indication: Prophylaxis of cerebro vascular diseases, and myocardial infarction, thromboembolic disorder, post-MI, ischemic stroke and angina.

Contraindication/Precautions: Antiplatelet drugs are not used in the management of haemorrhagic stroke, hypersensitivity (including asthma, angioedema, urticaria) to acetylsalicylic, active peptic ulceration, haemophilia and other bleeding disorder. Asthma, uncontrolled hypertension, pregnancy. Tell the patient to take aspirin after food with full glass of plenty of water to reduce stomach irritation. Aspirin should not be given to children and adolescent due to Reye's syndrome. Watch for signs of bleeding. Watch for the sign of salicylate poisoning.

Dosage schedule:

- *Thromboembolic disorders:* Adult: oral 325-650 mg/day.
- *Transient ischemic attack:* adult oral 50-325 mg/day.
- *Evolving MI with ST segment elevation:* adult oral 160-325 mg nonenteric, chewed and swallowed immediately, maintenance 75-162 mg/day MI,
- *Stroke prophylaxis:* adult oral 50-325 mg/day

Adverse effects: Bronchospasm, GI bleeding, thrombocytopenia, seizures, Reye's syndrome

Drug and food interaction: Aspirin may increase the effects of oral hypoglycemic effects. if it is given with anticoagulant; the chance of bleeding will be increased.

CLOPIDOGREL

Dosage form and strength: *Tablet: 75 mg*

Indications: Prevention of atherothrombotic events, transient ischaemic attack or acute ischaemic stroke for patients with aspirin hypersensitivity/intolerant of aspirin, Prevention of artherothrombotic events in acute coronary syndrome with or without ST-segment elevation (given with aspirin)

Contraindication/Precautions: Hypersensitivity, Coagulation disorders, active pathological bleeding. Risk of increased bleeding form trauma, surgery or other pathological conditions. Pregnancy: Avoid, hepatic and renal impairment: use with caution.

Dosage schedule:

- Prevention of atherothrombotic events in percutaneous coronary intervention (adjunct with aspirin) in patients not already on clopidogrel: Adult, oral: Loading dose 300 mg, to be taken prior to the procedure, Or loading dose 600 mg, higher dose may produce a greater and more rapid inhibition of platelet aggregation
- *Transient ischaemic attack for patients with aspirin hypersensitivity/intolerant of aspirin, acute ischaemic stroke for patients with aspirin hypersensitivity/intolerant of aspirin:* Adult, oral: 75 mg once daily
- *Prevention of atherothrombotic events in peripheral arterial disease or within 35 days of MI/ within 6 months of ischaemic stroke:* Adult, oral: 75 mg once daily
- *Prevention of artherothrombotic events in acute coronary syndrome without ST-segment elevation (given with aspirin):* Adult, oral: Initially 300 mg, then 75 mg daily for up to 12 months
- *Prevention of artherothrombotic events in acute myocardial infarction with ST-segment elevation (given with aspirin):* Adult, oral: 18-75 years: Initially

300 mg, then 75 mg for at least 4 weeks. >75years and over: 75 mg daily

- *Prevention of atherothrombotic and thromboembolic events in patients with atrial fibrillation (with aspirin) and for whom warfarin is unsuitable:* Adult, oral: 75 mg once daily

Adverse effects: Abdominal pain, bleeding disorders (including gastro-intestinal and intracranial), diarrhea, dyspepsia.

Drug and food interaction: Anticoagulants, aspirin, NSAIDS, increase bleeding risks. It increases action of some NSAIDSs, Phenytoin, Tamoxifen. Proton pump inhibitor decrease clopidogrel effects.

PRASUGREL

Dosage form and strength: *Tablet:* 5 mg and 10 mg

Indications: Prevention of atherothrombotic events in patients with acute coronary syndrome undergoing percutaneous coronary intervention, Patients undergoing coronary angiography within 48 hours of admission for unstable angina or NSTEMI, alternative to clopidogrel in certain patients undergoing percutaneous coronary intervention

Contraindication/Precautions: Active bleeding, history of stroke or transient ischemic attack. Pregnancy: D, Breastfeeding: avoid, Hepatic impairment: Use with caution in moderate impairment, increased risk of bleeding. Avoid in severe impairment, renal impairment Use with caution—increased risk of bleeding. Body weight less than 60 kg, discontinue at least 7 days before elective surgery if antiplatelet effect not desirable, elderly, patients at increased risk of bleeding(e.g. from recent trauma, surgery, gastrointestinal bleeding, or active peptic ulcer disease)

Dosage schedule:

- *In combination with aspirin for the prevention of atherothrombotic events in patients with acute coronary syndrome undergoing percutaneous coronary intervention:* Adult, oral: 18–74 years :body-weight up to 60 kg: Initially 60 mg for 1 dose, then 5 mg once daily usually for up to 12 months. body-weight \geq 60 kg: Initially 60 mg for 1 dose, then 10 mg once daily usually for up to 12 months. \geq 75 years: : Initially 60 mg for 1 dose, then 5 mg once daily usually for up to 12 months.
- *Patients undergoing coronary angiography within 48 hours of admission for unstable angina or NSTEMI:* Adult, oral: Initially 60 mg, to be administered at the time of percutaneous coronary intervention to minimize the risk of bleeding, maintenance dose of 10 mg or 5 mg daily should then be selected as appropriate.
- *Alternative to clopidogrel in certain patients undergoing percutaneous coronary intervention:* Adult, oral: 60 mg as a single dose

Adverse effects: Anemia, gastro-intestinal hemorrhage, hematoma, hematuria, hemorrhage, intracranial hemorrhage, rash

Drug and food interaction: More chance hypersensitivity reaction while administered with thienopyridines (e.g. clopidogrel)

TICLOPIDINE

Dosage form and strength: *Tablet:* 250 mg

Indications: Coronary artery stent thrombosis (prevention), stroke

Contraindication/Precautions: Neutropenia, thrombocytopenia, hemostatic disorder or active bleeding, severe hepatic impairment, history of either thrombotic thrombocytopenic purpura (TTP) or aplastic anemia. Pregnancy: B. Breast feeding: avoid. Hepatic impairment: caution, avoid in severe hepatic impairment. Monitor Complete blood count, Liver function test prior to initiation of treatment and every 2 weeks for the first 3 months. May cause lifethreatening hematologic events, including neutropenia, agranulocytosis, thrombocytopenia purpura and aplastic anemia.

Dosage schedule:

- *Coronary artery stent thrombosis (prevention):* Adult, oral: 250 mg twice a day with aspirin for 30 days.
- *Stroke:* adult, oral: 250 mg twice daily with food.

Adverse effects: Diarrhea, elevated alkaline phosphatase and aspartate aminotransferase, nausea, dyspepsia, rash, neutropenia, purpura

Drug and food interaction: Concurrent use of other anticoagulant drugs increases the incidence of bleeding

3.4 Fibrinolytic drugs/Thrombolytics

ALTEPLASE (rTPA; TISSUE-TYPE PLASMINOGEN ACTIVATOR)

Dosage form and strength: Powder: 10 mg, 20 mg; *Cathflo* powder: 2 mg and 50 mg.

Indications: Acute myocardial infarction, pulmonary embolism, acute stroke

Contraindication/Precautions: Current intracranial hemorrhage, subarachnoid hemorrhage, history of recent stroke, active internal bleeding, recent (within 3 months) intracranial or intraspinal surgery or serious head trauma, presence of intracranial conditions that may increase the risk of bleeding (eg. Some neoplasms, arteriovenous malformations, aneurysms), bleeding diathesis, current severe uncontrolled hypertension. Contraindicated if history of hypersensitivity to gentamicin (residue from manufacturing process). Conditions in which thrombolysis might give rise to embolic complications such as enlarged left atrium with atrial fibrillation (risk of dissolution of clot and subsequent embolisation), elderly, external chest compression, hypertension. Pregnancy: C, Breast feeding: use with caution. When used for acute ischemic stroke Monitor for intracranial hemorrhage and monitor blood pressure (antihypertensive recommended if systolic above 180 mmHg or diastolic above 105 mmHg).

Dosage schedule:

- *Acute myocardial infarction: accelerated regimen: (to be initiated within 6 hours of symptom onset):* Adult, intravenous injection: body-weight ≤ 65 kg: Initially 15 mg over 1-2minutes, followed by intravenous infusion 0.75 mg/kg, over 30 minutes, then by intravenous infusion 0.5 mg/kg, to be given over 60 minutes, maximum total dose of 100 mg administered over 90 minutes. Adult, intravenous injection: body-weight >65 kg: Initially 15 mg, to be initiated within 6 hours of symptom onset, followed by intravenous infusion 50 mg, to be given over 30 minutes, then by intravenous infusion

35 mg, to be given over 60 minutes, maximum total dose of 100 mg administered over 90 minutes.

- **Acute myocardial infarction: 3 hour regimen: (to be initiated within 6–12 hours of symptom onset):** Adult, intravenous injection: Initially 10 mg, followed by intravenous infusion 50 mg, to be given over 60 minutes, then by intravenous infusion 10 mg for 4 infusions, each 10 mg infusion dose to be given over 30 minutes, total dose of 100 mg over 3 hours; maximum 1.5 mg/kg in patients <65 kg.
- **Pulmonary embolism:** Adult, intravenous injection: Initially 10 mg, to be given over 1–2 minutes, followed by (by intravenous infusion) 90 mg, to be given over 2 hours, maximum 1.5 mg/kg in patients <65 kg
- **Acute stroke: (under specialist neurology physician only):** Adult, intravenous infusion: 18–79 years: Initially 900 mcg/kg (max. per dose 90 mg), treatment must begin within 4.5 hours of symptom onset, to be given over 60 minutes, the initial 10% of dose is to be administered by intravenous bolus injection and the remainder by intravenous infusion

Directions for administration: For intravenous infusion give intermittently or continuously in sodium chloride 0.9%; dissolve in water for injections to a concentration of 1 mg/mL or 2 mg/mL and infuse intravenously; alternatively dilute the solution further in the infusion fluid to a concentration of not less than 200 mcg/mL; not to be infused in glucose solution.

Adverse effects: Risk of cerebral bleeding increased in acute stroke, allergic reactions, anaphylaxis, angina (when used in MI), back pain, bleeding (usually limited to the site of injection, but can occur from other sites), cerebral edema (caused by reperfusion), convulsions, fever, flushing, hypotension, intracerebral hemorrhage, nausea, pulmonary edema (caused by reperfusion), rash, recurrent ischemia (when used in myocardial infarction), reperfusion arrhythmias (when used in myocardial infarction), uveitis, vomiting

Drug and food interaction: Concurrent use of other anticoagulant drugs increases the incidence of bleeding

STREPTOKINASE

Dosage form and strength: Powder: 250000 unit, 750000 unit

Indications: Pulmonary embolism, deep venous thrombosis, acute myocardial infarction, central retinal venous or arterial thrombosis.

Contraindication/Precautions: Surgery within 10 days including organ biopsy, puncture of non-compressible vessel, severe trauma, cardiopulmonary resuscitation; serious gastrointestinal bleeding within 3 months, history of hypertension (diastolic > 110 mm Hg), active bleeding or hemorrhagic disorder, aortic dissection, acute pericarditis. Risk of bleeding from any invasive procedure, pregnancy, abdominal aneurysm or where thrombolysis may give rise to embolic complications such as enlarged left atrium with atrial fibrillation (risk of dissolution of clot and subsequent embolization), diabetic retinopathy (small risk of retinal hemorrhage); recent or concurrent anticoagulant treatment. Streptokinase is strongly antigenic, repeated administration elicits antibodies which diminish the effect and may

cause allergic reactions.

Dosage schedule:

- *Acute myocardial infarction:* Adult, intravenous infusion: 1500000 units, to be initiated within 12 hours of symptom onset, dose to be given over 60 minutes
- *Deep-vein thrombosis, Pulmonary embolism, Acute arterial thromboembolism, Central retinal venous or arterial thrombosis:* Adult, Intravenous infusion: 250000 units, dose to be given over 30 minutes, then 100000 units every 1 hour for up to 12–72 hours, duration is adjusted according to condition with monitoring of clotting parameters.

Adverse effects: Nausea, vomiting, bleeding, hypotension, arrhythmias (Particularly in MI), allergic reactions including rash, flushing, uveitis, and anaphylaxis.

Drug and food interaction: Use of streptokinase and oral anticoagulants or heparin or platelet function may increase the risk of hemorrhage. Avoid use with the drugs that affect platelet function such as aspirin, indomethacin, dipyridamole etc that can increase possible risk of hemorrhage.

TENECTEPLASE

Dosage form and strength: Powder for injection: 50 mg

Indications: Acute myocardial infarction

Contraindication/Precautions: Active bleeding, history of CVA, recent (within 2 months) intracranial or intraspinal surgery or trauma, intracranial neoplasm, AVM, aneurysm, bleeding diathesis, severe uncontrolled hypertension, recent (within 3 month) facial, trauma, suspected aortic dissection. See under 'Alteplase'

Pregnancy: C, Breast feeding: avoid

Dosage schedule: Adult, intravenous: 30–50 mg (max. per dose 50 mg), dose to be given over 10 seconds and initiated within 6 hours of symptom onset, dose varies according to body weight (< 60 kg: 30 mg, 60-70 kg: 35 mg, 70-80 kg: 40 mg, 80-90 kg: 45 mg and >90 kg: 50 mg)

Adverse effects: See under alteplase

UROKINASE

Dosage form and strength: Injection: 25000 international units (IU), 50000 IU, 100000 IU and 500000 IU.

Indications: See under streptokinase.

Contraindications/Precautions: It must not be given by subcutaneous or intramuscular injection. A dose reduction may be required in patients with impaired renal and/or hepatic function. In these cases, the fibrinogen level should not fall below 100 mg/dl. Before starting thrombolytic therapy, haemostasis tests should be performed including haematocrit, platelet count, thrombin time (TT), prothrombin time (PT) and activated partial thromboplastin time (aPTT). If heparin has been given, it should be discontinued and the aPTT should be less than twice the normal control value before urokinase therapy is initiated. Also see under streptokinase.

Dosage schedule: *Pulmonary embolism:* injection, adult: Initial dose: 4400

IU/kg IV at a rate of 90 mL/hr over 10 minutes. Maintenance dose: 4400 IU/kg/hr IV at a rate of 15 mL for 12 hours.

Adverse effects: In contrast to streptokinase, urokinase is non-antigenic; however, mild allergic reactions including bronchospasm and rash have been reported. Also see under streptokinase.

Drug and food interactions: Anticoagulants: Oral anticoagulants or heparin may increase the risk of haemorrhage and should not be used concomitantly with urokinase. Active substances affecting platelet function: Due to increased risk of haemorrhage, concomitant use of urokinase and active substances that affect platelet function (e.g., acetylsalicylic acid, other non-steroidal anti-inflammatory agents, dipyridamole, dextrans) should be avoided. Contrast agents: Contrast agents may delay fibrinolysis.

3.5 Antifibrinolytic drugs

ETHAMSYLATE

Dosage form and strength: *Tablet:* 500 mg

Indications: Blood loss in menorrhagia, post-partum bleeding, post abortion bleeding.

Contraindications/Precautions: Pregnancy or breastfeeding woman; Category B. Avoid excess dosage. The drug should be used with caution if patient develops fever with treatment, non-cancerous growths fibroids in uterus and, porphyria **Dosage schedule:** Oral, adult: 500 mg 4 times daily during menstruation.

Adverse effects: Headache, rashes, hypotension

TRANEXAMIC ACID

Dosage form and strength: *Tablet:* 500 mg

Indications: Menorrhagia, epistaxis, thrombolytic overdose, hereditary angioedema, prophylaxis of hereditary angioedema.

Contraindication/Precautions: Severe renal impairment ($\text{CrCl} < 1.5 \text{ mg/dl}$) and thromboembolic disease. Caution in renal impairment and pregnancy

Adverse effects: Nausea, vomiting, diarrhoea, disturbances in colour vision, nose stuffiness

Dosage schedule:

- *Menorrhagia (initiated when menstruation started):* oral, adult: 1 g 3 times daily for up to 4 days, maximum 4 g daily.
- *Local fibrinolysis:* adult, oral: 15-25 mg/kg 2-3 times daily. Epistaxis: oral, adult: 1 g 3 times a day for 7 days.
- *Hereditary angioedema:* oral, adult: 1-1.5 g 2-3 times a day, for short-term.

Patient information: Drug shouldn't be used in combination with hormonal contraceptives (birth control pills, patches, rings, injection). Do not take for more than 5 days in a row.

PROTAMINE SULPHATE

Dosage forms and strength: *Injection:* 10 mg/ml in 5 ml ampoule

Indication: Heparin overdose

Contraindication/Precautions: Bleeding that occurs without prior exposure to heparin. Should be cautiously used in patients with known hypersensitivity to fish, post-vasectomy, severe left ventricular dysfunction and abnormal pulmonary hemodynamics. Monitor patients closely following cardiac surgery; administer additional doses of protamine sulfate if indicated by coagulation studies. Pregnancy Category C

Dosage schedule: Adult, slow intravenous injection: 1 mg neutralises 100 units heparin when given within 15 minutes; if longer time, less protamine required as heparin rapidly excreted, maximum 50 mg.

Adverse effect: Hypotension, bradycardia, flushing, urticaria and angioedema.

Patient information: Do not take if allergic to fish

3.6 Antidotes

PHYTOMENADIONE (VITAMIN K₁)

Dosage form and strength: *Injection:* 10 mg /ml in 5 ml ampoule; *Tablet:* 10 mg

Indications: Antagonists to warfarin, prophylaxis against hemorrhagic disease of newborn.

Contraindications/Precautions: Rapid IV administration may cause potentially fatal anaphylaxis. Protect from light; agent is degraded. Avoid IM route if patients is bleeding or in 3rd trimester of pregnancy. IV/IM reactions may occur with first dose (no prior exposure to phytonadione). Restricts use of IV/IM routes where SC administration is not feasible and serious risk involved is considered justified.

Dosage schedule:

- *Warfarin-induced hypoprothrombinemia:* adult: 5-10 mg slow intravenous injection.
- *Prophylaxis, hemorrhagic disease of newborn:* intramuscular injection, 0.5-1 mg as single dose.

Adverse effects: Hypersensitivity characterized by flushing of the face, bronchospasm, dyspnea, hypotension.

Drug and food interactions: Vitamin K decreases effects of warfarin by pharmacodynamics antagonism.

3.7 Plasma fractions for specific use

HUMAN ALBUMIN

Dosage form and strength: Albumin (Human) 20% is supplied in 10 g/50 mL infusion bottle, 20 g/100 mL infusion bottle

Indications: Hypovolemia with or without shock, hypoalbuminemia, ovarian hyperstimulation syndrome, adult respiratory distress syndrome (ARDS), hemolytic disease of the newborn.

Contraindications/Precautions: Severe anemia, increased risk of bleeding, high blood pressure, failure of the heart to maintain adequate circulation, esophageal varices, fluid in the lungs, fluid overload, absence of urine

formation, allergy to albumin products. Decompensated cardiac insufficiency, hypertension, esophageal varices, pulmonary edema, hemorrhagic diathesis, severe anemia, renal and post-renal anuria.

Dosage schedule: The concentration of the albumin preparation, dosage and the infusion rate should be adjusted to the patient's individual requirements. The dose required depends on the body weight of the patient, the severity of trauma or illness and on continuing fluid and protein losses. Measures of adequacy of circulating volume and not plasma albumin levels should be used to determine the dose required. The daily dose should not exceed 2 g of Albumin (Human) 20% per kg of body weight.

- *Hypovolemia:* In adults, intravenous infusion: 25 g should be given. If adequate response (stabilization of circulation) is not achieved within 15 to 30 minutes, an additional dose may be given. In spite of limited information about the efficacy in pediatric subjects, an intravenous infusion of 2.5 to 12.5 g or 0.5 to 1 g/kg body weight may be given. If adequate response (stabilization of circulation) is not achieved within 15 to 30 minutes, an additional dose may be given.
- *Hypoalbuminemia:* adults, intravenous infusion: 50 to 75 g of Albumin (Human) 20% may be used. Hypoalbuminemia is usually accompanied by a hidden extravascular albumin deficiency of equal magnitude. This total body albumin deficit must be considered when determining the amount of albumin necessary to reverse the hypoalbuminemia. In burns, therapy usually starts with the administration of large volumes of crystalloid injection to maintain plasma volume. After 24 hours, Albumin (Human) 20% may be added at an initial dose of 25 g with the dose adjusted thereafter to maintain a plasma protein concentration of 2.5 g per 100 mL or a serum protein concentration of 5.2 g/100 mL.
- *Ovarian Hyperstimulation Syndrome:* adults, intravenous, doses of 50 – 100 g of Albumin (Human) 20% should be infused over 4 hours and repeated at 4- to 12-hour intervals as necessary, when infusion of normal saline fails to achieve or maintain hemodynamic stability and urine output.
- *Adult Respiratory Distress Syndrome (ARDS):* adults, intravenous: a dose of 25 g of Albumin (Human) 20% can be infused over 30 minutes and repeated at 8 hour intervals for 3 days, if necessary.
- *Induction of Diuresis in Patients with Acute Nephrosis:* In adults, a dose of 25 g of Albumin (Human) 20% can be infused, administered with an appropriate diuretic once a day for 7 to 10 days.
- *Hemolytic Disease of the Newborn:* newborns, Albumin (Human) 20% may be administered prior to or during exchange transfusion at a dose of 1 g per kg body weight.

Adverse effects: Anaphylactic shock, circulatory failure, cardiac failure, pulmonary edema

FACTOR IX COMPLEX

(COAGULATION FACTORS, II, VII, IX, X dried concentrate)

Dosage form and strength: 500 IU FIX/5 mL single dose vial; 1000 IU FIX/10 mL single dose vial; 1500 IU FIX/10 mL single dose vial

Factor IX complex concentrate is a complementary list preparation and a representative coagulation factor preparation.

Indications: Replacement therapy for factor IX deficiency in haemophilia B; bleeding due to deficiencies of factors II, VII, or X.

Contraindications/Precautions: Disseminated intravascular coagulation. Risk of thrombosis (less risks with highly purified Preparations). Factor IX Complex should not be administered at a rate exceeding 10 mL/minute. Rapid administration may result in vasomotor reactions. Nursing personnel, and others who administer this material, should exercise appropriate caution in handling due to the risk of exposure to viral infection. Discard any unused contents. Discard administration equipment after single use. Do not resterilize components. Do not reuse components. Pregnancy Category C. It should be stored at temperatures between 2 and 8°C. Do not freeze diluent. May be stored at room temperature not to exceed 30°C for up to 3 months. When removed from refrigeration, record the date on the vial or carton.

Dosage schedule:

- *Haemophilia B:* adult and child, slow intravenous infusion: according to patient's needs and specific preparation used.
- *Treatment of bleeding due to deficiencies in factor II, VII or X as well as IX:* adult and child, slow intravenous infusion: according to patient's needs. In general, factor IX 1 unit/kg will increase the plasma factor IX level by 1%: Number of factor IX units required = bodyweight (kg) x desired factor IX increase (as % of normal) x 1 unit/kg. For example, to increase factor IX level to 25% of normal in a 70 kg patient: Number of factor IX units needed = 70 kg x 25 x 1 unit/kg = 1,750 units

Adverse effects: Allergic reactions including chills, and fever, Flushing, thrombosis (sometimes fatal)

Drug and food interaction: Aminocaproic Acid: May enhance the adverse/toxic effect of Factor IX Complex (Human) [(Factors II, IX, X)]. Specifically, use of this combination may increase the risk of thrombosis. Avoid combination

3.8 Other drugs

DESMOPRESSIN

Dosage forms and strength: *Tablets:* 100 mcg, 200 mcg. *Injection:* 4 mcg.

Indications: For bleeding control, diabetes insipidus, primary nocturnal enuresis.

Contraindications/Precautions: Hypersensitivity, pseudo Von Willebrand's disease, cardiac insufficiency, angina pectoris, hypertension, renal impairment, hypertension and cardiovascular disease. Rhinitis or Upper respiratory tract infection can decrease the effectiveness of intranasal preparation

Adverse effects: Fluid retention, headache, nausea, vomiting, epistaxis, allergic reaction. Less pressor activity, but still need for considerable caution in renal impairment, cardiovascular disease and hypertension.

Dosage schedule:

- *Hemophilia A/ Von Willebrand's disease:* Intranasal (adults and children) 1

spray (150 mcg) in each nostril (if >50 kg), in one nostril (if <50 kg)

- *Diabetes insipidus diagnosis*: subcutaneous or intramuscular, adult and child, 2 mcg; Treatment: subcutaneous, intramuscular or intravenous, adult: 1-4 mcg daily, child: 400 nanogram.
- *Renal function testing*: subcutaneous or intramuscular, adult and child: 2 mcg

Drug and food interactions: Chlorpropamide, clofibrate or carbamazepine may enhance antidiuretic response to desmopressin. Demeclocycline, lithium, norepinephrine, alcohol may diminish the antidiuretic response to desmopressin.

POLYGELINE

Dosage form and strength: Solution: 3.5%

Indications: Low blood volume

Contraindications/Precautions: Use caution in cardiac disease, severe liver disease. Pregnancy: avoid at the end of pregnancy. Use with caution in severe impairment and renal impairment. Monitor urine output, hypersensitivity reactions, fluid and electrolyte therapy. Avoid hematocrit concentration from falling below 25–30%

Dosage schedule: Intravenous infusion, adult: initially 500-1000 ml of a 3.5% solution

Adverse effects: Anaphylactic reaction, hypersensitivity reactions, transient increase in bleeding time

Drug and food interaction: Avoid use with febuxostat

Section II - Chapter 4

Vitamins & Minerals

4.1 Minerals

Calcium
Iodine
Iron
Phosphates
Sodium flouride
Zinc

4.2 Vitamins

4.2.1 Fat soluble vitamins

Vitamin A (Retinol)
Vitamin D₃ (Calcitriol)
Vitamin E (Tocopherol)
Vitamin K

4.2.2 Water soluble vitamins

Vitamin B₁ (Thiamine)
Vitamin B₂ (Riboflavin)
Vitamin B₃ (Niacin)
Vitamin B₆ (Pyridoxine)
Vitamin B₉ (Folic acid)
Vitamin B₁₂ (Cobalamin)
Vitamin C (Ascorbic acid)

4.1 Minerals

CALCIUM

Dosage form and strength: *Tablets:* 1.25 g calcium carbonate (equivalent to 500 mg calcium); *Injection:* 500 mg/5 ml, 1 g/10 ml (as calcium gluconate) and 100 mg/10 ml (as calcium chloride)

Indications: Hypocalcemia in tetany, osteoporosis

Contraindications/Precautions: Hypercalcemic states, do not use if allergic to any ingredients of calcium preparations

Dosage schedule:

- *Supplement:* 1-2 g between meals; daily requirement varies with the age and is greater in childhood, pregnancy, lactation and old age
- *Acute hypocalcaemia:* 1-2 g by slow intravenous injection

Adverse effects: Constipation, bradycardia, cardiac arrhythmia, hypotension and irritation after parenteral administration

Drug and food interactions: Reduce absorption of ciprofloxacin, tetracycline, iron, bisphosphonates

IODINE

Dosage form and strength: *Injection:* 480 mg/ml (iodized oil)

Indications: Prevention and treatment of iodine deficiency

Dosage schedule: Daily recommended intake is 150 µg (200 µg in pregnant and breast-feeding mothers), 50 µg for under 1 year, 90 µg for 2-6 years and 120 µg for 7-12 years. Also see section 12.5 under drugs used in endocrine system.

Adverse effects: See section 12.5 under drugs used in endocrine system

IRON

See section 4 under drugs used in blood

PHOSPHATES

Dosage form and strength: *Tablet:* Potassium phosphate 126 mg with Sodium phosphate 67 mg; Potassium phosphate 250 mg with Sodium phosphate 160 mg; Potassium phosphate 250 with Sodium phosphate 298 mg

Indications: Treatment of hypophosphatemia

Contraindications/Precautions: Hyperphosphotemia, hyperkalemia, hypocalcemia, hypomagnesemia

Adverse effects: Diarrhoea, nausea, vomiting, fluid retention, and hypocalcaemia

SODIUM FLUORIDE

Dosage form and strength: *Tablet:* 2.2 mg; *Mouth wash:* 0.05% and 0.2%

Indications: Prevention of dental caries

Contraindications/Precautions: Infants under 6 months of age, advisable to institute artificial fluoridation in areas with drinking water containing less than 700 µg/l (0.7 ppm)

Dosage schedule:

- *Water content less than 0.3 ppm:* child up to 6 months none; 6 months-3 years 250 µg daily; 3-6 years 500 µg daily; over 6 years 1 mg daily;
- *Water content 0.3-0.7 ppm:* child up to 3 years none; 3-6 years 250 µg daily, over 6 years 500 µg daily;
- *Prevention of dental caries:* as oral rinse, child over 6 years 10 ml 0.05% solution daily or 10 ml 0.2% solution weekly

Adverse effects: White flakes on teeth with recommended doses; Yellowish brown discoloration of teeth with more than recommended doses

ZINC

Dosage form and strength: *Tablets:* 10 mg and 20 mg

Indications: Zinc deficiency, diarrhoea in children (rota virus infection), adjunct to vitamin A therapy

Contraindications/Precautions: Must be taken for 2-3 months to be effective. Used with caution in acute renal failure

Dosage schedule: Adjunct to oral rehydration solution in acute diarrhoea,

- *Under 6 months:* 10 mg (elemental zinc) daily for 10 days;
- *6 months – 5 years:* 20 mg daily for 10 days

Adverse effects: Dyspepsia, abdominal pain, headache, nausea, vomiting, gastritis

Drug and food interactions: Decreases absorption of fluoroquinolones; absorption of zinc is reduced when taken with dietary products, caffeine

4.2 Vitamins**4.2.1 Fat soluble vitamins****VITAMIN A (RETINOL)**

Dosage form and strength: *Capsules:* 200,000 U; *Soft gel capsules:* 200,000 U (retinol) and 40 U (DL-alpha-tocopherol or tocopheryl acetate)

Indications: Deficiency states, prophylaxis in high risk subjects, steatorrhea, severe biliary obstruction, cirrhosis of liver or following total gastrectomy, severe ocular damage

Contraindications/Precautions: Hypersensitivity to vitamin A, malabsorption syndrome, hypervitaminosis A, pregnancy, breastfeeding, impaired renal function, children, hepatic disease, alcoholism, hepatitis

Dosage schedule:

- *Treatment of xerophthalmia:* infants (6-11 months) 100,000U (3 drops) on diagnosis, repeated next day and then after one month; child over one year and adult (except women of child-bearing age) 200,000 units on diagnosis, repeated next day and then after one month
- *Prevention of vitamin A deficiency:* child age 6 months to 5 years, 200,000 U every 6 months
- *Measles:* 200,000 U on diagnosis, repeated next day
- *Prolonged diarrhoea of more than 14 days:* 200,000 U on diagnosis

- *Newly delivered mothers:* 200,000 U at delivery or in the first 6 weeks
- *Severe malnutrition:* 200,000 U on diagnosis

Adverse effects: Hypervitaminosis, fatigue, irritability, mental change, anorexia, nausea, vomiting, GI upset

Drug and food interactions: Mineral oil, cholestyramine, colestipol decrease absorption of Vitamin A

Patient information: Refer to prescriber upon development of adverse effects

VITAMIN D₃ (CALCITRIOL)

Dosage form and strength: *Capsule:* 0.25 µg and 0.5 µg; *Injection:* 1 µg/ml

Indications: Hypocalcaemia with chronic renal disease, psoriasis, renal dystrophy, prevention and treatment of rickets, post menopausal osteoporosis

Contraindications/Precautions: Hypersensitivity, hyperphosphataemia, hypercalcaemia

Precautions: Pregnancy, breastfeeding, renal calculi

Dosage schedule:

- *Hypocalcaemia (Stage 5 chronic kidney disease):* Children > 5 yrs and adults, oral, 0.25 µg/day, Children 1-5 year, oral, 1-5 µg/day; Rickets, oral, 1 µg/day,
- *Osteoporosis prophylaxis in corticosteroid therapy:* oral, 0.5-1 mcg/day

Adverse effects: Drowsiness, headache, palpitations, Hypertension, photophobia, hypercalcemia, myalgia, arthralgia, weakness, pain in injection site

Drugs and food interactions: Hypercalcaemia may occur if thiazide diuretics, calcium supplements are concomitantly used; cardiac dysarrhythmia may occur with concomitant use of cardiac glycosides, verapamil

Patient information: Avoid over the counter products containing calcium, potassium, sodium; maintain adequate fluid and water intake

VITAMIN E (TOCOPHEROL)

Dosage form and strength: *Capsule:* 100 IU, 200 IU, 400 IU, 500 IU, 600 IU and 1000 IU

Indications: Vitamin E deficiency states, impaired fat absorption, hemolytic anemia in premature neonates, prevention of retrolental fibroplasias, sickle cell anemia, supplementation of malabsorption syndrome

Contraindications/Precautions: Pregnancy, anemia, breastfeeding, hypoprothrombinaemia.

Dosage schedule: *Deficiency states:* adult, oral, 60-75 IU/day, child, oral, 1 IU/day

Adverse effects: Headache, fatigue, increased risk of thrombophlebitis, cramps, diarrhea, gonadal dysfunction, weakness

Drug and food interactions: Increases actions of oral anticoagulants, concomitant use of cholestyramine, sucralfate decrease absorption of vitamin E

VITAMIN K

See under Drugs used in blood disorders

4.2.2 Water soluble vitamins**VITAMIN B₁ (THIAMINE)**

Dosage form and strength: *Tablets:* 50 mg, 100 mg, 250 mg and 500 mg, 20 mg (enteric coated); *Injection:* 100 mg/ml

Indications: Vitamin B₁ deficiency, polyneuritis, cheilosis, beri-beri, Wernicke-Korsakoff syndrome, pellagra, metabolic disorders

Contraindications/Precautions: Hypersensitivity, pregnancy

Dosage schedule: Adult, oral (males) 1.2-1.5 mg, (females) 1.1 mg, (pregnancy) 1.4 mg, (breast feeding): 1.4 mg; child, oral-0.5-0.9 mg; infant, oral 0.2 mg

Adverse effects: Weakness, restlessness, pulmonary edema, hypotension, collapse, angioneurotic edema, cyanosis, hemorrhage

Patient information: About the necessary foods to be included in diet: yeast, beef, liver legumes, whole grains.

VITAMIN B₂ (RIBOFLAVIN)

Dosage form and strength: *Tablets:* 5 mg, 10 mg, 25 mg, 50 mg, 100 mg and 250 mg

Indications: Vitamin B₂ deficiency, polyneuritis, cheilosis, migraine and prophyllaxis

Contraindications/Precautions: Hypersensitivity to vitamin B₂, pregnancy.

Dosage schedule: Adult- 5-30 mg/day, child>12 yr: PO 3-10 mg/day then 0.6 mg/1000 calories ingested; *Migraine prophylaxis:* adult- 400 mg/day for three months

Adverse effects: Yellow discoloration of urine

Drug and food interactions: Decrease action of tetracyclines, may cause false elevations of urinary catecholamines

Patient information: Urine may turn bright yellow; Avoid alcohol

VITAMIN B₃ (NIACIN)

Dosage form and strength: *Tablets:* 50 mg, 100 mg, 250 mg and 500 mg (niacin); *Tablets:* 100 mg and 500 mg (niacinamide)

Indications: Pellagra, hyperlipidemias (types 4, 5), peripheral vascular disease

Contraindications/Precautions: Pregnancy, breastfeeding, hypersensitivity, peptic ulcer, hepatic disease, hemorrhage, severe hypotension, glaucoma, coronary artery disease, diabetes mellitus, gout, schizophrenia. Assess cardiac status, nutritional status, CNS symptoms, Niacin deficiency, Hyperlipidemia

Dosage schedule: *Pellagra:* adult, up to 500 mg daily in divided doses.

Adverse effects: Paraesthesia, headache, dizziness, anxiety, Postural hypotension, vasovagal attacks, dysrhythmias, vasodilation, blurred vision, ptosis, jaundice, hepatotoxicity, hepatitis, glycosuria,

Drug and food interactions: When combined with statins, either increases the toxicity of the other: increase risk of rhabdomyolysis. Cholestyramine, erythromycin, insulin decrease the blood level of niacin.

Patient information: Flushing and increase in feelings of warmth will occur several hours after taking medicine; remain recumbent if postural hypotension occurs; abstain from alcohol if product is prescribed for hyperlipidemia; avoid sunlight if lesions are present

VITAMIN B₆ (PYRIDOXINE)

Dosage form and strength: *Tablets:* 10 mg, 25 mg, 50 mg and 100 mg; 100 mg (extended release); *Injection:* 100 mg/ml; *Capsules:* 150 mg (extended release)

Indications: Vitamin B₆ deficiency, seizures, isoniazid therapy, oral contraceptives, alcoholic polyneuritis

Contraindications/Precautions: Pregnancy, breastfeeding, children, Parkinson's disease, patients taking levodopa should avoid supplemental vitamins with >5 mg pyridoxine.

Adverse effects: Paresthesia, flushing, warmth, lethargy, pain at injected site.

Dosage schedule:

- *Deficiency states:* oral, 25–50 mg up to 3 times daily;
- *Isoniazid neuropathy, prophylaxis:* oral, 10 mg daily;
- *Isoniazid neuropathy treatment:* oral, 50 mg 3 times daily;
- *Sideroblastic anemia:* oral, 100–400 mg daily in divided doses

Drug and food interactions: Decrease the effects of levodopa

Patient information: Avoid vitamin supplements unless directed by prescriber; increase meat, bananas, potatoes, lima beans, whole grains, and cereals in diet

VITAMIN B₉ (FOLIC ACID)

Dosage form and strength: *Tablets:* 0.1 mg, 0.4 mg, 0.8 mg, 1 mg and 5 mg; *Injection:* 5 mg/ml and 10 mg/ml

Indications: Megaloblastic or macrocytic anemia caused by folic acid deficiency; hepatic disease, alcoholism, hemolysis, intestinal obstruction, pregnancy to reduce risk for neural tube defects

Contraindications/Precautions: Pregnancy, anemia other than megaloblastic/macrocytic anemia, vit B₁₂ deficiency anemia, uncorrected pernicious anemia.

Dosage schedule:

- *Treatment of folate-deficiency, megaloblastic anemia:* oral, adult, 5 mg daily for 4 months (in pregnancy continued to term); up to 15 mg daily may be necessary in malabsorption states;
- *Prevention of first occurrence of neural tube defects:* oral, adult, 400–500 micrograms daily before conception and during the first 12 weeks of pregnancy;
- *Prevention of recurrence of neural tube defects:* oral, adult, 5 mg daily from

at least 4 weeks before conception until 12th week of pregnancy.

Adverse effects: Confusion, depression, excitability, irritability, anorexia, nausea, pruritus, rash, erythema, bronchospasm, anaphylaxis

Drug and food interactions: Folic acid by estrogen, hydantoins, carbamazepine, glucocorticoids, decreased levels of methotrexate, sulfonamides, sulfasalazine, trimethoprim

Patient information: Urine will turn bright yellow; alter nutrition to include high folic acids

VITAMIN B₁₂ (COBALAMIN)

Dosage form and strength: *Injection:* 1 mg/ml (cyanocobalamin), 1 mg/ml (hydroxycobalamin); *Tablets:* 50 µg

Indications: Vitamin B₁₂ deficiency states, malabsorption, pernicious anemia, stomach or lower ileal resection; macrocytic anemia

Contraindications/Precautions: Hypersensitivity to Vitamin B₁₂, uremia, folate deficiency, concurrent infections, iron deficiency, renal dysfunction. Parenteral products should be used when deficiency is due to malabsorption.

Dosage form and schedule:

• *Vitamin B₁₂ deficiency of dietary origin:* oral- adult, 50-150 µg /day (cyanocobalamin), child, 25-50 µg, twice daily; intramuscular injection- initially 1 mg repeated 10 times at intervals of 2-3 days, maintenance 1 mg every month;

• *Pernicious anaemia and other macrocytic anaemias without neurological involvement:* intramuscular injection, initially 1 mg (hydroxocobalamin) repeated 5 times at intervals of 2 days, then 1 mg every 3 months

Parenteral preparation should be used until hematologic remission develops and then should be switched to oral preparations

Adverse effects: Dizziness, memory impairment, restlessness, hypertension, chest pain, tachycardia, dry throat, eye redness, diarrhea, dyspepsia, thrombocytosis, hypokalemia, pain at injection site

Drug and food interactions: Chloramphenicol and antineoplastics may decrease hematologic response to B₁₂; Colchicine, aminoglycosides, aminosalicic acid, cimetidine, excess intake of alcohol or vitamin C may decrease oral absorption or effectiveness of B₁₂

Patient information: Patient should be encouraged to comply with diet recommendations of health care professional.

VITAMIN C (ASCORBIC ACID)

Dosage form and strength: *Tablet:* 50 mg

Indications: Vitamin C deficiency, scurvy, delayed wound, bone healing, chronic disease; urine acidification; before gastrectomy; dietary supplement

Contraindications/Precautions: Tartrazine, sulfite sensitivity; glucose-6-phosphate deficiency. Pregnancy, gout, diabetes, renal calculi.

Adverse effects: Headache, insomnia, dizziness, fatigue, flushing, nausea, vomiting, diarrhea, anorexia, heartburn, cramps, polyuria, hemolysis

Dosage schedule:

- *Prophylaxis of scurvy*: oral, 25–75 mg daily;
- *Treatment of scurvy*: oral, not less than 250 mg daily in divided doses

Patient information: Addition of citrus fruits; avoid smoking

Section II - Chapter 5

Drugs used in Renal Disorders

5.1 *Diuretics*

Acetazolamide
Amiloride hydrochloride
Chlorthalidone
Eplerenone
Furosemide
Hydrochlorothiazide
Indapamide
Mannitol
Metolazone
Spironolactone
Torsemide
Triamterene

5.2 *Anti diuretics drugs*

Desmopressin
Vasopressin

5.3 *Urinary antiseptics*

Nitrofurantoin

5.4 *Drug used for bladder pathology*

Bethanchol
Flavoxate
Mirabegron
Oxybutynin
Solifenacin
Tolteradin

5.5 *Solutions correcting fluid and electrolyte disturbances*

Albumin
Glucose
Glucose with sodium chloride
Potassium chloride
Ringer's lactate
Sodium bicarbonate
Sodium chloride

5.1 Diuretics

ACETAZOLAMIDE

Dosage form and strength: *Tablet:* 125 mg and 250 mg; *Powder for injection:* 500 mg; *Extended release capsule:* 500 mg; *Eye drops:* 2%

Indication: Open-angle glaucoma, angle-closure glaucoma (preoperatively if surgery delayed), secondary glaucoma, acute altitude sickness, CHF, drug induced edema

Contraindication/Precaution: Hypersensitivity to sulfonamide, severe renal disease, hepatic disease, electrolyte imbalance (hyponatremia/hypokalemia), hyperchloremic acidosis, Addison's disease, adrenocortical deficiency, cirrhosis, long-term use in non-congestive angle-closure glaucoma. Not recommended in pregnancy (C) and lactation: , hypercalciuria, diabetes, respiratory acidosis, pulmonary obstruction, emphysema and COPD, concomitant high dose aspirin.

Dosage schedule:

- *Angle closure glaucoma:* per oral/intravenous- 250 mg 24hr and 250 mg BD for short term therapy.
- *Open-Angle glaucoma:* per oral/intravenous – 250 mg/day in divided doses for amounts of more than 250 mg or 500 mg BD (max 1 g/day)

Adverse effects: Confusion, convulsions, cholestatic jaundice, drowsiness, malaise, metallic taste, metabolic acidosis

Drug and food interaction: Increases action of amphetamines, phenytoin, procainamide, quinidine, anticholinergic; increases toxicity of salicylate and cyclosporine; causes cardiac toxicity if hypokalemia develops with arsenic trioxide, cardiac glycoside.

Patient's information: May impair alertness and/or physical coordination.

AMILORIDE HYDROCHLORIDE

Dosage form and strength: *Tablet:* 5 mg

Indications: Oedema, CHF/HTN/Thiazide induced hypokalemia

Contraindications/Precautions: Hyperkalaemia, Addison's Disease, Renal failure (if CrCl<10), Anuria, Diabetic nephropathy. Pregnancy, breast-feeding, children, elderly, dehydration. Should be used with caution in patients with diabetes mellitus, mild renal impairment.

Dosage schedule:

- *Oedema (used alone):* per oral: initially 10 mg daily in 1 or 2 divided doses, adjusted according to response (maximum 20 mg daily).
- *Oedema (in combination with a thiazide or a loop diuretic):* per oral: initially 5 mg daily, increasing to 10 mg daily if necessary (maximum 20 mg daily).
- *CHF/HTN/Thiazide induced hypokalemia:* 5-10 mg/day PO q day or divided every 12 hour
- *Renal impairment:* If CrCl 10-50 ml/min: 50% normal dose; If CrCl<10 ml/minute: not recommended

Adverse effects: Hyponatremia, postural hypotension, diarrhoea, loss of appetite, dizziness.

Drug and food interaction: When combined with lithium: increases toxicity
Patient information: Take with food. To rise slowly from sitting to standing to avoid orthostatic hypotension. To avoid driving and using machineries if

dizziness occurs. To avoid potassium-rich food.

CHLORTHALIDONE

Dosage form and strength: *Tablet:* 15 mg, 25 mg, 50 mg and 100 mg

Indications: Hypertension, ascites due to cirrhosis in stable patients (under close supervision), oedema due to nephrotic syndrome, mild to moderate chronic heart failure, nephrogenic diabetes insipidus, partial pituitary diabetes insipidus.

Contraindications/Precautions: Hypersensitivity to it or sulfonamides, anuria. Pregnancy (B/D possible hazards include fetal or neonatal jaundice, thrombocytopenia). Lactation not recommended.

Dosage schedule:

- *Hypertension:* 12.5- 25 mg daily; per oral, dose to be taken in the morning, increase if necessary to 50 mg daily.
- *Edema:* 50-100 mg/day PO or 100 mg PO every other day; not to exceed 200 mg/day.
- *Mild to moderate heart failure:* 25-50 mg daily; per oral, dose to be taken in the morning, then increased if necessary to 100-200 mg daily, reduce to lowest effective dose for maintenance.
- *Nephrogenic diabetes insipidus /Partial pituitary diabetes insipidus:* Initially 100 mg per oral twice daily then reduced to 50 mg daily.

Adverse effects: Hypotension, vasculitis, photosensitivity, phototoxicity, electrolyte abnormalities, hyperglycemia, hyperuricemia, constipation, diarrhea, loss of appetite, nausea, vomiting, spasticity, restlessness, dizziness, headache, paresthesia, cardiac dysrhythmia (rare), pancreatitis (rare)

Drug and food Interactions: Aminolevulinic acid oral/topical + Chlorthalidone-increases toxicity by pharmacodynamic synergism. Amisulpride+Chlorthalidone:- Pharmacodynamic synergism, risk of hypokalemia. Cisapride+Chlorthalidone: Contraindicated .Risk of prolonged QTc interval. Tretinoin topical+ Chlorthalidone: Increased phototoxicity. Avoid concurrent use with lithium (lithium dose reduction by 50% may be necessary).

Patient information: Administered in the morning with food. Report to treating doctor if dizziness and other mentioned side effects occurs.

EPLERENONE

Dosage form and strength: *Tablet:* 25 mg and 50 mg

Indications: HTN, heart failure post MI, renal impairment, hepatic impairment

Contraindications/Precautions: Hypersensitivity. Serum potassium >5.5 mEq/L at initiation. Renal impairment if CrCl <50ml/min or Serum creatinine >2 mg/dl in males or >1.8 mg/dl in females. Concomitant use with strong CYP3A inhibitors. Pregnancy(B). Lactation -unknown. Hyperkalemia, liver dysfunction, metabolic or respiratory acidosis, renal impairment, hypersensitivity to spironolactone. Risk of hyperkalemia is higher in patients with impaired renal function, proteinuria, diabetes and those concomitantly treated with ACEIs and ARBs, NSAIDs and moderate CYP3A inhibitors.

Dosage schedule:

- *HTN:* Initial 50 mg PO qDay; may increase to 50 mg PO every 12 hour; may take up to four weeks for full therapeutic response; hyperkalemia may

occur with doses >100mg/day

- *Heart failure post MI*: Initial 25 mg PO qDay; may titrate to maximum of 50 mg once daily within 4 weeks as tolerated (Dose adjusted may be required based on potassium levels).

Adverse effects: Hyperkalemia, increased risk of hyperkalemia in presence of renal dysfunction, dizziness, fatigue, albuminuria, abdominal pain

Drug and food interactions: Itraconazole and Nefazodone and Saquinavir: will increase the level or effect of eplerenone by affecting hepatic/intestinal enzyme CYP3A4 metabolism. May increase the risk of hyperkalemia and hypotension.

Patient's information: Report to your treating doctor if awareness of heart beat (palpitation) occurs and all other mentioned side effects occurs. Do not use other medications without consulting registered doctor.

FUROSEMIDE

Dosage form and strength: *Injection*: 10 mg/ml in 2 ml ampoule; *Tablet*: 20 mg and 40 mg

Indications: Edema, heart failure, hypertension resistant to thiazide, fluid overload in AKI/CKD, Acute Pulmonary edema/hypertensive crisis/increased intracranial pressure

Contraindications/Precautions: Renal failure with anuria, comatose or precomatose states associated with liver cirrhosis, dehydration, hyperkalemia, hypovolemia, severe hyponatremia. Pregnancy(C).Lactation: drug excreted into breast milk; use with caution; may inhibit lactation. In patients with liver cirrhosis, hypotension, elderly (reduce dose), oliguria, renal and hepatic impairment and prostatic enlargement.

Dosage schedule:

- *Edema*: initially 40 mg in the morning, maintenance 20-40 mg daily, increased in resistant edema to 80 mg daily; child 1-3 mg/kg daily. Refractory CHF may necessitate larger doses.
- *Hypertension resistant*: 20-80 mg PO divided every 12 hour
- *Acute Pulmonary edema/Hypertensive crisis/Increased intracranial pressure*: 0.5 mg/kg (or 40 mg) IV over 1-2 minutes; may be increased to 80 mg if there is no adequate response within 1 hour; not to exceed 160-200 mg/dose.
- *Hyperkalemia in Advanced Cardiac Life Support (ACLS)*: 40-80 mg IV.
- *Hypermagnesemia in ACLS*: 20-40 mg IV q3-4hr PRN.

Adverse effect: Hypokalemia, hyponatremia, tinnitus, reversible or permanent hearing impairment, rashes, loss of appetite, vomiting, diarrhea, constipation, hyperuricemia gout.

Drug and food interactions: Patients receiving cardiac glycoside, furosemide predisposes the patient to digitalis toxicity principally due to hypokalemia. The hypotensive effects enhanced when given concomitantly with ACE inhibitors, alcohol, alpha blockers, general anesthetic agents, angiotensin-II receptor antagonists, beta blockers and calcium channel blockers. Concomitant administration of furosemide and aminoglycosides may result in increased incidence of ototoxicity and nephrotoxicity. Cisapride + Furosemide:-C/I; Risk of prolonged QTc interval.

Patient information: To take high potassium diet or potassium replacement

with drug as hypokalemia is seen. Rise slowly from lying or sitting position because orthostatic hypotension may occur, to take with food or milk for GI symptoms, to use sunscreen or protective clothing to prevent photosensitivity.

HYDROCHLORTHIAZIDE

Dosage form and strength: *Tablet:* 12.5 mg, 25 mg and 50 mg,

Indications: Edema associated with mild congestive heart failure, hepatic cirrhosis, nephritic syndrome, chronic renal failure, acute glomerulonephritis, hypertension, nephrogenic diabetes mellitus, calcium nephrolithiasis.

Contraindications/Precautions: Hypersensitivity, anuria, hyponatremia, hypercalcemic states (hyperparathyroidism, malignancies), hypokalemia, hyperuricemia, contraindicated in patients hypersensitive to sulfonamide, polymorphic ventricular tachycardia. Pregnancy(B), Lactation: drug excreted in breast milk. Use with caution in gout, elderly, may unmask latent diabetes mellitus, glucose intolerance, history of MI, DM, fluid or electrolyte imbalance, hypercholesterolemia, SLE.

Dosage schedule:

- *Hypertension:* 12.5 mg daily per oral (can be increased up to 25-50mg) administered in morning or in twice daily dose (second dose should be before 6pm)
- *Edema:* 25-50 mg per oral initially, maintenance dose 25-50 mg on alternate days.

Adverse effects: Anaphylaxis, anorexia, confusion, dizziness, extracellular fluid volume depletion, hypotension, hypokalemia, hyponatremia, hyperglycemia, hypercalcemia, hyperuricemia, hyperlipidemia, erectile dysfunction, CNS and GI disorders are less common or rare, hepatotoxicity, cholesterol.

Drug and food interaction: Amphotericin B and Corticosteroids increase the risk of hypokalemia, Torsade's de pointes and fatal ventricular fibrillation when used along with Quinidine. Decreased effects of anticoagulants, uricosuria drugs, sulfonyl ureas and increased effects of loop diuretics, anesthetics, digitalis, lithium when concomitantly used.

Patient's information: To rise slowly from lying or sitting position. To report if any signs of electrolyte imbalance, confusion occurs.

INDAPAMIDE

Dosage form and strength: *Tablet:* 2.5 mg (immediate release), 1.5 mg (sustained release)

Indications: Hypertension, congestive heart failure

Contraindications/Precautions: Avoid in severe hepatic impairment, renal impairment. Use caution in acute porphyria, hypotension, diabetes mellitus, hyperuricemia, gout, SLE, hepatic and/or renal impairment. Pregnancy (B). Breast feeding: avoid. Efficacy and safety of the drug has not been established in children

Dosage schedule:

- *Essential hypertension:* oral (using immediate-release), adult: 2.5 mg daily, dose to be taken in the morning
- oral (using sustained release), adult: 1.5 mg daily, may increase at 4 week interval up to 5 mg, dose to be taken in the morning.

• *Congestive heart failure*: oral (using immediate-release), adult: 2.5 mg daily, dose to be taken in the morning

Adverse effects: Skin rash, hypokalemia, anorexia, diarrhea, orthostatic hypotension, palpitation.

Drug and food interaction: Avoid if hypersensitivity to sulfonamides. Avoid concurrent use with arrhythmogenic drugs such as amisulpride, amitriptyline, artemether/ lumefantrine, astemizole, Chlorpromazine, cisapride, clarithromycin, disopyramide, desimipramine, fluconazole, ketoconazole, itraconazole, nilotinib, octreotide, haloperidol. Avoid use with other diuretics due to risk of hypokalemia.

MANNITOL

Dosage form and strength: *Injectable solution*: 10% and 20%.

Indications: Cerebral edema; raised intraocular pressure (emergency treatment or before surgery), anuria/ oliguria.

Contraindications/Precautions: Pulmonary edema, intracranial bleeding (except during craniotomy), severe congestive heart failure, metabolic edema with abnormal capillary fragility, severe dehydration, renal failure (unless test dose produces diuresis). Monitor fluid and electrolyte balance, monitor renal function. Advise patient to consult a physician or pharmacist before taking over the counter medication concurring with this therapy. Do not give simultaneously with blood .

Dosage schedule:

- *Cerebral edema*: 1.5-2 g/kg IV infused over 30-60 minutes.
- *Intraocular pressure*: 1.5-2 g/kg IV infused over 30-60 minutes.
- *Anuria/Oliguria*: Test dose by intravenous infusion as a 20% solution infused over 3-5 minutes, 200 mg/kg: repeat test dose if urine output is less than 30-50 ml/hour; if response is inadequate after a second test dose, re-evaluate the patient.

Adverse effects: Fluid and electrolyte imbalance, circulatory overload, acidosis, pulmonary edema (particularly in diminished cardiac reserve), chills, fever, chest pain, dizziness, visual disturbances, hypotension or hypertension, urticaria, hypersensitivity reactions, extravasation may cause edema, skin necrosis, and thrombophlebitis, rarely acute renal failure (with large doses).

Drug and food interaction: Increases excretion of salicylates barbiturates, imipramine, bromides.

Patient's information: To rise slowly from lying or sitting position. To report signs of electrolyte imbalance, confusion.

METOLAZONE

Dosage form and strength: *Tablet*: 2.5 mg, 5 mg and 10 mg

Indications: Hypertension, Edema

Contraindications/Precautions: Hypersensitivity to it or sulfonamides. Anuria, Hepatic coma or precoma. Acute porphyrias. Pregnancy (drug crosses placenta; hypokalemia, hypoglycemia, jaundice, thrombocytopenia and hyponatremia reported in fetus following maternal use of thiazide diuretics) Lactation: The amount present in milk is too small to be harmful. Large doses may suppress lactation. Use with caution in DM, hypercholesterolemia,

hyperuricemia or gout, hypotension, SLE, previously sympathectomy, liver disease.

Dosage schedule:

- *Oedema*: 5–10 mg daily, dose to be taken in the morning, dose may be increased in resistant oedema; increased if necessary to 20 mg daily; maximum 80 mg per day.
- *Hypertension*: initially 5 mg daily, dose to be taken in the morning; maintenance 5 mg once daily on alternate days

Adverse effects: Chest pain, chills, dizziness, drowsiness, electrolyte abnormalities, glucosuria, hyperuricemia, hepatotoxicity

Drug and food interactions: Aminolevulinic acid oral/topical + Metolazone increases toxicity. Amisulpride+Metolazone, risk of hypokalemia. Cisapride+Metolazone: Contraindicated. Risk of prolonged QTc interval. Tretinoin topical+ Metolazone: Increased phototoxicity.

Patient's information: Tablets may be crushed and mixed with water immediately before use.

SPIRONOLACTONE

Dosage form and strength: Tablet: 25 mg, 50 mg and 100 mg

Indications: Edema and ascites in cirrhosis of liver, nephrotic syndrome, congestive heart failure, primary hyperaldosteronism.

Contraindications/Precautions: Hyperkalemia, hyponatremia, Addison disease, moderate renal impairment. Elderly (reduce dose), diabetes mellitus, renal and hepatic impairment, pregnancy, breastfeeding. Spironolactone should be cautiously used when aforementioned drugs are to be used concomitantly. Serum level of Blood Urea Nitrogen (BUN) and K⁺ should be monitored regularly.

Dosage schedule:

- *Edema*: In adult: 100–200 mg per oral daily, increased up to 400 mg daily in resistant edema; maintenance dose 25–200 mg daily. (child) 1–3 mg/kg daily in 1–2 divided doses.
- *Primary hyperaldosteronism*: per oral (adult) 400 mg daily for 3–4 weeks, preoperative management: 100–400 mg daily; if not suitable for surgery, lowest effective dose is used as maintenance therapy.
- *Adjunct in severe heart failure*: per oral (adult) usually 25 mg daily.

Adverse effects: Hyperkalemia, metabolic acidosis (in cirrhotic patients), gynecomastia, impotence, decreased libido, hirsutism, menstrual irregularity, diarrhea, gastritis, gastric bleeding, breast cancer risk is increased in chronic use.

Drug and food interactions: Hepatic CYP3A4 isoform inhibitors like macrolide antibiotics, (clarithromycin), azole antifungals (ketoconazole, itraconazole), protease inhibitors (indinavir, ritonavir) may induce dangerous hyperkalemia by inhibiting spironolactone catabolism.

Patient information: Avoid foods with high potassium content, oranges, bananas, salty food.

TORSEMIDE

Dosage form and strength: Tablet: 10 mg, 20 mg and 100 mg

Indications: Congestive heart failure, Chronic renal failure, Hepatic cirrhosis,

Hypertension.

Contraindications/Precautions: Known hypersensitivity to torsemide or to povidone, Anuria, Hepatic Coma. Pregnancy & Lactation- No available data. Use with caution in DM, fluid or electrolyte imbalance (hypokalemia, hyponatremia), hyperglycemia, hyperlipidemia, hyperuricemia or gout, severe liver disease with cirrhosis and ascites.

Dosage schedule:

- *CHF:* 10-20 mg PO/IV mg once daily initially, doubled until desired diuretic effect is achieved, individual dose not to exceed 200 mg.
- *CRF:* 20 mg PO/IV OD initially; doubles until desired diuretic effect is achieved; individual dose not to exceed 200 mg.
- *Hepatic cirrhosis:* 5-10 mg PO/IV once daily initially with aldosterone antagonist or potassium sparing diuretic; individual dose not to exceed 40 mg.
- *Hypertension:* 2.5-5 mg/day PO initially; increased to 10 mg/day PO in 4-6 weeks PRN

Adverse effects: Headache, Electrolyte imbalance, Dizziness, Rhinitis, Constipation, Cough, Diarrhoea, Dyspepsia

Patient's information: Rise slowly from lying or sitting position. Limit alcohol use. Take the medication with milk or food to limit GI symptoms. Use sunscreen, protective clothing to prevent sunburn.

TRIAMTERENE

Dosage forms and strength: *Tablet:* 50 mg

Indications: Edema, potassium conservation with thiazides and loop diuretics.

Contraindications/Precautions: Addison's disease, anuria, hyperkalemia. Diabetic mellitus, elderly, gout, may causes blue fluorescence of urine. Regular monitoring of blood K⁺ to check for hyperkalemia

Dosage schedule: Initially 15-250 mg daily, reducing to alternate days after 1 week, taken in divided dose after breakfast and lunch, lower initial dose when given with other diuretics.

Adverse effects: Hyperkalemia, nausea, vomiting, diarrhea, muscle cramps, dizziness

Drug and food interactions: When other K⁺ sparing diuretics are concomitantly used dangerous hyperkalemia may develop.

Patient's information: Avoid using high K⁺ diet like avocado, banana, dried apricots etc.

5.2 Antidiuretic drugs

DESMOPRESSIN

Dosage form and strength: *Tablet:* 100 µg and 200 µg; *Injection:* 4 µg

Indications: Diabetes insipidus, primary nocturnal enuresis, post-operative polyuria or polydipsia, nocturia associated with multiple sclerosis.

Contraindications/Precautions: Hyponatremia. In cardiac insufficiency, renal impairment, conditions treated with diuretics, polydipsia in alcohol dependence, psychogenic polydipsia. Asthma, cardiovascular disease,

cystic fibrosis, heart failure. If hyponatremia occurs therapy may be hold or discontinued.

Dosage schedule:

- *Diabetes insipidus*: adult and child, initially 300 µg per oral daily (in three divided doses); maintenance: 300-600 µg daily in three divided doses; range 0.2-1.2 mg daily. By injection in diabetes insipidus, for diagnosis (subcutaneous or intramuscular adult and child, 2 µg; for treatment (subcutaneous, intramuscular or intravenous) adult 1-4 µg daily, child 400 ng
- *Primary nocturnal enuresis*: Adult and child over 5 years: 200 µg at bedtime, increased to 400 µg if lower dose not effective.
- *Postoperative polyuria/polydipsia*: adjust dose according to urine osmolality.
- *Renal function testing (subcutaneous or intramuscular)*: adult and child: 2 µg.

Adverse effects: fluid retention, headache, nausea, vomiting, epistaxis, allergic reaction.

Drug and food interactions: Chlorpropamide/dobutamine increases effects of desmopressin by pharmacodynamic synergism.

Patient's information: Patients being treated for primary nocturnal enuresis should avoid fluid overload and stop taking desmopressin during an episode of vomiting or diarrhoea. Do not take excessive fluid while on therapy.

VASOPRESSIN (ANTIDIURETIC HORMONE)

Dosage form and strength: *Injection*: 20 units/ml.

Indications: Diabetes insipidus, abdominal distension, abdominal roentgenography, bleeding oesophageal varices.

Contraindications/Precautions: Hypersensitivity. Vascular disease (especially disease of coronary arteries). Pregnancy (C). Lactation: unknown. Use caution in patients with seizure, migraine, asthma, heart failure, vascular disease, angina pectoris, coronary thrombosis. Controlled infusion should be administered via controlled infusion device.

Dosage schedule:

- *By subcutaneous or intramuscular injection, diabetes insipidus*: 5-20 units every four hours.
- *By intravenous infusion, initial control of variceal bleeding*: 20 units over 15 minutes.
- *In abdominal distension*: 5 units IM initially; repeated q3-4hr PRN; may be increased to 10 units.
- *In abdominal roentgenography*: 10 units (0.5 ml) IM/SC 2 hrs before procedure, then 10 units IM 30 minutes before procedure. (May give enema prior to first dose of vasopressin)

Adverse effects: Nausea, vomiting, abdominal cramps, angina, belching, fluid retention, sweating, tremor, constriction of coronary arteries and desire to defecate, pounding in the head, vertigo

Drug and food interactions: Amitriptyline/ Chlorpropamide/ Carbamazepine/ Fludrocortisone/Urea: increases effects of Vasopressin by Pharmacodynamic synergism. Heparin/lithium: decreases effects of vasopressin by pharmacodynamic antagonism.

5.3 Urinary antiseptics

NITROFURANTOIN

Dosage form and strength: *Tablet:* 50 mg and 100 mg; *Suspension:* 25 mg/5 ml

Indications: UTI, cystitis, pyelonephritis, and postoperative infection of urinary tract.

Contraindications/Precautions: Hypersensitivity, infant under 1-month, impaired renal function with estimated GFR <30 ml/min, pregnancy at term (38-42 weeks), hepatic dysfunction. Gastritis patients, gastrointestinal disease, diabetes. Pregnancy (B). Crosses placenta. Lactation: enters breast milk; discontinue drug or do not nurse. Avoid long term use in elderly.

Dosage schedule: Adult 50-100 mg per oral tid/qid. Child: 3-6 mg/kg body weight per oral in four divided doses.

Adverse effects: Headache, dizziness, peripheral neuritis and neurological effects, chest pain, leukopenia, blood dyscrasias, hemolytic anemia, GI intolerance, nausea, diarrheas, anorexia

Drug and food Interactions: Probenecid increases levels of nitrofurantoin. Increases antagonistic effect of norfloxacin.

Patient's information: Suggested to take medicine after meal to avoid gastric irritation. Color of the urine can be brownish, not to worry. Tablets should not be crushed. Protect from light.

5.4 Drugs used in bladder pathology

BETHANECHOL

Dosage form and strength: *Tablet:* 5 mg, 10 mg, 25 mg and 50 mg

Indications: Urinary retention

Contraindications/Precautions: Hypersensitivity, hyperthyroidism, peptic ulcer, asthma, bradycardia, hypotension, AV Conduction defects, CAD vasomotor instability, vagotonia, epilepsy, parkinsonism, obstructive pulmonary disease, HTN. GI disturbances or anastomosis. Pregnancy (C), Lactation: decision should be made whether to discontinue nursing or to discontinue drug.

Dosage schedule: *Urinary retention:* 10-50 mg PO 3-4 times daily. Some patients may require doses of 50-100 mg PO twice daily. Take 1 hour before or 2 hours after meal.

Adverse effect: Abdominal cramps, belching, bronchial constriction, diarrhoea, flushing, headache, urinary urgency

Drug and food interactions: Amibenonium: It increases effects of bethanechol by pharmacodynamic synergism. Amitriptyline: Bethanechol increases and amitriptyline decreases cholinergic effects/transmission. Flavoxate/ Solifenacin/Ipratropium: Bethanechol increases and flavoxate/solifenacin/ Ipratropium decreases cholinergic effects/transmission.

Patient's information: Take 1 hour before meal or 2 hour after meals

FLAVOXATE

Dosage form and strength: *Tablet:* 100 mg

Indications: Overactive bladder (OAB)

Contraindications/Precautions: Obstructive uropathy, pyloric/duodenal obstruction, ileus, GI bleeding, achalasia. Pregnancy (B). Lactation: not known. Use caution in patients with glaucoma. May impair ability to perform hazardous tasks. May cause ocular disturbances; advise patients of potential effects.

Dosage schedule: OAB (indicated for dysuria, increased urinary frequency/incontinence, nocturia, suprapubic pain, urinary incontinence, urinary tract irritation, urinary urgency): 100-200 mg PO q6-8hr

Adverse effects: Abdominal pain, Blurred vision, Confusion, Constipation, Disturbance in ocular accommodation, Drowsiness, Dry mouth, Dysuria, Increased ocular tension, Vertigo.

Drug and food interactions: Pramlintide+Flavoxate: either increases effects of the other by pharmacodynamic synergism. Contraindicated. Synergistic inhibition of GI motility. Secretin: Flavoxate decreases effects of secretin by pharmacodynamic antagonism. (avoid or use alternative drug). Monitor closely while using amilsulpride/amitriptyline/Clozapine/Chlorpromazine. Patient's information: Vertigo can occur.

MIRABEGRON

Dosage form and strength: Tablet (extended release): 25 mg and 50 mg

Indications: Overactive Bladder (OAB)

Contraindication/ Precautions: Hypersensitivity, Pregnancy (C), Lactation: unknown, discontinue nursing or the drug. May increase BP, Urinary retention may occur with bladder outlet obstruction or with concomitant antimuscarinic therapy. Angioedema of the face, lips, tongue and/or larynx reported.

Dosage schedule: Indicated for OAB with symptoms of urge urinary incontinence, urgency and urinary frequency: 25 mg PO qDay. 25 mg dose is typically effective within 8 weeks. May increase to 50 mg PO qDay based on individual efficacy and tolerability. Dosage modification in renal impairment: Severe (Crcl-15-29ml/min) not to exceed 25 mg/day. ESRD-not recommended.

Adverse effects: Elevated BP occurring predominantly in patients with preexisting hypertension, dry mouth, nasopharyngitis, UTI, headache, constipation, cystitis, back pain, arthralgia, Steven Johnson syndrome.

Drug and food interactions: Monitor closely: while using amitriptyline/codeine/metoprolol/tramadol- Mirabegron will increase the level or effect of amitriptyline/codeine/metoprolol/tramadol, by inhibiting hepatic enzyme CYP2D6 metabolism.

Instructions and warning: Appropriate monitoring is recommended and dose adjustment may be necessary for narrow therapeutic index CYP2D6 substrates.

Patient's information: May take with or without food. Swallow whole with water, do not chew, divide or crush tablet.

OXYBUTYNIN

Dosage form and strength: Tablet: 5 mg; Tablet extended-release: 5 mg, 10 mg and 15 mg; Syrup: 5 mg/ml

Indications: Overactive bladder (OAB)

Contraindications/Precautions: Hypersensitivity, gastric or urinary obstruction or retention, paralytic ileus, severe ulcerative colitis, uncontrolled

narrow-angle glaucoma. Use with caution in: Myasthenia gravis, tachycardia secondary to cardiac insufficiency or thyrotoxicosis. Pregnancy/Lactation: NA. In controlled angle closure glaucoma; mild to moderate ulcerative colitis, hyperthyroidism; partial obstructive uropathy; benign prostatic hyperplasia. hepatic and renal impairment. May aggravate symptoms of decreased gastrointestinal motility in patients with autonomic neuropathy.

Dosage schedule:

- **OAB:** Relief of symptoms (e.g. urge incontinence, frequency, urgency) in patients with uninhibited neurogenic or reflex neurogenic bladder. Immediate release: 5 mg PO twice/three times daily; not to exceed 5 mg PO four times daily. Extended release: 5-10 mg/day PO; may be increased by 5 mg/day at weekly intervals; not to exceed 30 mg/day. Pediatric: Tab 5 mg, Syrup: 5 mg/ml
- **Detrusor overactivity:** Bladder overactivity associated with a neurologic condition (e.g. Spina bifida) ≥5 yrs (immediate release): 5 mg PO every 12 hour; may be increased to 5 mg PO q8hr. ≥ 6 yrs (Extended release): 5 mg/day PO initially; may be increased by 5 mg/day at weekly intervals; not to exceed 20 mg/day.

Adverse effects: Dry mouth, constipation, somnolence, nausea

Drug and food interactions: Potassium chloride + oxybutynin. Avoid or use alternate drug. Patients using drugs with extensive anti cholinergic effects should avoid concomitant use with solid oral dosage forms of potassium chloride. May use effervescent potassium preparations as alternatives. Pramlintide + oxybutynin: Either increases effects of the other by pharmacodynamic synergism. Contraindicated. Synergistic inhibition of GI motility. Secretin: Oxybutynin decreases effects of secretin by pharmacodynamic antagonism.

Patient's information: May cause memory loss. Contact doctor if symptoms do not improve with 2 weeks of initial use.

SOLIFENACIN

Dosage form and strength: *Tablet:* 5 mg and 10 mg

Indications: Overactive bladder (OAB), Urge incontinence

Contraindications/Precautions: Urinary or gastric retention, uncontrolled narrow angle glaucoma, severe hepatic impairment, hypersensitivity. Pregnancy (C), Lactation: Avoid using drug or stop nurse. Bladder outflow obstruction, controlled narrow angle glaucoma, decreased GI motility, renal or hepatic impairment. Peripheral edema, exfoliative dermatitis, erythema multiforme, elevated liver enzymes, hyperkalemia, muscular weakness, renal impairment, GERD were noted after post marketing.

Dosage schedule: *OAB:* 5 mg PO OD; may be increased to 10 mg PO OD

Adverse effects: Dry mouth, Constipation, Abdominal Pain, Blurred Vision

Drug and food interactions: Itraconazole: it will increase the level or effect of solifenacin by inhibiting hepatic/intestinal enzyme CYP3A4 metabolism(C/I) Coadministration with solifenacin in hepatic/renal impairment may result in potentially fatal adverse events. Use caution while using Ondansetron/ Ketoconazole/carbamazepine together with Solifenacin.

Patient's information: Reports if there is headache, confusion, hallucinations and somnolence.

TOLTERODIN

Dosage form and strength: *Tablet:* 1 mg and 2 mg

Indications: Overactive bladder, Urge incontinence

Contraindications/Precautions: Urinary or gastric retention, Uncontrolled narrow angle glaucoma, hypersensitivity. Pregnancy(C), Lactation: Unknown. Controlled narrow angle glaucoma, bladder outflow obstruction, gastrointestinal obstruction, hepatic or renal impairment. Caution with patients of myasthenia gravis. Reduce dosage of tolterodine when coadministered with strong CYP3A4. Anaphylaxis and angioedema necessitating hospitalization and emergency treatment reported with first or subsequent doses.

Dosage schedule: *OAB, urge incontinence:* immediate release 2 mg PO every 12 hour, Extended release: 2-4 mg PO once daily

Adverse effects: Dry mouth, blurred vision, constipation, dizziness, drowsiness, dyspepsia

Drug and food interactions: Carbamazepine will decrease the level or effect of tolterodine. Clarithromycin will increase the level or effect of tolterodine by affecting CYP3A4 metabolism.

Patient's information: Report if dizziness/somnolence occurs. Do not drive or operate heavy machinery until adjusted to therapy.

5.5 Solutions correcting fluid and electrolyte disturbances**ALBUMIN**

Dosage form and strength: *Injectable solution:* 50 mg/dl, 250 mg/dl

Indications: 25% solution (acute nephrosis, acute liver failure, ARDS, burns, hypoproteinemia, renal dialysis, hypovolemic shock, hemolytic disease of newborn, hepatic surgery/transplantation). 5% solution (hypovolemic shock, burns, hypoproteinemia, cardiopulmonary bypass, acute liver disease)

Contraindications/Precautions: Hypersensitivity to albumin; hypersensitivity to blood, blood products, severe anaemia, cardiac failure. Pregnancy (C), Lactation: endogenous albumin found in breast milk; compatible. Chronic renal insufficiency, chronic anaemia, low cardiac reserve, normal plasma albumin. Monitor patients for signs of hypervolaemia, such as pulmonary edema. Use caution in patients with sodium restriction. Serious cardiopulmonary reactions, including fatalities; always have resuscitation equipment and trained personnel readily available. If 5% human albumin is unavailable, dilute 25% human albumin with NS or D5W. Do not use sterile water as diluents-risk of potentially fatal hemolysis & ARF. Use within 4 hr after opening vial; discard unused portion. Do not dilute 5% solution. Albumin 25% may be given undiluted or diluted in NS.

Dosage schedule: Initial 25 g (5% or 25% solution) IV infusion; may repeat q15-30 min if response adequate. Not to exceed 250 g/48 hr.

Adverse effects: Anaphylaxis, CHF, edema, HTN/hypotension hypervolemia, tachycardia, pulmonary edema, bronchospasm, chills, fever. Also see under section 3.7 Plasma fractions for specific use.

GLUCOSE

Dosage form and strength: *Injectable solution:* (5% w/v): 10 ml, 20 ml, 250

ml, 500 ml, 1000 ml.

Indications: Fluid replacement without significant electrolyte deficit, hypoglycemia, varicose veins

Contraindications/Precautions: Avoid in anuria, thiamine deficiency, trauma, intracranial hemorrhage, hemodilution, acute ischemic shock, hypophosphatemia, sepsis. Use caution in diabetes mellitus (may require additional insulin), mannitol fluid balance

Dosage schedule:

- *Fluid replacement without significant electrolyte deficit:* intravenous/infusion, adult/ child: determined on the basis of clinical and wherever possible, electrolyte monitoring.
- *Treatment of hypoglycemia:* Infusion, adult: 25 ml, 50% glucose solution into a large vein.

Adverse effects: local venous irritation, thrombophlebitis, fluid and electrolyte disturbances, edema or water intoxication (on prolonged administration or rapid infusion of large volumes of isotonic solutions), hyperglycemia (on prolonged administration of hypertonic solutions)

GLUCOSE WITH SODIUM CHLORIDE

Dosage form and strength: *Injectable solution:* Dextrose 5% and sodium chloride 0.9%: 250 ml, 450 ml, 500 ml, 1000 ml.

Store at 30°C.

Indications: Fluid and extracellular volume depletion with excess diuresis; gastroenteritis

Contraindications/Precautions: Avoid in impaired renal function, cardiac failure, hypertension, peripheral and pulmonary edema; toxemia of pregnancy.

Dosage schedule: Intravenous/ infusion, adult and child: fluid replacement determined on the basis of clinical and wherever possible, electrolyte monitoring.

Adverse effects: Administration of large doses may give rise to edema.

POTASSIUM CHLORIDE

Dosage form and strength: *Solution:* 15%. *Syrup:* 75 mg/ml

Indications: Prevention of hypokalaemia (patients with normal diet), electrolyte imbalance

Contraindications/Precautions: Avoid in plasma-potassium concentration >5 mmol/litre. Use caution in intravenous use (seek specialist advice in very severe potassium depletion or difficult cases), oral use cardiac disease, elderly Potassium overdose can be fatal. Ready-mixed infusion solutions containing potassium should be used. Exceptionally, if potassium chloride concentrate is used for preparing an infusion, the infusion solution should be thoroughly mixed. Renal impairment: reduce dose. Avoid in severe renal impairment. Regularly monitor plasma potassium concentration, ECG when IV potassium is used

Dosage schedule:

- *Prevention of hypokalemia (patients with normal diet):* oral, adult: 2–4 g daily in divided doses
- Potassium chloride concentrate as ampoules containing 1.5 g (potassium

20 mmol) in 10 mL, is thoroughly mixed with 500 mL of sodium chloride 0.9% intravenous infusion and given slowly over 2 to 3 hours with specialist advice and with ECG monitoring. For peripheral intravenous infusion, the concentration of potassium should not usually exceed 40 mmol/L. Higher concentrations of potassium chloride may be given in very severe depletion, but require specialist advice.

- *Electrolyte imbalance*: intravenous infusion, adult: Dose dependent on deficit/ the daily maintenance requirements

Adverse effects: Abdominal pain, diarrhea, flatulence, nausea, vomiting, heart toxicity (with rapid infusion)

RINGER'S LACTATE

Dosage form and strength: *Injectable solution*: (1.87% w/v): 250 ml, 500 ml, 1000 ml

Indications: Perioperative fluid and electrolyte replacement, hypovolemic shock, metabolic acidosis, peritoneal dialysis

Contraindications/Precautions: Avoid in metabolic or respiratory alkalosis, hypocalcaemia or hypochlorhydria; hypernatremia. Use caution in impaired renal function, cardiac failure, hypertension, peripheral and pulmonary edema, toxemia of pregnancy, corticosteroid therapy, shock, hypoxemia

Dosage schedule: *Fluid and electrolyte replacement or hypovolemic shock*: Intravenous infusion, adult/child: determined on the basis of clinical and wherever possible, electrolyte monitoring. Common adult dose is 1 to 3 L/day

Adverse effects: On excessive administration risk of metabolic alkalosis, edema, tissue necrosis, hypernatremia, hypervolemia, reaction at injection site.

SODIUM BICARBONATE

Dosage form and strength: *Injectable solution*: 7.5 % in 10-ml ampoule.

Indications: Metabolic acidosis, cardiopulmonary resuscitation, hyperkalemia; muscle spasm

Contraindications/Precautions: avoid in metabolic or respiratory alkalosis, hypocalcaemia, hypochlorhydria, hypoventilation, hypoosmolarity. Use caution in impaired renal function, cardiac failure, hypertension, peripheral and pulmonary edema, toxemia of pregnancy. Monitor electrolytes and acid base status. Pregnancy (C)

Dosage schedule:

- *Metabolic acidosis*: *Slow intravenous infusion*, adult/ child: strong solution (up to 8.4%), an amount appropriate to the body base deficit.
- *Continuous intravenous infusion*, adult/ child: weaker solution (up to 1.4%), an amount appropriate to the body base deficit

Adverse effects: On excessive administration risk of hypokalemia and metabolic alkalosis, especially in renal impairment; large doses may give rise to sodium accumulation and edema seizures; lactic acidosis; pulmonary edema; hyperventilation

SODIUM CHLORIDE

Dosage form and strength: *Injectable solution*: 0.9% isotonic (sodium ions (154 mmol/L), chloride ions (154 mmol/L) in water)

Indications: Extracellular fluid replacement, electrolyte replacement for maintenance, metabolic alkalosis in the presence of fluid loss, mild sodium depletion, diabetic ketoacidosis, sterile irrigation medium, vehicle for many parenteral drugs

Contraindications/Precautions: Avoid in congestive heart failure, severe renal impairment, hypertension, peripheral edema, pulmonary edema (auscultate bases of the lungs for crepitations), conditions of sodium retention, liver cirrhosis and irrigation during electrosurgical procedures. Use caution in toxemia of pregnancy, dilutional hyponatremia (especially in children and the elderly). Examine jugular venous pressure, monitor the right atrial (central) venous pressure in elderly or seriously ill patients

Dosage schedule:

- *Extracellular fluid replacement/ electrolyte replacement for maintenance/ metabolic alkalosis in the presence of fluid loss/ mild sodium depletion:* intravenous, adult: As per requirement.
- *Diabetic ketoacidosis (if systolic blood pressure is below 90 mmHg and adjusted for age, sex, and medication as appropriate):* intravenous infusion, adult: 500 mL, sodium chloride 0.9% to be given over 10-15 minutes, repeat if blood pressure remains below 90 mmHg and seek senior medical advice, when blood pressure is over 90 mmHg, sodium chloride 0.9% should be given by intravenous infusion at a rate that replaces deficit and provides maintenance (management regimen also includes administration of potassium chloride, soluble insulin, long acting insulin analogues and glucose 10% solution)

Adverse effects: On large doses risk of sodium accumulation, hyperchloremic, acidosis, hypokalemia, edema. In overdose: gastrointestinal effects of nausea, vomiting, diarrhea and cramps, reduced salivation and lacrimation, increased thirst and sweating, hypotension, tachycardia, renal failure, peripheral and pulmonary edema and respiratory arrest may occur. CNS symptoms include headache, dizziness, restlessness, irritability, weakness, muscular twitching and rigidity, convulsions, coma and death.

Section II - Chapter 6

Drugs used in Respiratory Disorders

6.1 *Anti-asthmatic drugs*

6.1.1 *Anticholinergic (antimuscarinic) bronchodilators*

Ipratropium bromide

6.1.2 *Beta-2 adrenoceptor agonists*

Bambuterol

Formoterol

Salbutamol

Salmeterol

Terbutaline sulphate

6.1.3 *Corticosteroids*

6.1.3.1 *Inhaled corticosteroids*

Beclomethasone dipropionate

Budesonide

6.1.3.2 *Systemic corticosteroids*

Hydrocortisone

6.1.4 *Leukotriene receptor antagonists*

Montelukast

Zafirlukast

6.1.5 *Mast cell stabilizers*

Sodium cromoglycate

6.1.6 *Sympathomimetic*

Ephedrine hydrochloride

Epinephrine

6.1.7 *Xanthines*

Aminophylline

Doxofylline

Theophylline

6.2 *Drugs used in cough*

6.2.1 *Antitussives*

Codeine phosphate

Dextromethorphan

Noscapine

Pholcodine

6.2.2 *Mucolytic*

Bromhexine

Carbocysteine

Acetylcysteine

6.3 *Systemic nasal decongestant*

Phenylephrine

Pseudoephedrine

6.4 *Others*

Caffeine citrate

6.1. Anti-asthmatic drugs

6.1.1 Anticholinergic (antimuscarinic) bronchodilators

IPRATROPIUM BROMIDE

Dosage form and strength: *Aerosol pressurized inhalation:* 20 µg per inhalation

Indications: COPD, bronchial asthma

Contraindications/Precautions: Closed angle glaucoma, urinary outflow obstruction, enlarged prostate, glaucoma (standard doses unlikely to be harmful; reported with nebulized drugs; particularly with nebulized salbutamol; care needed to protect patient eyes from drug powder or nebulized drug); medical supervision necessary for first dose of nebulized solution (risk of paradoxical bronchospasm), use with caution among children. If there is severe palpitation, product has to be changed.

Dosage schedule:

- *By aerosol inhalation:* 20-40 µg, 3-4 times daily; child up to 6 years - 20 µg 3 times daily; 6-12 years - 20-40 µg 3 times daily.
- *By inhalation of powder:* 40 µg 3-4 times daily; child under 12 years - not recommended

Adverse effects: Occasionally dry mouth, urinary retention, constipation, tachycardia and atrial fibrillation reported

Drug and food interactions: Anticholinergic action is increased with phenothiazines, antihistamines, disopyramide, belladonna. Bronchodilator effect is increased when taken with large amounts of tea.

Patient information: Shake well before use. Patient should prime the inhaler before using for the first time by releasing 2 test sprays in the air, away from the face, rinse after use.

6.1.2 Beta-2 adrenoceptor agonists

BAMBUTEROL

Dosage form and strength: *Tablet:* 10 mg and 20 mg

Indications: See under salbutamol.

Contraindications/Precautions: See under terbutaline

Dosage schedule: Initially, 10 mg once daily at bed time, increased if necessary after 1-2 weeks to 20 mg once daily; not recommended in children.

Adverse effects: See under salbutamol

Drug and food interaction: See under salbutamol

FORMOTEROL

Dosage form and strength: *Aerosol pressurized inhalation:* 12 µg per dose; *Dry powder inhalation:* 12 µg per dose

Indications: Asthma, prophylaxis of exercise induced bronchospasm, nocturnal asthma, COPD

Contraindications/Precautions: Same as salmeterol

Dosage schedule: Adult: 12 µg twice daily, dose may be increased in more severe airway obstruction; increased to 24 µg twice daily

Adverse effects: Very rare QT-interval prolongation, frequency not known

dizziness, nausea, pruritus, taste disturbances

Drug and food interaction: Same as salbutamol

SALBUTAMOL

Dosage form and Strength: *Aerosol pressurized inhalation:* 100 µg per inhalation; *Dry powder:* 200 µg per dose; *Injection:* 50 µg and 500 µg/ml; *Oral Solution:* Each 2 mg/5 ml; *Tablets:* 2 mg, 4 mg and 8 mg.

Indications: Bronchial asthma, COPD

Contraindications/Precautions: Salbutamol must not be used to prevent premature labour in the case of pre-eclampsia, placenta previa and bleeding. Hyperthyroidism, myocardial insufficiency, arrhythmias, susceptibility to QT-interval prolongation, hypertension, pregnancy (high doses should be given by inhalation because parenteral use can affect the myometrium and possibly cause cardiac problems), breastfeeding. Monitor blood Glucose (Ketoacidosis has been reported in Diabetes Mellitus following Intravenous administration)

Dosage schedule:

- *By mouth:* 4 mg (elderly and sensitive patient initially 2 mg) 3-4 times daily; maximum single dose 8 mg (but unlikely to provide much extra benefit or to be tolerated), child under 2 years 100 µg/kg 4 times daily; 2-6 years 1-2 mg 3-4 times daily; 6-12 years 2 mg
- *By subcutaneous or intramuscular injection:* 500 µg, repeated every 4 hours if necessary
- *By slow intravenous injection:* 250 µg repeated if necessary
- *By intravenous infusion:* initially 5 µg/minute, adjusted according to response and heart-rate usually in range 3-20 µg/minute or more if necessary
- *By aerosol inhalation:* 100-200 µg (1-2 puffs); for persistent symptoms up to 3-4 times daily; child 100 µg (1 puff) increased to 200 µg (2 puffs) if necessary. Prophylaxis in exercise induced bronchospasm, 200 µg (2 puffs); child 100 µg (1 puff)
- *By inhalation of a powder:* 200-400 µg; for persistent symptoms up to 3-4 times daily; child 200 µg. Prophylaxis in exercise-induced bronchospasm (powder), 400 µg; child 200 µg
- *By inhalation of nebulized solution:* adult and child over 18 months, chronic bronchospasm unresponsive to conventional therapy and severe acute asthma, 2.5 mg, repeated up to 4 times daily, increased to 5 mg if necessary, child 2.5 mg increased to 5 mg if required.

Adverse effects: Muscle cramps, dizziness, headache, muscle tremor, palpitation, ankle edema, hypokalemia.

Drug and food interactions: Concomitant use of high dose of salbutamol and corticosteroids or diuretics increases the risk of hypokalemia.

SALMETEROL

Dosage form and strength: *Aerosol pressurized inhalation:* 25 µg per inhalation; *Dry powder inhalation:* 50 µg per dose

Indications: Reversible airways obstruction (including nocturnal asthma and prevention of exercise-induced bronchospasm) in patients requiring long term bronchodilator therapy, chronic obstructive pulmonary diseases.

Contraindications/Precautions: Hypersensitivity, tachyarrhythmias, severe cardiac disease. Pregnancy, breastfeeding, cardiac disorders, hyperthyroidism, diabetes mellitus, hypertension, close angle glaucoma, seizure, acute asthma. It should not be used in children as monotherapy for asthma, use only in combination with inhaled steroid

Dosage schedule: Adult: 50 µg (2 puffs or 1 blister) twice daily. Up to 100 µg (4 puffs or 2 blisters) twice daily in severe air way obstruction; Child: under 4 years: not recommended; Over 4 years: 50 µg (2 puffs or 1 blister) twice daily

Adverse effects: Headache, dizziness, tachycardia, palpitation, ventricular arrhythmias, cough.

Drug and food instruction: Same as salbutamol

Patient information: Hold breath for 10 seconds after inhalation, Wash rotahaler only with tap water.

TERBUTALINE SULFATE

Dosage form and Strength: *Aerosol pressurized inhalation:* 250 µg dose; *Injection:* 500 µg per ml; *Tablets:* 2.5 mg and 5 mg

Indications: See under salbutamol.

Contraindications/Precautions: See under salbutamol. Tolerance develops in patients receiving long term therapy; dose may have to be changed; monitor rebound bronchospasm

Precautions: See under salbutamol

Dosage schedule:

- Oral: 2.5-5 mg 2-3 times daily; child 0.1 µg /kg 3 times daily.
- *By subcutaneous, intramuscular or slow intravenous injection:* 250-500 µg up to 4 times daily; child <12 years 0.01µg /kg every 20 minutes 3 doses;
- *By continuous intravenous infusion (as a solution containing):* 3-5 µg /ml, 1.5-5 µg /minute for 8-10 hours, reduce dose for children.
- *By aerosol inhalation:* adults and children 250-500 µg (1-2 puffs), for persistent symptoms up to 3-4 times daily.

Adverse effects: See under salbutamol

Drug and food interactions: Increases hypertensive crisis with MAOIs. Decreases the action of beta-blockers. The effect of terbutaline is increased with green tea (large amounts).

6.1.3 Corticosteroids

6.1.3.1 Inhaled corticosteroids

BECLOMETHASONE DIPROPIONATE

Dosage form: *Inhalation (aerosol):* 50 µg and 250 µg per dose.

Indications: See under budesonide

Contraindications/Precautions: Untreated fungal infection, active or quiescent tuberculosis; systemic therapy may be required during periods of stress or when airway obstruction or mucus prevent drug access to smaller airways; not for relief of acute symptoms; monitor height of children receiving prolonged treatment; if growth is slowed, review therapy.

Dosage schedule:

- *Chronic asthma: by aerosol inhalation (standard-dose inhaler):* adult: 200

µg twice daily or 100 µg 3–4 times daily (in more severe cases, initially 600–800 µg daily); child: 50–100 µg 2–4 times daily or 100–200 µg twice daily.

- *Chronic asthma: by aerosol inhalation (high-dose inhaler):* adult: 500 µg twice daily or 250 µg 4 times daily; if necessary may be increased to 500 µg 4 times daily; child: not recommended.

Adverse effects: Oropharyngeal candidiasis, cough, and dysphonia (usually only with high doses); adrenal suppression, growth retardation in children and adolescents, impaired bone metabolism, glaucoma, and cataract (with high doses, but less frequent than with systemic corticosteroids); paradoxical bronchospasm (requires discontinuation and alternative therapy but if mild, may be prevented by inhalation of beta-2 adrenoceptor agonist or by transfer from aerosol to powder inhalation); rarely urticaria, rash, and angioedema; very rarely anxiety, sleep disorders, and behavioral changes. Candidiasis can be reduced by the use of a spacer device; rinsing the mouth with water after inhalation may also help to prevent candidiasis.

Patient information: The products are not always interchangeable owing to differences in route of administration and in the amount of active drug released per spray. Use the personal container to avoid the spread the infection and shake the canister well before administering.

BUDESONIDE

Dosage form and strength: *Inhalation powder:* 100, 200, 400 µg per dose; *Nebulizer liquid:* 250 µg per ml and 500 µg per ml

Indication: Bronchial asthma

Contraindications/Precautions: Avoid in case of hypersensitivity, active PTB, oral thrush. An inhaled corticosteroid should be used cautiously in quiescent tuberculosis, osteoporosis, diabetes mellitus. Not to exceed recommended doses because adrenal suppression may occur, maintain good oral hygiene if using nebulizer or inhaler and avoid breastfeeding.

Dosage schedule:

- *By inhalation of powder, when starting treatment, during period of severe asthma and while reducing or discontinuing oral corticosteroid:* 0.2–1.6 mg daily in 2 divided dose; in less severe cases 200–400 µg once daily (each evening); child under 12 years 200–800 µg daily in 2 divided doses;
- *By inhalation of nebulized suspension, when starting treatment, during periods of severe asthma and while reducing or discontinuing oral corticosteroid:* 1–2 mg twice daily; child 3 months – 12 years, 0.5–1 mg twice daily. Maintenance, usually half above doses.

Adverse effects: Inhaled corticosteroids have considerably fewer systemic effects than oral corticosteroids. Oropharyngeal candidiasis, cough, adrenal suppression (usually with higher doses of inhaled drug and in children), growth retardation (usually with oral drug and in children), glaucoma (prolonged high dose of inhaled drug), cataract (inhaled drug).

Drug and food interactions: Concomitant use of corticosteroids (generally other than topical and inhaled) antagonize hypotensive effect of ACE inhibitors, alpha-blockers, angiotensin-II receptor antagonists and calcium channel blockers.

6.1.3.2 Systemic corticosteroids

HYDROCORTISONE

Dosage form and strength: *Injection:* 100 mg and 200 mg; *Injection:* 25mg/5ml; *Ointment:* 0.1%, 0.5% and 1%

Indications: Inflammatory and allergic disorder, inflammatory bowel disease, asthma, immunosuppression, nephritic syndrome, rheumatic disease, hematological disorders, collagen disease, neoplastic disease, adrenal insufficiency.

Contraindication/Precautions: Active untreated infectious, except for tuberculous meningitis, lactation, and peptic ulcer, diabetes mellitus, psychiatric disease, undiagnosed fever. Avoid live virus vaccines in those receiving immunosuppressive doses. Dose depends upon condition being treated and response of patient. Discontinuation of long term therapy requires gradual withdrawal by tapering the dose.

Dosage schedule: Adult: slow IV or infusion, 100-500 mg TDS or QID in a day or as required; Child: up to 1 year Slow IV: 25 mg daily; 1-5 year: 50mg daily; 5-12 years: 100 mg daily; locally: 1-2 times daily for mild inflammatory skin disorder such as eczema, nappy rash; 5-50 mg intra-articular depending on joint size.

Adverse effects: Euphoria, depression, seizure, vertigo, pseudotumor cerebri, peptic ulceration, thromboembolism, hypertension, glaucoma, cataracts.

Drug and food interactions: Hypokalemia with furosemide, hydrochlorothiazide, piperacillin. It may reduce the action of insulin and oral hypoglycemic drugs.

Patient information: Emergency card id as corticosteroid user should be carried. Report immediately in case of abdominal pain, black tarry stools because GI bleeding/perforation can occur. Not to discontinue abruptly because adrenal crisis can result; product has to be tapered before stopping.

6.1.4 Leukotriene receptor antagonists

MONTELUKAST

Dosage form and strength: *Tablet:* 4 mg, 5 mg and 10 mg.

Indications: Chronic asthma in adults and children, seasonal allergic rhinitis, bronchospasm prophylaxis.

Contraindications/Precautions: Hypersensitivity. Pregnancy, breastfeeding, children <6 yrs, acute attack of asthma, alcohol consumption, severe hepatic disease, corticosteroid withdrawal, phenylketonuria, suicidal ideation, depression.

Dosage schedule: Adult and child >15 yr: 10 mg/day in PM; child 6 -14 yrs: 5 mg chew tab/day in PM; child 2 – 5 yrs: 1 packet (4 mg) granules taken in PM

Adverse effects: Dizziness, fatigue, headache, behavior change, hallucinations, seizures, agitation, anxiety, Churg-Strauss syndrome.

Patient information: Avoid hazardous activities; dizziness may occur, continue the use inhaled beta agonists if exercise-induced asthma.

ZAFIRLUKAST

Dosage form and strength: *Tablet:* 10 mg and 20 mg.

Indications: Prophylaxis and chronic treatment of asthma in adults/children

>5yr, allergic rhinitis

Contraindications/Precautions: Hypersensitivity, hepatic encephalopathy. Pregnancy, breastfeeding, children, geriatric patients, hepatic disease, Churg-strauss syndrome, acute bronchospasm. Adult patients carefully for symptoms of Churg- Strauss syndrome; Liver function test.

Dosage schedule: Adult and children>yr: 20 mg twice daily; Child 5-11yr: 10 mg twice daily; Child >12 yr: 20 mg twice daily

Adverse effects: Headache, dizziness, nausea, diarrhea, abdominal pain, vomiting, hepatic failure, hepatitis, angioedema

Drug and food interactions: Food decrease bioavailability.

6.1.5 Mast cell stabilizers

SODIUM CROMOGLYCATE

Dosage form and strength: *Hard gelatin capsule:* 20 mg

Indications: Prophylaxis of asthma, allergic rhinitis, allergic conjunctivitis.

Contraindications/Precautions: Known hypersensitivity. Pregnancy, lactation, old age children and used with caution in patients with cardiac, hepatic and renal diseases

Dose schedule: Inhalation of powder, adults and children, 20 mg 4 times daily, increased in severe cases to 8 times daily.

Adverse effects: Throat irritation and cough, nasal congestion, headache, dizziness, arthralgia, rashes, bronchospasm

Patient's information: The capsules are intended for use in an inhaler and not to be swallowed. Sodium cromoglycate insufflation should be protected from moisture. Nasal sol. blow nose, hold pump between fingers; if its use, spray in air until fine mist occurs, Aerosol: take off cover mouthpiece, sake gently, breathe out slowly, place mouthpiece in mouth, close mouth around it, till head back, breathe in as inhaler, inhalation: Do not swallow sol, empty ampule into power driven nebulizer as directed.

6.1.6 Sympathomimetic

EPHEDRINE HYDROCHLORIDE

Dosage form and strength: *Tablets:* 30 mg

Indications: Reversible airways obstruction

Contraindications/Precautions: The drug should be used with caution in patients with hypertension, severe renal impairment and prostate hypertrophy.

Dosage schedule: 15-60 mg 3 times daily; child 3 times daily, up to 1 year: 7.5 mg, 1-5 years: 15 mg, 6-12 years: 30 mg.

Adverse effect: Arrhythmias, insomnia, tremor, tachycardia.

EPINEPHRINE

See under medicines used in shock

6.1.7 Xanthines

AMINOPHYLLINE

Dosage form and strength: *Tablet:* 100 mg; *Injection:* 250 mg/10ml

Indications: Bronchial asthma, COPD, Neonatal apnea.

Contraindications/Precautions: Hyperthyroidism, uncontrolled arrhythmias. Patient of Age > 60 years, patient with liver disease. Should not be given to the children under one year of age except in apnea of prematurity, therapeutic dose is near the toxic dose so that give carefully, don't give IM or SC.

Dosage schedule: Adult: 100-300 mg three times a day; Injection: IV dose 6 mg/kg over 20 to 30 minutes as loading dose, then maintenance dose 0.4 to 0.7 mg/kg/hour depending on comorbidities; Child dose, loading dose: IV 5-6mg/kg, maintenance dose: IV 1-2 mg/kg/dose every 8 hours

Adverse effects: Headache, dizziness, extra systoles, sinus tachycardia, anorexia, nervousness, tremor

Drug and food Instruction: Additive CVS and CNS side effects can be seen with sympathomimetic, elevated serum levels in patients receiving cimetidine, beta blockers, erythromycin, allopurinol or oral contraceptive pills.

Patient information: Suggest patients to take a lot of water with this medicine.

DOXOFYLLINE

Dosage form and strength: *Tablet:* 400 mg

Indications: Asthma, COPD

Contraindications/Precautions: Hypersensitivity, acute myocardial infarction, hypotension. Use with caution in patients with hypoxemia, hyperthyroidism, liver disease, renal disease, in those with a history of peptic ulcer and in elderly.

Dosage schedule: Adult: 400 mg once daily or twice daily; Children: 12 mg/kg/day

Adverse effects: Headache, nausea, vomiting, sleeplessness, dizziness,

Drug and food interaction: Should not be administered together with other xanthine derivatives, including beverages and foods containing caffeine

THEOPHYLLINE

Dosage form and strength: *Tablet:* 100 mg and 200 mg

Indications: COPD, Bronchial asthma, Nocturnal asthma

Contraindications/Precautions: Same as aminophylline. Close monitoring of the patient taking medicine should be done because the effective dose is very close to the toxic dose.

Dosage schedule:

- *Adult:* 200 mg bid .Dose can be increased after 1 week up to 300 mg bid, Over 70 kg: 200-300 mg twice daily;
- *Neonatal apnea:* Loading dose: PO 5 mg/kg/dose, maintenance dose: PO 3-6 mg/kg/day in 3-4 divided doses; Child: >1 year
- *Bronchospasm:* PO 12-14 mg/kg/day in 3-4 divided doses (Max. dose 300 mg/day)

Adverse effects: Nausea, vomiting, GI upset, headache, dizziness, convulsion,

Drug and food interaction: Never combine with ciprofloxacin, corticosteroids, theophylline, erythromycin and cimetidine they may cause increase the level of theophylline in the blood. Never combine with carbamazepine; phenytoin and barbiturates they may cause decrease the level of theophylline in the

blood.

Patient information: Same as aminophylline

6.2 Drugs used in cough

6.2.1 Antitussives

CODEINE PHOSPHATE

Dosage forms and strength: *Tablet:* 15 mg, 30 mg and 60 mg

Indications: Non-productive cough, pain

Contraindications/Precautions: In asthmatics, patients with decreased respiratory reserve, patients who are allergic to codeine or oxycodone, patients with history of drug abuse and drug seeking behavior (due to abuse liability). It should be cautiously used in patients with severe prostatic hypertrophy and hepatic disease; pregnancy, breastfeeding, COPD.

Dosage Schedule:

- *Mild to moderate pain:* 30-60 mg every 4 hours when necessary, to a maximum of 240 mg daily; child 1-12 years, 0.5-1 mg/kg/dose every 6 hours (Max. dose 60 mg/kg);
- *Dry or painful cough:* 15-30 mg 3-4 times daily. Child 5-12 years, 1-1.5 mg/kg 4 times daily.

Adverse drug reaction: Nausea, constipation, drowsiness, confusion, blurred vision, hypotension, bradycardia, respiratory depression on large doses, physical dependence on prolonged use.

Drug and food interaction: Codeine is used with extreme caution in patient receiving MAO inhibitors, additive CNS depression occurs with alcohol, antidepressants, antihistamines, sedative and hypnotics.

Patient information: Avoid driving or other activities requiring high alertness

DEXTROMETHORPHAN

Dosage form and strength: *Syrup:* 10 mg and 30 mg/5 ml

Indication: Non productive cough

Contraindications/Precautions: Allergy to Dextromethorphan, patients taking MAO inhibitors or SSRIs, should not be used for chronic productive cough. Pregnancy, lactation, children less than four years of age, patients with history of drug abuse and drug seeking behavior.

Dosage schedule: 10-20 mg every four hours or 30 mg every 6-8 hours; child, 6-12 years 5-10 mg every 4-8 hours to a maximum of 60 mg in 24 hours, and 2-6 years 2.5-5 mg every 4 hours, to a maximum of 30 mg in 24 hours.

Adverse drug effects: Dizziness, sedation, nausea

Drug and Food interactions: Use along with MAO inhibitors may cause serotonin syndrome (nausea, confusion, changes with blood pressure), CNS depression is increased with alcohol, antihistamines, antidepressants, sedatives, hypnotics, opioids, amiodarone. Quinidine may increase blood levels and precipitate adverse drug reaction.

NOSCAPINE

Dosage form and strength: *Linctus:* 15 mg/5 ml

Indication: Nonproductive cough

Contraindications/Precautions: Lactation, children below 2 years, pregnancy

Dosage schedule: Adults: 15-30 mg daily; Children: 15 mg three times daily (6-12 years); Infants: 7.5 mg three times daily (2-6 years)

Adverse effects: Drowsiness and nausea, occasionally large doses can cause bronchospasm and hypertension.

PHOLCODINE

Dosage form and strength: *Syrup:* 1.5 mg/5 ml

Indications: Nonproductive cough.

Contraindications/Precautions: Chronic lung diseases, liver or kidney failure, productive cough, pregnancy, breastfeeding. Difficulty in breathing, chronic cough and asthma, children under 5 years. It has practically no analgesic or addictive property, but is similar in efficacy as antitussive to codeine; It is longer acting—acts for 12 hours

Dose Schedule: 5-10 ml 3-4 times daily; child 1-2 years: 2.5-5 ml, 2-5 years: 5 ml, 5-12 years: 5-10 ml.

Adverse effects: Dizziness, loss of attention, swelling of the face and neck, difficulty in breathing

Drug and Food Interactions: Additive depressant effects with other depressants

Patient information: Do not drive or operate machines; Do not drink alcohol;

6.2.2 *Mucolytic*

BROMHEXINE

Dosage form and strength: *Tablets:* 5 mg; *Syrup:* 4 mg/5 ml

Indications: Reduction of sputum viscosity in COPD patients.

Contraindications/Precautions: Not recommended for infants < 1 year, peptic ulcer, severe hepatic /renal impairment. Should be used with caution in pregnant and breastfeeding women. Since mucolytics may disrupt the gastric mucosal barrier, bromhexine should be used with caution in patients with a history of gastric ulceration. Clearance of bromhexine or its metabolites may be reduced in patients with severe hepatic or renal impairment.

Dosage Schedule: Oral: 8 to 16 mg three times daily; child 2-6 years 8 mg 2-3 divided dose daily; 6-12 years: 4-8 mg per dose three times daily.

Adverse effects: Gastrointestinal side effects may occur occasionally with bromhexine and a transient rise in serum aminotransferase values has been reported. Other reported adverse effects include headache, vertigo (dizziness), sweating and allergic reactions.

Drug and food interactions: Should not be given with especially paracetamol (if so chances of hepatitis is increased).

Patient information: Should be taken after meal.

CARBOCYSTEINE

Dosage form and strength: *Capsules:* 375 mg; *Syrup:* 250 mg/5 ml

Indications: Reduction of sputum viscosity in COPD.

Contraindications/Precautions: Avoid use in pregnancy. It should be used with caution by patients with a history of peptic ulceration. Should be

cautiously used in children under 2 years old.

Dosage schedule : 750 mg 3 times daily initially; then 1.5 g daily in divided doses; child 2-5 years 200-500 mg per day 2- 4 times divided dose daily, 6-12 years 300-750 mg 3 times divided dose daily.

Adverse effects: Skin rashes, occasional gastro- intestinal irritation.

ACETYL CYSTEINE

Dosage form and strength: *Inhalation:* 200 mg/ml

Indications: Mainly as a mucolytic and in the management of paracetamol (acetaminophen) overdose.

Contraindications/Precautions: Hypersensitivity

Dosage schedule: When nebulized into a face mask, mouth piece or tracheostomy, 1 to 10 mL of the 20% solution or 2 to 20 mL of the 10% solution may be given every 2 to 6 hours

Adverse effects: Stomatitis, nausea, vomiting, fever, rhinorrhea, drowsiness, clamminess, chest tightness

6.3 Systemic nasal decongestant

PHENYLEPHRINE

Dosage form and strength: *Tablet:* 5 mg; *Nasal spray:* 0.125%, 0.25%, 0.5% and 1%

Indications: Nasal congestion associated with acute or chronic rhinitis, common cold, and sinusitis

Contraindications/Precautions: Patients with diabetes, hypertension, ischemic heart disease, hepatic impairment, renal impairment. Stinging may occur: to rinse dropper with hot water to prevent contamination.

Dosage schedule: Oral: 5 mg 3-4 times a day; Child 1-6 years: 1-2 drops 0.01%, 6-12 years: 1-2 drops 0.25 %, > 12 years: 0.25 or 0.5%.

Adverse effects: Increased heart rate, palpitation, tremors, ventricular premature contractions and hypertension.

PSEUDOEPHEDRINE

Dosage form and strength: *Syrup:* 30 mg/5 ml; *Tablets:* 60 mg

Indications: Nasal congestion associated with acute or chronic rhinitis, common cold, sinusitis. In patients with otic inflammation or infection, the drug may be useful in opening obstructed Eustachian tube. The drug may be used as an adjunct to analgesics, antihistamines, antitussives when indicated.

Contraindications/Precautions: Use cautiously in patients with prostatic hypertrophy, ischemic heart disease, glaucoma and diabetes mellitus.

Dosage schedule: 60 mg 3-4 times daily; child 4 mg/kg/day per oral in 3-4 divided doses.

Adverse effects: Nervousness, restlessness, dizziness, insomnia, headache and drowsiness. Larger doses may cause lightheadedness, nausea and /or vomiting.

Drug and food interactions: Do not use with MAOIs or tricyclics; hypertensive crisis may occur.

Patient information: Do not crush, divide, chew or dissolve, avoid taking drug

near bed time because stimulation can occur.

6.4 Other medicines acting on the respiratory tract

CAFFEINE CITRATE

Dosage form and strength: *Injection:* 20 mg/ml (equivalent to 10 mg caffeine base/ml); *Oral liquid:* 20 mg/ml (equivalent to 10 mg caffeine base/ml)

Indication: Neonatal apnea in preterm infants

Contraindications/Precautions: Cardiovascular disorders, hepatic or renal impairment

Dosage schedule: Neonatal apnea, by mouth, or by intravenous injection, Neonate 20-25 mg/kg as a loading dose, then 5-10 mg/kg once daily starting 24 hours after loading dose; continue for 4-5 days after cessation of apnea.

Adverse effects: Lethargy (physical sign of withdrawal), feeding intolerance, irritability, excessive CNS stimulation, tachycardia (early sign of toxicity), hyperglycemia or hypoglycemia; rarely acidosis, disseminated intravascular coagulation, hemorrhage, lung edema, gastritis, renal failure, retinopathy of prematurity, sepsis.

Section II - Chapter 7

Drugs used in Neurological & Psychiatric Disorders

7.1 *Anticonvulsants*

Carbamazepine
Clobazam
Clonazepam
Diazepam
Gabapentin
Lacosamide
Lamotrigine
Levetiracetam
Oxcarbazepine
Phenobarbital
Phenytoin
Topiramate
Valproic acid

7.2 *Antiparkinsonian drugs*

Amantadine
Benzotropine
Bromocriptine
Entacapone
Levodopa and carbidopa
Oxphenadrine hydrochloride
Pramipexole
Rasagiline
Ropinirole
Selegiline hydrochloride
Trihexyphenidyl hydrochloride (benzhexol)

7.3 *Drugs used for migraine*

7.3.1 *Drugs for acute migraine attacks*

Ergotamine tartarate
NSAIDS
Opioids
Rizatriptan
Sumatriptan

7.3.2 *Drugs for migraine prophylaxis*

Amitriptyline
Flunarizine
Lamotrigine
Metoprolol
Propranolol
Sodium valproate
Topiramate

7.4 Drugs used for neuropathic pain

Amitriptyline
Carbamazepine
Duloxetine
Gabapentine
Lamotrigine
Oxcarbazepine
Pregabalin
Topiramate

7.5 Drugs used to lower intracranial pressure

Acetazolamide
Mannitol

7.6 Opioid analgesics

Buprenorphine
Codeine phosphate
Methadone hydrochloride
Morphine sulphate
Pethidine hydrochloride (meperidine)
Tramadol hydrochloride

7.7 Opioid antagonists

Naloxone
Naltrexone
Pentazocine

7.8 Psychotropic drugs**7.8.1 Antidepressants/antianxiety****7.8.1.1 Noradrenergic and specific serotonergic (NaSSA)**

Mirtazapine

7.8.1.2 Norepinephrine dopamine reuptake inhibitors (NDRIs)

Bupropion

7.8.1.3 Selective Serotonin Reuptake Inhibitors (SSRIs)

Escitalopram

Fluoxetine

Fluvoxamine

Paroxetine

Sertraline

7.8.1.4 Serotonin Antagonists and Reuptake Inhibitors (SARIs)

Trazodone hydrochloride

7.8.1.5 Serotonin Norepinephrine Reuptake Inhibitors (SNRIs)

Duloxetine

Venlafaxine

7.8.1.6 Tricyclic antidepressants and related drugs

Amitriptyline

Clomipramine

Dosulepin (dothiepin)

Imipramine
Nortriptyline

7.8.2 Antipsychotics

7.8.2.1 First generation

Chlorpromazine
Fluphenazine decanoate
Haloperidol
Trifluoperazine

7.8.2.2 Second generation

Amisulpride
Aripiprazole
Clozapine
Olanzapine
Quetiapine
Risperidone

7.8.3 Drugs used for Attention Deficit Hyperactivity Disorder (ADHD)

Atomoxetine
Bupropion

7.8.4 Drugs used for dementia

Donepezil hydrochloride
Memantine hydrochloride
Rivastigmine

7.8.5 Drugs used for psychoactive substance use disorder

7.8.5.1 Drugs used for alcohol dependence

7.8.5.1.1 Drugs used for acute withdrawal

Chlordiazepoxide
Diazepam
Lorazepam

7.8.5.1.2 Drugs used for relapse prevention

Disulfiram
Naltrexone
Topiramate

7.8.5.2 Drugs used for opioid dependence

7.8.5.2.1 Antagonist for relapse prevention

Naltrexone

7.8.5.2.2 Drugs used for acute withdrawal

Codeine
Clonidine

7.8.5.2.3 Substitution therapy

Buprenorphine
Methadone

7.8.5.3 Drugs used in smoking cessation

Bupropion

7.8.6 Mood stabilizers

Carbamazepine
Gabapentine
Lamotrigine
Lithium

Sodium valproate

7.8.7 Sedatives/hypnotics

7.8.7.1 Benzodiazepines

Alprazolam

Chlordiazepoxide

Clobazam

Clonazepam

Diazepam

Lorazepam

7.8.7.2 Non - benzodiazepines

Zolpidem

7.1 Anticonvulsants

CARBAMAZEPINE

Dosage form and strength: *Tablet:* 100mg, 200mg, 300 mg, 400mg; *oral solution:* each 5ml of oral solution containing 100mg of carbamazepine

Indications: Treatment of tonic-clonic, mixed and complex partial seizures (not used in absence seizures and myoclonic seizure), management of pain in trigeminal neuralgia or diabetic neuropathy, acute mania.

Contraindications/Precautions: Bone marrow suppression, administration of MAO-I within last 14 days, jaundice, hepatitis. Use cautiously in cardiac or hepatic disease, renal failure, skin reactions, history of blood disorders, glaucoma, pregnancy (esp. 1st trimester: risk of fetal carbamazepine syndrome).

Dosage schedule:

- As *anticonvulsants*: PO (adults) 200mg BD (tab) or 100mg q (suspension), increase by 200mg/day for 7 days until therapeutic levels are achieved (range 600-1200mg/day in divided doses q 6-8 hours; not to exceed 1 gm/day in 12-15 year olds).
- As *antineuralgic*: 100mg BD or 50mg qid (suspension); increase by up to 200mg/day until pain is relieved, then maintenance dose of 200-1200mg/day in divided doses (usual range: 400-800mg/day); PO (children 6-12 years): 100mg BD or 50mg qid (suspension), increase by 100mg weekly until therapeutic levels are obtained (400-800mg/day, not to exceed 1gm/day); PO (children <6 years): 10-20mg/kg/day in 2-3 divided doses; may be increased at weekly intervals until optimal response and therapeutic levels are achieved. Usual maintenance dose is 250-350mg/day (not to exceed 35 mg/kg/day)

Adverse effects: Ataxia, drowsiness, CHF, renal damage, blurring of vision, agranulocytosis, migraine (headache), increased ADH secretion (dilutional hyponatremia), exfoliative dermatitis/hypersensitivity reaction, decreased platelet, increased risk of lupus, nausea, emesis.

Drug and food interactions: Concurrent use of MAO-I may result in hyperpyrexia, hypertension, seizures and death, induces hepatic enzymes. Regular dosage promotes its own metabolism and that of other drugs metabolized in liver, including phenobarbital, ethosuximide, phenytoin, oral contraceptives.

Patient information: Report immediately to health care provider if behavioral changes, suicidal ideation occur. Confirm that chewable tablets are crushed or chewed before swallowing.

CLOBAZAM

Dosage form and strength: *Tablet:* 10 mg

Indication: Adjunct in epilepsy, anxiety

Contraindications/Precautions: Hypersensitivity. Do not stop the drug abruptly

Dosage schedule: *Epilepsy:* 20 to 30 mg daily (max. 60mg daily); child >3yrs: not more than half adult dose; *Anxiety:* 20 to 30 mg daily in divided doses or as a single dose at bed time, increased in severe anxiety (in hospitalized

patients) to a maximum of 60mg daily in divided doses; elderly 10-20 mg daily.

Adverse effects: Somnolence, sedation, pyrexia, URTI

Drug and food interactions: CNS depressants (effect may be potentiated)

Patient information: Tablets should be swallowed whole; do not crush, break or chew

CLONAZEPAM

Dosage form and strength: *Tablets:* 0.25mg, 0.5mg, 1mg

Indications: Status epilepticus, all types of epilepsy, anxiety disorder

Contraindications/Precautions: Hypersensitivity, severe liver diseases, respiratory depression and acute pulmonary insufficiency. Pregnancy category C, breast feeding mothers. Do not stop the drug abruptly

Dosage schedule:

- *Seizures:* 1.5 mg divided into 3 doses, raise by 0.5 mg every 3 days until desired effect is reached; divide into 3 even doses or else give largest dose at bedtime.
- *Panic:* 1 mg/day; start at 0.25 mg divided into 2 doses, raise to 1 mg after 3 days; dose either twice daily or once at bedtime; maximum dose generally 4 mg/day

Adverse effects: Suicidal thoughts, dizziness, drowsiness, ataxia, muscle hypotonia, restlessness, salivary or bronchial hypertension in infants and small children, sexual dysfunction, dependence.

Drug and food interactions: With verapamil, diltiazem: risk of AV block.

Patient information: Notify if mouth sores, sore throat, fever, swelling of hands or feet, irregular heartbeat, chest pain, signs of angioedema. Avoid prolong use beyond prescription.

DIAZEPAM

Dosage forms and strength: *Injection:* 5mg/ml, *Tablets:* 2mg, 5mg

Indications: Adjunct in the management of anxiety disorder, anxiety relief prior to cardioversion, preoperative sedation, conscious sedation (provides light anaesthesia and anterograde amnesia), treatment of status epilepticus/uncontrolled seizures, as a skeletal muscle relaxants, management of symptoms of alcohol withdrawal.

Contraindications/Precautions: Acute alcohol intoxication, myasthenia gravis, acute narrow angle glaucoma and sleep apnea, children <6 months. Severe renal impairment, compromised liver function, history of suicidal tendency or drug dependence and acute alcoholism, debilitated patients with low albumin, COPD and sleep apnea. Facilities for mechanical ventilation should always be at hand and patients should remain under close observation for at least 1 hr. Danger of apnea and hypotension are reduced if injections are administered slowly.

Dosage schedule: IV inj. 10-20 mg at the rate of 0.5ml (2.5 mg) per 30 sec; repeat if necessary after 30-60 min; may be followed by IV infusion to max. 3mg/kg over 24 hrs. Children: 200-300 µg/kg.

Adverse effects: Apnea, hypotension, thrombophlebitis, dizziness and drowsiness, lethargy, depression, headache, muscle weakness, ataxia,

dependence.

Drug and food interactions: Concomitant use of benzodiazepine with opioids and/or other CNS depressants may result in profound and potentially fatal respiratory depression.

GABAPENTIN

Dosage form and strength: *Capsule:* 300mg

Indication: Adjunct treatment of partial seizures, with and without secondary generalization; bipolar affective disorder (BPAD), post-herpetic neuralgia, neuropathic pain

Contraindications/Precautions: Increased blood CPK levels and rhabdomyolysis. Safety not established in children <3yrs and pregnant women.

Dosage schedule: *Epilepsy:* 300mg on day 1, then 300mg twice daily on day 2, then 300mg 3 times daily on day 3, then increased according to response in steps of 300 mg daily (in 3 divided doses) to a maximum 2.4 gm daily; child (6-12 yrs) 10 mg/kg on day 1, then 20mg/kg on day 2, then 25-35mg/kg daily, maintenance 900 mg daily.

Adverse effects: Ataxia, dizziness, drowsiness, fatigue, somnolence, diplopia, nystagmus, tremor, suicidal thoughts.

Drug and food interactions: Antacids may decrease the absorption of gabapentin, increased risk of CNS depression with other CNS depressants.

Patient information: Not to drive until they have gained experience to assess whether therapy will impair their ability to drive. Do not discontinue abruptly (may increase seizure frequency); gradually taper over a minimum of 1 week.

LACOSAMIDE

Dosage form and strength: *Tablets:* 50 mg, 100 mg, 150 mg, 200 mg; *injectable solution:* 200 mg/20 ml; *Oral solution:* 10 mg/ml

Indications: As monotherapy or adjunctive treatment of focal seizures with or without secondary generalization.

Contraindications/Precautions: Second- or third-degree AV block. Conduction problems, in elderly, severe cardiac disease; Caution in renal and hepatic impairment.

Dosage schedule:

- *Monotherapy:* 100 mg PO/IV 12hrly initially, then, based on response and tolerability, increase dose at weekly intervals by 50 mg PO/IV BID; up to a recommended dose of 150-200 mg BID (300-400 mg/day); Alternate loading dose schedule: 200 mg PO/IV as a single loading dose, followed 12 hr later by 100 mg PO/IV BID; then increase dose at weekly intervals by 50 mg BID; up to a recommended dose of 150-200 mg BID (300-400 mg/day). In patients already taking an antiepileptic drug (AED), maintain at recommended maintenance dose of 150-200 mg PO BID for at least 3 days before initiating withdrawal of the previous AED.
- *Adjunctive therapy:* Initial: 50 mg PO/IV 12 hourly, based on response and tolerability, increase dose at weekly intervals by 50 mg PO/IV BID, up to a recommended dose of 100-200 mg BID (200-400 mg/day).

Adverse effects: Abnormal gait, tremor, impaired coordination, nystagmus,

blurred vision, cognitive disorder, depression, dizziness, drowsiness, fatigue, headache, agitation. Nausea, vomiting, constipation, flatulence, pruritus. Cardiac arrhythmias and conduction defects.

LAMOTRIGINE

Dosage form and strength: *Tablets:* 25mg, 50mg, 100mg

Indications: Partial, secondarily generalized tonic clonic seizures, Lennox-Gastaut syndrome, bipolar affective disorder

Contraindications /Precautions: Hypersensitivity, lactation. Pregnancy Category C, cardiac/renal/hepatic disease, severe depression, blood dyscrasias, children <16yr

Dosage schedule:

- *Monotherapy:* 25mg daily initially for 14 days, increased to 50mg daily for further 14 days, then increased by 50-100 mg daily every 7-14 days; usual maintenance as monotherapy, 100-200 mg daily in 1-2 divided doses;
- *Adjunct therapy with valproate:* initially 25 mg every other day for 14 days, then 25 mg daily for further 14 days, thereafter increased by 25-50mg daily every 7-14days; usual maintenance 100-200mg daily in 1-2 divided doses.
- *Adjunct therapy with carbamazepine:* for the first 2 weeks administer 50 mg/day; at week 3 increase to 100 mg/day in 2 doses; every 1-2 weeks can increase by 100 mg/ day; usual maintenance dose 300-500 mg/ day in 2 doses.

Adverse effects: Dizziness, ataxia, blurred or double vision, nausea, vomiting, rash, Stevens-Johnson syndrome.

Patient information: Medicine to be taken with food if gastrointestinal upset occurs. Do not discontinue the drug abruptly. Discontinue the drug and consult your doctor at first sign of rashes.

LEVETIRACETAM

Dosage form and strength: *Tablet:* 250 mg, 500 mg, 750 mg, 1 g; *Granules:* 250 mg, 500 mg, 1 g; *Oral solution:* 100 g/ml; *Solution for infusion:* 100 mg/ml

Indications: Monotherapy of focal seizures with or without secondary generalization, adjunctive therapy of focal seizures with or without secondary generalization, adjunctive therapy of myoclonic seizures and tonic-clonic seizures

Contraindications/Precautions: Avoid in breastfeeding mothers. Dose should be monitored carefully during pregnancy and after birth, and adjustments made on a clinical basis. It is recommended that the fetal growth should be monitored. Cautions in hepatic and renal impairment, dose adjustment required. Monitor renal function regularly.

Adverse effects: Abdominal pain, anorexia, nausea, vomiting, dyspepsia, diarrhea. Headache, malaise, agitation, anxiety, insomnia, ataxia, convulsion, dizziness, drowsiness, depression. Alopecia, amnesia, diplopia, blurred vision, leucopenia, thrombocytopenia, myalgia, paraesthesia, eczema, pruritus, psychosis, suicidal ideation.

Patient information: Consult therapist in case of suicidal ideation and chest pain.

OXCARBAZEPINE

Dosage form and strength: *Tablet:* 150mg, 300mg

Indications: Monotherapy or adjunctive therapy of partial seizures

Contraindications/Precautions: Hypersensitivity, lactation. Renal impairment, may be teratogenic, children <4 years. Monitor patients for notable changes in behavior that might be associated with suicidal thoughts or depression. Discontinue if dermatological reactions occur. Monitor especially in patients at risk of hyponatremia.

Dosage schedule: Initially 300 mg BD, increased according to response in steps up to 600mg daily at weekly intervals; Usual dose range: 0.6-2.4 g daily in divided doses; Child over 6 years: 8-10mg/kg daily in 2 divided doses increased according to response in steps up to 10 mg/kg daily at weekly intervals.

Adverse effects: Suicidal thoughts, dizziness, diplopia, headache, nausea, vomiting, nystagmus, somnolence, ataxia, abnormal gait, tremor, abdominal pain, fatigue, vertigo, vision abnormalities. Potentially fatal skin reactions may occur. E.g. Steven Johnson Syndrome

Drug and food interactions: May render oral contraceptives ineffective due to metabolic enzyme induction. Increased CNS depression with CNS depressants

Patient's information: Immediate release tablets should be administered on an empty stomach. Extended release tablets should be swallowed whole; do not crush, break or chew

PHENOBARBITAL

Dosage form and strength: *Tablets:* 30mg, 60mg; *Injection* 200mg

Indications: As anti-convulsant in tonic-clonic (grand mal), partial and febrile seizures in children (except absence seizures). Pre-operative sedative and other situations in which sedation may be required. Hypnotic (short-term)

Contraindications/Precautions: Hypersensitivity, porphyria, severe hepatic impairment, COPD, dyspnea, pregnancy and lactation. Use cautiously in hepatic and renal dysfunction; history of suicide or drug abuse. Chronic use in pregnancy results in drug dependency in the infant; may result in fetal malformations and coagulation defects. May require regular monitoring of the drug levels in plasma. Commercial injection is highly alkaline and may cause tissue necrosis if given SC or if it extravasates (if it happens treat with inj. 0.5% procaine); may render OCPs ineffective. Monitor respiratory function when given parenterally or at high dose. Be aware of risk of fall among elderly and children.

Dosage schedule:

- *Status epilepticus* (adults and children >1 mo): 15-18 mg/kg in single or divided doses, max. loading dose = 20mg/kg;
- *Maintenance anticonvulsant:* IV, PO (adults and children >12 yrs): 1-3mg/kg/day as a single dose or 2 divided doses; IV, PO (children 5-12 yrs): 4-6 mg/kg/day in 1-2 divided doses; IV, PO (children 1-5yr): 6-8 mg/kg/day in 1-2 divided doses; IV, PO (infants): 5-6 mg/kg/day in 1-2 divided doses; IV, PO (neonates): 3-4 mg/kg/day, once daily, may need to increase up to 5mg/kg/

day by 2nd week of therapy.

- **Sedation:** PO, IM (adults): 30-120 mg/day in 2-3 divided doses; pre-op sedation: 100-200 mg IM 1-1.5 hrs before procedure; PO (children): 2mg/kg 3 times daily; pre-op sedation: 1-3 mg/kg PO/IM/IV 1-1.5 hrs before procedure.
- **Hypnotic:** PO, IV, IM, S/C (adults): 100-300 mg at bed time; PO, IV, IM, S/C (children): 3-5 mg/kg at bed time.

Adverse effects: Ataxia, dizziness, drowsiness, dysarthria, nystagmus, irritability, vertigo, impairment in cognitive function (especially in children); IV: respiratory depression, laryngospasm, hypotension. Hypersensitivity reactions including angioedema, serum sickness.

Drug and food interactions: Induces hepatic microsomal enzyme system leading to increase in its own metabolism as well as that of other drugs such as carbamazepine, warfarin, OCPs and corticosteroids thereby decreasing their plasma concentrations

PHENYTOIN

Dosage form and strength: *Capsule:* 100mg ; *Oral suspension:* 100mg/5ml; *Tablet:* 100mg

Indications: All forms of epilepsy (except absence seizures, myoclonic seizure and drug induced), trigeminal neuralgia.

Contraindications/Precautions: Hypersensitivity, alcohol intolerance, myoclonic seizure. It has a wide pharmacokinetic variability; needs therapeutic drug level monitoring. Monitor closely for notable changes in behavior that could indicate the emergence or worsening of suicidal thoughts or behavior or depression. Tell patients about hypersensitivity syndrome. Monitor for gingival hypertrophy.

Dosage schedule: By mouth, initially 3-4 mg/kg daily or 150-300mg daily (as a single dose or 2 divided doses) increased gradually as necessary (plasma monitoring); usual dose 200-500 mg daily; child 4-8 mg/kg daily (1 or 2 doses); By slow IV injection (with blood pressure and ECG monitoring) for status epilepticus, 15mg/kg at a rate not exceeding 50mg per minute, as a loading dose. Maintenance doses of about 100mg should be given thereafter at intervals of every 6-8 hours, monitored by measurement of plasma concentration; rate and dose reduced according to weight. Child: 15mg/kg as a loading dose. Not recommended by IM injection.

Adverse effects: Suicidal thoughts, agranulocytosis, aplastic anemia, Stevens-Johnson syndrome; gingival hyperplasia, acne, hirsutism and skin rash at therapeutic level; nystagmus, ataxia, diplopia, sedation, nausea and vomiting occur at high plasma level

Drug and food interactions: Metabolism may be impaired by drugs that inhibit liver enzymes. Isoniazid, chloramphenicol, sulfonamides cause phenytoin to accumulate and may precipitate toxicity. Carbamazepine, alcohol and steroids induces its metabolism resulting in low plasma level. Phenytoin can induce its own metabolism and that of other drugs like OCPs. Patient information: Inform your physician in case of suicidal thoughts, swelling of gums.

TOPIRAMATE

Dosage form and strength: *Tablets:* 25 mg, 50 mg, 100 mg, 200 mg; *Capsules:* 15 mg, 25 mg, 50 mg.

Indications: Monotherapy of generalized tonic-clonic seizures or focal seizures with or without secondary generalization, adjunctive treatment of generalized tonic-clonic seizures or focal seizures with or without secondary generalization, adjunctive treatment for seizures associated with Lennox-Gastaut syndrome, migraine prophylaxis, substance dependence.

Contraindications/Precautions: Acute porphyrias. Risk of metabolic acidosis, risk of nephrolithiasis; ensure adequate hydration

Adverse effects: CNS symptoms: anxiety, agitation, cognitive impairment, depression, drowsiness, dizziness, sleep disturbance, visual disturbances, seizures, GI distress, arthralgia, myalgia, pruritus, paraesthesia, speech disorder, etc.

Patient information: Ensure adequate hydration; consult your doctor in case of lower abdominal pain, flank pain or burning micturition.

VALPROIC ACID

Dosage form and strength: *Tablet:* 200mg

Indications: All forms of epilepsy, bipolar affective disorder

Contraindications/Precautions: Hypersensitivity, hepatic impairment. Pregnancy Category D. Hepatic function tests should be performed before treatment and every 2 months for the first six months.

Dosage schedule: By mouth-initially, 600 mg daily in divided doses, preferably after food, increasing by 200 mg/day at 3 days intervals to a maximum of 2.5 g daily in divided doses, usual maintenance 1-2 g daily (20-30 mg/kg daily); Child up to 20 kg (about 4 years), initially 20 mg/kg daily in divided doses, may be increased provided plasma concentration monitored; over 20 kg, initially 400 mg daily in divided doses increased gradually to 20-30 mg/kg daily; maximum 35 mg/kg daily. By IV injection (over 3-5 minutes) or by IV infusion, continuation of valproate treatment when oral therapy not possible, same as current dose by oral route. Initiation of valproate therapy when oral valproate not possible by IV injection (over 3-5 minutes), 400- 800 mg (up to 10 mg/kg) followed by IV infusion up to maximum 2.5 g daily; Child, usually 20-30 mg/kg daily.

Adverse effects: Suicidal thoughts, agitation, dizziness, headache, insomnia, sedation, confusion, visual disturbance, tremor, nausea and gastric irritation, weight gain, increased appetite, thrombocytopenia, transient hair loss, oedema, drug induced hepatitis, sedation and drowsiness

Drug and food interactions: Increased risk of bleeding with warfarin

Patient information: Monitor weight and blood sugar (control calorie in case of weight gain), avoid conception (consult your physician in case you are planning for conception).

7.2 Antiparkinsonian drugs**AMANTADINE**

Dosage form and strength: *Capsule:* 100mg

Indications: Parkinsonism, post-herpetic neuralgia

Contraindications/Precautions: Hypersensitivity, breast-feeding, pregnancy, children. In patients with cardiac, hepatic and renal disease and history of seizures. Watch patient for confusion, mottling of skin, bowel pattern before or during treatment.

Dosage schedule: 100mg daily increased after 1 week to 100mg twice daily, max. 400mg daily in divided doses.

Adverse effects: Restlessness, depression, irritability, insomnia, excitement, agitation and confusion, livedo reticularis, peripheral edema and postural hypotension.

Drug and food interactions: Increases anticholinergic response of atropine and other anticholinergics. Metoclopramide, phenothiazines decreases effect of amantadine.

Patient information: Drug should be taken after meals. To avoid potentially hazardous activities like driving and operating of machineries if dizziness, blurred vision occurs.

BENZTROPINE

Dosage form and strength: *Tablet:* 2mg

Indications: Parkinsonism, EPS associated with neuroleptic drugs, acute dystonic reactions, hypersalivation

Contraindications/Precautions: Children <3yrs, hypersensitivity, closed angle glaucoma, dementia, tardive dyskinesia. Pregnancy (category C) and breast-feeding; renal and hepatic diseases; hypo/hypertension, tachycardia, dysrhythmia; myasthenia gravis; GI/GU obstruction, peptic ulcer, megacolon, prostrate hypertrophy.

Dosage schedule: *Parkinsonism:* 0.5-1 mg at bed time, increased by 0.5 mg q5-6 days titrated to patient's response, max. 6mg/day

Adverse effects: Anxiety, restlessness, irritability, hallucinations, confusion, delirium, palpitation, tachycardia. Dry mouth, constipation, paralytic ileus, hyperthermia, heat stroke, numbness of fingers.

Drug and food interactions: Amantadine, TCAs, antihistamines, phenothiazines increase the effect of benztropine. Antidiarrheal and antacids decrease its absorption.

Patient information: Not to discontinue product abruptly, to taper off over 1 week or withdrawal symptoms may occur; avoid driving as dizziness may occur. Take plenty of fluids and bulk forming food.

BROMOCRIPTINE

Dosage form and strength: *Tablets:* 1.25 mg, 2.5 mg

Indications: Parkinsonism, hyperprolactinemia; galactorrhoea, amenorrhoea, infertility in women; gynecomastia, impotence and sterility in men; acromegaly, breast engorgement.

Contraindications/Precautions: Hypersensitivity to ergot alkaloids, breast carcinoma, severe ischemic heart disease, uncontrolled HTN, pregnancy and lactation, children. In patients with hepatic, renal and cardiovascular disease; history of psychosis, peptic ulcer, DM. Ability to drive may be impaired. May result in failure of OCPs. Disulfiram reaction with alcohol.

Dosage schedule: *Parkinsonism:* 1-1.25 mg OD at bed time in the 1st week, 2-2.5 mg at bed time in the 2nd week, gradually increasing to 2.5mg twice daily and thrice daily weekly as required up to usual maintenance dose of 7.5-30 mg/day.

Adverse effects: Headache, nausea, vomiting, fatigue, postural hypotension, confusion, leg cramps, loss of appetite, nasal stuffiness.

Patient information: Raise slowly from lying and sitting position. Do not discontinue drug abruptly. Take medicine with food to reduce GI upset. Hormonal contraception may fail (use other methods).

ENTACAPONE

Dosage form and strength: *Tablet:* 200 mg

Indications: Adjunct in Parkinson's disease with 'end-of-dose' motor fluctuations

Contraindications/Precautions: History of neuroleptic malignant syndrome, history of non-traumatic rhabdomyolysis, pheochromocytoma, hepatic failure; avoid in pregnancy (no information available), avoid in breastfeeding women (present in milk in animal studies).

Dosage schedule: under expert supervision, oral, adult: 200 mg, along with each dose of levodopa with dopa-decarboxylase inhibitor; maximum 2 g/day

Adverse effects: Abdominal pain, nausea, vomiting, constipation/diarrhoea, confusion, dizziness, insomnia, hallucinations, abnormal dreams, dyskinesia, dystonia, sweating, dry mouth, fatigue, ischaemic heart disease.

Drug and food interactions: Avoid iron-containing products at the same time of day

Patient information: May colour urine reddish-brown with concomitant iron containing products.

LEVODOPA AND CARBIDOPA

Dosage form and strength: *Tablet:* 10mg+100mg, 25mg+250mg

Indication: Parkinsonism

Contraindications/Precautions: Acute angle closure glaucoma, psychotic illness, malignant melanoma, pregnancy and lactation. Caution should be taken in patients with hepatic and renal impairment, MI, cerebrovascular accidents and psychiatric disorders; history of peptic ulcer, glaucoma and gout. Monitor skin lesion changes as levodopa may activate malignant melanoma. Observe for S/E including mental status and BP changes.

Dosage schedule: 100mg levodopa+25mg carbidopa 3 times daily ½ hrs before meal. 100mg levodopa + 10mg carbidopa 3-5 times daily. Start with 1 tablet 3 times a day and increase by 1 tab/day every 1-2 days, maximum up to 8tabs/day. 200mg levodopa + 50mg carbidopa (controlled release form) once or twice daily.

Adverse effects: Acute effect: Nausea, anorexia, vomiting, postural hypotension, altered taste sensation, cardiac arrhythmia, angina, psychosis. After prolonged therapy: dyskinesia, abnormal movements, behavioral effects like delusion, nightmares, hallucinations.

Drug and food interactions: Pyridoxine promotes metabolism of levodopa. Phenothiazine and butyrophenones antagonize effects of levodopa.

Anticholinergic acts synergistically to decrease tremors of parkinsonism. Amino acid present in food compete for same carrier for absorption
Patient information: Inform patient that sometimes a “wearing off” effect may occur at the end of dosing interval, especially after 2-5yrs of therapy. So, dose fractionation and frequent administration may be helpful.

OXPHENADRINE HYDROCHLORIDE

Dosage form and strength: *Tablet:* 50 mg

Indications: See under Trihexyphenidyl; muscle spasm and pain

Contraindications/Precautions: Narrow angle glaucoma, pyloric/duodenal obstruction, BPH, stenosing peptic ulcer, cardiospasm (megoesophagus), paralytic ileus, ulcerative colitis, toxic megacolon, achalasia; Myasthenia gravis, obstructive uropathy. Use cautiously in patients with diarrhea, partial obstructive uropathy, open angle glaucoma, hepatic/renal impairment, cardiac conduction disorder, thyrotoxicosis, history of drug abuse or acute alcoholism. May be taken with food to avoid stomach upset

Dosage schedule: 150mg daily in divided doses, gradually increased; maximum 400mg daily

Adverse effects: Drowsiness, anticholinergic effects (dry mouth, constipation, urinary retention, increased intraocular pressure, palpitation, tachycardia), CNS stimulation (restlessness, agitation, insomnia, mental confusion). Injectable form contains sulfites and precipitates anaphylactic reactions in sensitive or asthmatic individuals

PRAMIPEXOLE

Dosage form and strength: *Tablets:* 0.125 mg, 0.25 mg, 0.5 mg, 1 mg

Indications: Parkinson's disease, used alone or as an adjunct; restless leg syndrome.

Contraindications/Precautions: Severe cardiovascular disease. Avoid in breast feeding, may suppress lactation. Psychotic disorders, risk of visual disorders (ophthalmological testing recommended). In pregnancy, use only if potential benefit outweighs risk. Caution in patients with renal impairment.

Adverse effects: Nausea, vomiting, anorexia, weight changes, constipation; Headache, confusion, dizziness, drowsiness, sleep disturbances, sudden onset of sleep, dyskinesia, hallucinations, restlessness, visual disturbances; Hypotension, postural hypotension, peripheral oedema; Impulse control disorders: pathological gambling, binge eating, hypersexuality.

RASAGILINE

Dosage form and strength: *Tablet:* 1 mg

Indications: Parkinson's disease, used alone or as adjunct for 'end-of-dose' fluctuations

Contraindications/Precautions: Avoid in moderate to severe hepatic impairment. Pregnancy, breast feeding, mild hepatic impairment. Avoid abrupt withdrawal

Dosage schedule: Oral, adult: 1 mg daily

Adverse effects: Anorexia, weight loss, dyspepsia, flatulence, constipation, headache, vertigo, abnormal dreams, hallucinations, depression, angina,

arthralgia, conjunctivitis, dry mouth, rash, influenza-like symptoms, leucopenia, rhinitis, skin carcinoma, urinary urgency.

Drug and food interactions: May cause serotonin syndrome when used with antidepressants

Patient information: Can be taken without regards to meal. Avoid taking it with high tyramine containing food.

ROPINIROLE

Dosage form and strength: *Tablets:* 250 microgram, 500 microgram, 1 mg, 2 mg, 4 g, 5 mg, 8 mg

Indications: Parkinson's disease, either used alone or as adjunct

Contraindications/Precautions: Breast feeding: may suppress lactation. In elderly, in patients with major psychotic disorders, severe cardiovascular diseases (risk of hypotension, monitor blood pressure). Avoid in pregnancy unless potential benefit outweighs risk (toxicity in animal studies). Avoid in patients with renal impairment, hepatic impairment. Monitor patient for impulsive behavior.

Adverse effects: Abdominal pain, dyspepsia, nausea, vomiting, constipation, fatigue, gastro-oesophageal reflux, hypotension, peripheral oedema, syncope, dizziness, drowsiness, sudden onset sleep, nervousness, dyskinesia, confusion, hallucinations. Impulse control disorders: pathological gambling, binge eating, hypersexuality.

Patient information: Should exercise caution when driving or operating machinery. Should be counselled on improving sleep behavior. Consult in case of impulsive behavior.

SELEGILINE HYDROCHLORIDE

Dosage form and strength: *Tablets:* 5 mg, 10 mg; oral lyophilisates: 1.25 mg

Indications: Parkinson's disease, used alone or as adjunct

Contraindications/Precautions: Active duodenal or gastric ulceration, avoid in postural hypotension (when used in combination with levodopa). Avoid in patients with angina, arrhythmias, acute porphyrias, duodenal ulceration, gastric ulceration, history of hepatic dysfunction, patients predisposed to confusion and psychosis, uncontrolled hypertension. Avoid in pregnancy and lactation. Caution in patients with renal and hepatic impairment. Oral lyophilisates should be placed on the tongue and allowed to dissolve.

Dosage schedule: Immediate-release tablets, adult: Initially 5 mg once daily for 2–4 weeks, then increased if tolerated to 10 mg daily, dose to be taken in the morning. Oral lyophilisate, adult: 1.25 mg once daily, dose to be taken before breakfast. Dose equivalence and conversion: 1.25 mg oral lyophilisate is equivalent to 10 mg tablet (dosage form interchangeable)

Adverse effects: Arthralgia, myalgia, movement disorders, tremor, impaired balance; Bradycardia, hypotension, hypertension, angina, palpitations; Headache, confusion, depression, dizziness, fatigue, sweating, anxiety; Nausea, constipation, diarrhea, dry mouth, mouth ulcers, stomatitis; Hair loss, nasal congestion, psychosis, sleeping disorders.

Drug and food interactions: increased risk of serotonin syndrome with SSRIs.

Patient information: Should exercise caution when driving or operating machinery. Advise patient not to drink, rinse, or wash mouth out for 5 minutes after taking the tablet

TRIHEXYPHENIDYL HYDROCHLORIDE (BENZHEXOL)

Dosage form and strength: Tablet: 2mg

Indications: Drug induced parkinsonism; modest improvement in tremor and rigidity but no effect on bradykinesia.

Contraindications/Precautions: Hypersensitivity, angle-closure glaucoma. Caution in patient with conditions in which anti-cholinergic effects are undesirable. Not recommended in children. Monitor fluid intake and urine output ratio: retention commonly causes decreased urine output, distention.

Dosage schedule: 1 mg daily, gradually increased, usual maintenance dose 5-15mg daily in 3-4 divided doses.

Adverse effects: Drowsiness, confusion, atropine like effects (dry mouth, constipation, impaired vision and urinary retention)

Patient information: Take plenty of fluids and bulk forming food. Monitor urine output.

7.3 Drugs used for migraine

7.3.1 Drugs for acute migraine attacks

ERGOTAMINE TARTARATE

Dosage form and strength: Tablet: 2 mg

Indications: Acute attack of migraine and migraine variants unresponsive to analgesics; Menopausal hot flushes

Contraindications/Precautions: Hypersensitivity, PVD, CAD, Raynaud's disease, pregnancy/lactation, sepsis, malnutrition, impaired renal and hepatic function, severe HTN. Illnesses associated with peripheral vascular pathology such as DM; Children: safety not established. Should be initiated at first sign of vascular headache. Discontinue if signs and symptoms of impaired circulation.

Dosage schedule:

- *Migraine:* 2mg sublingual followed by 1.2mg every 30mins until attack abated; not to exceed 6mg/day and no more than 10mg/week.
- *Menopausal hot flushes:* 0.6mg PO every 12 hours (not to exceed 10mg/week)

Adverse effects: Dizziness, rhinitis, hypertension, arterial spasm, intermittent claudication; Abdominal pain, nausea, vomiting, diarrhea, polydipsia; Extremity and neck stiffness, muscle pain and weakness, numbness or tingling sensation, fatigue.

Drug and food interactions: Co-administration with CYP3A4 inhibitors (including protease inhibitors like ritonavir, nelfinavir, indinavir; macrolides like erythromycin, clarithromycin and troleandomycin and some antifungals like ketoconazole, itraconazole) may produce life threatening peripheral ischemia and is contraindicated

NSAIDs

See under 'Drugs acting on musculoskeletal and joint disease'

OPIOIDS

See under 'Opioid analgesics'

RIZATRIPTAN

Dosage form and strength: *Tablets: 5 mg, 10 mg; orodispersible tablet: 10 mg; oral lyophilisate: 10 mg*

Indications: Acute migraine

Contraindications/Precautions: Severe hypertension, coronary vasospasm, ischaemic heart disease, Prinzmetal's angina, peripheral vascular disease, severe hepatic/renal impairment; history of MI, TIA or cerebrovascular accident. Conditions which predispose to coronary artery disease, elderly, hepatic/renal impairment, pregnancy; present in milk in animal studies: withhold breast-feeding for 24 hours. Drowsiness may affect performance of skilled tasks (e.g. driving).

Dosage schedule: Oral, adult: 10 mg, to be taken as soon as possible after onset, followed by 10 mg after 2 hours if required or if migraine recurs (patient not responding to initial dose should not take second dose for same attack); maximum 20 mg per day

Adverse effects: Decreased alertness, drowsiness, paraesthesia, headache, diarrhea, dry mouth, dyspnoea, palpitation, tachycardia, sweating, tremor, fatigue, pharyngeal discomfort, nausea.

Drug and food interactions: Food delays absorption. May enhance toxic effects of serotonin modulators.

Patient information: Orodispersible tablets should be placed on the tongue, allowed to disperse and swallowed. Oral lyophilisates should be placed on the tongue and allowed to dissolve.

SUMATRIPTAN

Dosage form and strength: *Tablets: 25 mg, 50 mg, 100 mg; Injection: 10 mg/ml*

Indication: Acute migraine attacks, cluster headache

Contraindications/Precautions: Current history of ischemic cardiac, cerebrovascular or peripheral vascular syndromes (angina, MI, stroke, TIA, ischemic bowel disease); history of stroke, TIA or hemiplegic/ basilar migraine; history of CAD or coronary artery vasospasm; WPW syndrome or other cardiac accessory conduction pathway disorders, uncontrolled HTN, within 2 weeks of MAO-A inhibitors, severe hepatic impairment. Use cautiously in patients with history of seizure disorder or lowered seizure threshold, hepatic impairment. Pregnancy category C. Avoid breast feeding for 8-12 hrs after administration. Should not be given intravenously; it may cause coronary vasospasm and angina. Use when clear diagnosis of migraine established; use carefully among elderly and patients with cardiovascular problems.

Dosage schedule:

• Oral: 50 mg to 100 mg, as soon as possible after onset (patient not

responding should not take second dose for the same attack); dose may be repeated after not less than 2 hours if migraine recurs. Child and adolescent under 18 years: not recommended. By SC injection: 6 mg as soon as possible after onset (patients not responding should not take second dose for same attack); dose may be repeated once after not less than 1 hour if migraine recurs; maximum 12 mg in 24 hours. Child and adolescent under 18 years: not recommended.

• *For cluster headache:* 6mg SC with auto-injector; may repeat in > 1hr; not to exceed 12mg SC/day

Adverse effects: Injection site reaction, paresthesia, dizziness, warm or hot sensation, chest discomfort, jaw or neck tightness, diaphoresis, dysphagia, sore throat, hypotension, bradycardia, tachycardia.

Drug and food interactions: Serotonin syndrome may occur when used along with SSRIs or SNRIs. Cerebral SAH and stroke reported when used with 5HT₁ agonist

Patient information: May cause depression including dizziness, weakness or drowsiness; caution when operating heavy machinery

7.3.2 Drugs for migraine prophylaxis

AMITRIPTYLINE

See under 'Tricyclic antidepressants and related drugs'

FLUNARIZINE

Dosage form and strength: *Tablets/Capsules:* 5 mg, 10 mg

Indications: Migraine prophylaxis

Contraindications/Precautions: in patients with depression, in the acute phase of a stroke, and in patients with extrapyramidal symptoms or Parkinson's disease. May cause CNS depression and precipitate depression. Galactorrhea may be seen in some patients. Monitor for extrapyramidal symptoms.

Dosage schedule: Oral, adult: 10-20 mg once daily; child: 5 mg once daily

Adverse effects: drowsiness, sedation, constipation, dry mouth, weight gain, hypotension, flushing, extrapyramidal effects, depression in elderly patients

Drug and food interactions: Effects of alcohol and other sedating drugs, as well as of antihypertensives, can be increased.

Patient information: Administer with water at bedtime.

LAMOTRIGINE

See under 'Anticonvulsants'

METOPROLOL

See under 'Drugs acting on CVS'

PROPRANOLOL

See under 'Drugs acting on CVS'

SODIUM VALPROATE

See under 'Anticonvulsants'

TOPIRAMATE

See under 'Anticonvulsants'

7.4 Drugs used for neuropathic pain

AMITRIPTYLINE

See under 'Tricyclic antidepressants'

CARBAMAZEPINE

See under 'Anticonvulsants'

DULOXETINE

See under 'SNRIs' under 'Antidepressants'

GABAPENTINE

See under 'Anticonvulsants'

LAMOTRIGINE

See under 'Anticonvulsants'

OXCARBAZEPINE

See under 'Anticonvulsants'

PREGABALIN

Dosage form and strength: *Capsules:* 25 mg, 50 mg, 75 mg, 100 mg, 150 mg, 200 mg, 225 mg, 300 mg; *Oral solution:* 20mg/ml oral solution

Indications: Peripheral and central neuropathic pain, adjunctive therapy for focal seizures with or without secondary generalization, generalized anxiety disorder.

Contraindications/Precautions: Hypersensitivity to pregabalin. Conditions that may precipitate encephalopathy, severe congestive heart failure, renal impairment. Avoid abrupt withdrawal (taper over at least 1 week).

Dosage schedule:

- *Peripheral and central neuropathic pain, oral, adult:* initially 150 mg daily in 2–3 divided doses, then increased after 3–7 days, if necessary, to 300 mg daily in 2–3 divided doses, again increased if necessary up to 600 mg daily in 2–3 divided doses after 7 days;
- *Adjunctive therapy for focal seizures with or without secondary generalization, oral, adult:* initially 25 mg twice daily, increased in steps of 50 mg daily, at 7 day intervals, to 300 mg daily in 2–3 divided doses for 7 days, then increased if necessary up to 600 mg daily in 2–3 divided doses;
- *Generalized anxiety disorder, oral, adult:* initially 150 mg daily in 2–3 divided doses, then increased in steps of 150 mg daily if required, dose to be increased at 7 day intervals, increased if necessary up to 600 mg daily in 2–3 divided doses.

Adverse effects: Vomiting, appetite changes, weight gain, flatulence,

constipation, diplopia, blurred vision, visual disturbances, visual field defects, confusion, dizziness, drowsiness, insomnia, irritability, euphoria, impaired attention, impaired memory, disturbances in muscle control and movement, malaise, dry mouth, oedema, paraesthesia, sexual dysfunction, speech disorder, congestive heart failure, QT-interval prolongation, Stevens-Johnson syndrome.

Drug and food interactions: Increased CNS depression if taken with alcohol. Patient information: Medicine may cause sleepiness, weight gain and dizziness.

TOPIRAMATE

See under 'Anticonvulsants'

7.5 Drugs used to lower intracranial pressure

ACETAZOLAMIDE

See under 'Diuretics'

MANNITOL

See under 'Diuretics'

7.6 Opioid analgesics

BUPRENORPHINE

Dosage form and strength: *Injection:* 0.3mg/ml; *sublingual tablet:* 200 µg

Indications: Perioperative analgesia; Moderate to severe pain; withdrawing opioid addicts; chronic non-malignant pain.

Contraindications/Precautions: Pregnancy category C. Drug overdose can result coma and death so use the dose exactly as prescribed. Keep opioid antagonist (naloxone) in hand while giving this drug.

Dosage schedule: IM/Slow IV injection: 300 to 600 µg every 6-8hrs; 3-6 µg/kg every 6-8hrs for children >6mnths (Max. 9 µg/kg). Sublingual tablet: 200 to 400 µg every 8hrs; 100 µg every 6-8hrs for children >6yrs (16-25kg); 100-200 µg every 6-8hrs for children >6yrs (25-37.5kg); 200-300 µg every 6-8hrs for children >6yrs (37.5-50kg).

Adverse effects: See under in Morphine, less abuse potential than Morphine

Drug and food interactions: See under in Morphine

Patient information: Do not chew or swallow the sublingual tablet. Hold it under the tongue until it dissolves. Warn about the possibility of dependence if used beyond prescription.

CODEINE PHOSPHATE

Dosage form and strength: *Tablet:* 15mg; *linctus:* <3mg/5ml (pediatric)

Indications: Management of mild to moderate pain, headache; as an antitussive (non-productive cough); unlabeled use: management of diarrhea, opioid withdrawal.

Contraindications/Precautions: Hypersensitivity reaction, respiratory depression, obstructive airway disease, acute asthma attack; where there is

risk of paralytic ileus. Pregnancy Category C; renal and hepatic impairment; head trauma; dependence; breastfeeding children <1 year, BPH. Codeine phosphate tablet should be protected from light

Dosage schedule: *Mild to moderate pain:* 30-60mg 3-4 times a day

Adverse effects: Constipation, sedation, confusion, hypotension, nausea/vomiting; codeine is much less liable than morphine to produce tolerance, dependence, euphoria, sedation or other adverse effects.

Drug and food interactions: MAO inhibitors (use cautiously)

Patient information: Take with food to minimize GI upset. Increase intake of fluid and fiber rich food. May cause dependence and tolerance, so use only as prescribed.

METHADONE HYDROCHLORIDE

Dosage form and strength: *Methadone oral concentrate* (10mg/ml)

Indications: Severe pain, adjunct in treatment of opioid dependence, cough in terminal disease, unlabeled use: neonatal abstinence syndrome

Contraindications/Precautions: Hypersensitivity, known alcohol intolerance and concurrent MAO inhibitor therapy. Pregnancy category C.

Dosage schedule: Adjunct in treatment of opioid dependence, initially 10-40mg daily, increased by up to 10mg daily (maximum weekly increase 30mg) until no signs of withdrawal or intoxication, usual dose range: 60-120 mg daily, not recommended to children

Adverse effects: See under morphine.

Drug and food interactions: Rifampicin and Phenytoin accelerate the metabolism of Methadone and can precipitate withdrawal symptoms. MAO inhibitors (may result in severe unpredictable reactions).

MORPHINE SULPHATE

Dosage form and strength: *Injection:* 10mg/ml (morphine hydrochloride or morphine sulfate); *Tablets:* 10mg (morphine sulfate); *Oral liquid:* 10mg (morphine hydrochloride or morphine sulfate)/5ml.

Indications: Severe pain, MI, acute pulmonary edema, adjunct during major surgery and post-operative analgesia.

Contraindications/Precautions: Respiratory insufficiency, bronchial asthma, hypotension, undiagnosed acute abdominal pain, head injury. Renal and hepatic impairment, elderly and debilitated, dependence, hypothyroidism, convulsive disorders, breastfeeding, pregnancy category C. Obtain baseline respiratory rate, rhythm and depth and size of pupils before administering morphine. Bedside rails are advisable in patients under morphine.

Dosage schedule: *Acute pain by SC or IM injection:* 10mg every 4 hours; child up to 1 month: 150ug/kg, 1-12 month: 200ug/kg, 1-5 years: 2.5-5mg, 6-12 years: 5-10mg. By slow IV injection: 1/4- 1/2 corresponding IM dose. MI, by slow IV injection: 2mg/min, 10mg followed by further 5-10mg if necessary.

Adverse effects: Classic triad of pinpoint pupil, respiratory depression, coma in acute toxicity. Sedation, mental clouding, lethargy, constipation, blurring of vision, urinary retention, idiosyncrasy and allergy, urticaria, itch, swelling of lips, local reaction at the site of injection, apnoea in new born if morphine

given to mother during labor.

Drug and food interactions: Patients receiving MOA inhibitors within 14 days.

Patient information: Sustained release tablets should be taken at regular intervals and not on an as-needed basis for episodic or breakthrough pain. Sustained-release tablets should not be crushed.

PETHIDINE HYDROCHLORIDE (MEPERIDINE)

Dosage form and strength: *Injection:* 50mg/ml, *Tablet:* 50mg

Indications: Moderate to severe pain and for obstetric analgesia

Contraindications/Precautions: Acute or severe bronchial asthma in an unmonitored setting or in absence of resuscitative equipments. Known or suspected GI obstruction, including paralytic ileus. May cause addiction, abuse and misuse. May cause life threatening respiratory depression. May increase ventricular rate through a vagolytic action, the drug should be used with caution in patients with atrial flutter and other supraventricular tachycardias.

Dosage schedule: PO: 50-150mg every 4 hours; child: 0.5-2mg/kg every 4 hours; SC or IM injection: 25-100mg, repeated after 4 hours; child by IM injection, 0.5-2mg/kg; By slow IV injection: 25-50mg repeated after 4 hours; Obstetrical analgesia: IM/SC, 50-100mg repeated 1-3 hours later if necessary; maximum 400mg in 24 hours.

Adverse effects: Similar to morphine but may cause more severe nausea and hypotension than morphine. It produces same degree of respiratory depression, euphoria and sedation as morphine in equianalgesic doses.

Drug and food interactions: With MAO-I, may cause a serious (possibly fatal) reaction

TRAMADOL HYDROCHLORIDE

Dosage form and strength: *Tablet:* 50mg; *Injection:* 50mg/ml.

Indications: Moderate pain, as adjunct in chronic pain

Contraindications/Precautions: Hypersensitivity, opioid dependence. Pregnancy category C. Do not confuse Tramadol with Toradol (Ketoralac). Watch for constipation. Monitor patient for seizure.

Dosage schedule: Oral: 50 to 100mg not more often than every 4 hours, total of >400mg not usually required; by IM or IV injection (over 2-3 minutes) or by IV infusion, 50-100mg every 4-6hrs.

Adverse effects: Seizures, dizziness, headache, somnolence, constipation, nausea

Drug and food interactions: CNS depressants (increases risk of CNS depression); B-Lactam antibiotics (increases risk of seizures)

Patient information: Tablets should be swallowed whole; do not crush, break or chew. Change position slowly. Take plenty of fluids and fiber rich food.

7.7 Opioid antagonists

NALOXONE

Dosage form and strength: *Injection:* 400µg/ml (hydrochloride) in 1ml

ampoule

Indications: Opioid overdose (coma and respiratory depression), neonatal asphyxia (due to opioid use in labor), respiratory depression due to intra-operative opioid use, diagnosis of opioid addiction.

Contraindication/Precautions: Physical dependence on opioids or other situations where acute withdrawal syndrome may be precipitated, cardiovascular disease.

Dosage schedule: *Overdose of opioids:* by IV; adult: 0.4-2mg repeated at intervals of 2-3 mins to maximum of 10mg; child: 10µg/kg, a subsequent dose of 100µg/kg if no response.

Adverse effects: Nausea, vomiting, sweating; withdrawal symptoms in opioid abusers.

Drug and food interactions: Antagonizes the effects of opioid analgesics
Patient information: Watch for signs of opioid withdrawal.

NALTREXONE

Dosage form and strength: *Tablet:* 50 mg, *Injection:* 380 mg

Indications: Opioid dependence, alcohol dependence, herpetic neuralgia, Crohn's disease in children.

Contraindications/Precautions: Currently dependent on opioids; acute hepatitis or liver failure. In hepatic or renal impairment, pregnancy and breastfeeding. Opioid withdrawal precipitated abruptly by administration of opioid antagonist to opioid dependent patient may be severe enough to necessitate hospitalization. Risk of hepatotoxicity with increasing doses; discontinue therapy if signs/symptoms of acute hepatitis develop.

Dosage schedule: *For chronic opioid dependence,* PO: 25mg initially, then observation for 1 hr, then 50mg once daily starting on day 2; IM: 380mg in gluteal muscle every 4 weeks for maintenance of abstinence.

Adverse effects: Injection site reaction (bruising, induration, nodules, pain, pruritus, swelling, tenderness), nausea, vomiting, diarrhea, decreased appetite, headache, insomnia, dizziness, URTI, anxiety, arthralgia.

Drug and food interactions: Similar to naloxone

Patient information: Patients should be opioid free for a minimum of 7-10 days before initial therapy. Do not use opioid while taking naltrexone. Be aware of signs and symptoms of anxiety and depression; if these occur, inform your doctor.

PENTAZOCINE

Dosage form and strength: *Injection:* 30mg/ml as lactate; *Tablet:* 25mg as hydrochloride

Indications: Moderate to severe pain, preoperative or pre-anesthetic / supplement to surgical anesthesia.

Contraindications/Precautions: Toxin-mediated diarrhea, Pseudomonas enterocolitis, respiratory depression, MI. Use cautiously in acute asthma, bradycardia, chronic respiratory disease, head injury. May produce acute withdrawal symptoms in those who have been receiving opioids on regular basis. Pentazocine injection should be protected from light.

Dosage schedule: Oral: 50mg every 3-4 hours preferably after food (range:

25-100mg); child (6-12 years): 25mg. By SC, IM or IV injection: moderate pain: 30mg; severe pain: 45-60mg every 3-4 hours; child (>1 year): by SC or IM injection, up to 1mg/kg; by IV injection up to 500ug/kg.

Adverse effects: Similar to morphine. Nausea, vomiting, dizziness, sweating, hypertension, palpitation, tachycardia, pulmonary artery hypertension, tolerance, dependence.

Drug and food interactions: Use with caution in patients receiving MAO inhibitors (may result in unpredictable reactions with Pentazocine).

Patient information: Do not use beyond prescribed dose and time. Do not consume alcohol while taking this drug.

7.8 Psychotropic drugs

7.8.1 Antidepressants/antianxiety

7.8.1.1 Noradrenergic and specific serotonergic (NaSSA)

MIRTAZAPINE

Dosage form and strength: Tablets: 15 mg, 30 mg

Indications: Major depression, PTSD (off label), insomnia (off label)

Contraindications/Precautions: Hypersensitivity, concurrent MAOI therapy. Start slowly in hepatic and renal dysfunction and in elderly. Use cautiously in patients with history of seizures, mania, hypomania, head trauma, alcoholism, brain damage, prolonged QTc interval; Pregnancy category C; avoid in lactation; Child and adolescent under 18yrs: not recommended. Discontinue therapy if neutropenia/ agranulocytosis occur.

Dosage schedule: *Depression, adult:* 15 mg PO HS; may increase no more frequently than every 1-2 wks, not to exceed 60 mg HS; geriatric: 7.5 mg per day PO HS, increase by 7.5-15 mg per day, no more frequently than 1-2 wks, not to exceed 45 mg per day. *Insomnia:* 15-45 mg PO HS.

Adverse effects: Somnolence, increased appetite, weight gain, xerostomia, constipation, asthenia, weakness, dizziness, postural hypotension, convulsions, tremor, abnormal dreams, rash, reversible agranulocytosis.

Drug and food interactions: May cause hypertension, seizure and death when used with MAOI; do not use within 14 days of MAOI.

7.8.1.2 Norepinephrine dopamine reuptake inhibitors (NDRIs)

BUPROPION

See under 'Drugs used in smoking cessation'

7.8.1.3 Selective Serotonin Reuptake Inhibitors (SSRIs)

ESCITALOPRAM

Dosage form and strength: Tablets: 5, 10, 20 mg

Indications: Major depressive disorder, generalized anxiety disorder, OCD (off label), insomnia (off Label), panic disorder.

Contraindications/Precautions: Hypersensitivity. Similar to fluoxetine,

pregnancy category C

Dosage schedule: Adult, for major depression (10 mg PO everyday may increase to 20 mg per day after 1 week); generalized anxiety disorder, OCD (off label): 10 mg PO every day, may increase to 20 mg per week; maintain at lowest effective dose and assess need of therapy periodically if extended therapy required. Pediatric, major depression, < 12 yrs: safety and efficacy not established; > 12 yrs : 10 mg PO daily; may increase dose after at least 3 wks, not to exceed 20 mg/day. Geriatric, major depression/GAD: 10 mg/day.

Adverse effects: Similar to Fluoxetine

Drug and food interactions: Similar to Fluoxetine

Patient information: Similar to Fluoxetine

FLUOXETINE

Dosage form and strength: *Capsules:* 10mg, 20mg

Indications: Major depression, OCD, bulimia nervosa and panic disorder

Contraindications/Precautions: manic phase, hypersensitivity and breast feeding. Epilepsy, cardiac disease, diabetes, angle closure glaucoma, children and adolescents; pregnancy category C. Monitor closely for changes in behavior, clinical worsening and suicidal tendencies. Discontinue if symptomatic hyponatremia occurs. Gradually decrease dose while discontinuing.

Dosage schedule:

- *Adult, for major depression, OCD:* Initial 20 mg PO every day may consider gradually increasing dose after several weeks by 20 mg/day, not to exceed 80 mg/day;
- *Bulimia:* 60 mg once daily, max 80mg once daily;
- *Panic Disorder:* initial 10 mg PO daily for first week then 20 mg PO daily, may consider gradually increasing dose after several weeks, not to exceed 60 mg daily.
- *Pediatric, Major Depression:* >8 yrs: 10-20 mg PO daily initially, not to exceed 20 mg daily; OCD: >7yrs: 10 mg PO daily, further increases may be considered after several weeks.
- *Geriatric, major depression:* 10 mg PO daily, may gradually increase dose by 10-20 mg after several weeks as tolerated.

Adverse effects: Headache, nausea, insomnia, anorexia, anxiety, asthenia, diarrhea, nervousness, somnolence, tremor, weakness, dizziness, sexual dysfunction, postural hypotension, taste disturbances, ataxia, urinary retention and frequency, serotonin syndrome

Drug and food interactions: Co-administration with MAO inhibitors may cause serotonin syndrome (do not use within 14 days). Increased risk of serotonin syndrome with SSRI, SNRI. Not to be used with linezolid, IV methylene blue, pimozide.

Patient information: Therapeutic effect may take 1-4 week, not to discontinue abruptly. Avoid alcohol and other CNS depressants. Change position slowly because orthostatic hypotension may occur. Take medicine in the morning to reduce risk of insomnia. Take medicines with food to prevent gastrointestinal upset.

FLUVOXAMINE**Dosage form and strength:** *Tablets:* 50mg, 100mg**Indications:** Depression, OCD**Contraindications/Precautions:** Hypersensitivity. Similar to fluoxetine; Pregnancy category C; caution in breast feeding; <8yrs: safety and efficacy not established.**Dosage schedule:**

- *Depression:* initially 50-100 mg daily in the evening, increased gradually if necessary to maximum 300 mg daily (over 150 mg in divided doses); usual maintenance dose 100 mg daily; child and adolescent under 18 years: not recommended.
- *Obsessive-compulsive disorder:* initially 50 mg in the evening, increased gradually if necessary after some weeks to maximum 300 mg daily (over 150 mg in divided doses); usual maintenance dose: 100-300 mg daily. Child over 8 years: initially 25 mg daily, increased if necessary in steps of 25 mg every 4-7 days to maximum 200 mg daily (over 50 mg in divided doses).

Adverse effects: Similar to fluoxetine. Palpitation, tachycardia.**Drug and food interactions:** Similar to fluoxetine

Patient information: Therapeutic effects may take 2-3 weeks, not to use with CNS depressants, to increase bulk in diet if constipation occurs, especially in geriatric patients.

PAROXETINE**Dosage form and strength:** *Tablets:* 10mg, 12.5mg, 20mg, 25mg**Indications:** Major depressive disorder, GAD, OCD, panic disorder, social phobia, PTSD**Contraindications/Precautions:** History of mania, hypersensitivity. Use cautiously in patient with bipolar disorder, seizure, history of suicidal thoughts, angle closure glaucoma, severe hepatic impairment, severe renal impairment, children and adolescents. Pregnancy category D, use cautiously during lactation.**Dosage schedule:**

- *Major depression, social anxiety disorder, post-traumatic disorder, generalized anxiety disorder:* usually 20 mg each morning (maximum: 50 mg; elderly: 40 mg); child and adolescent under 18 years: not recommended.
- *Panic disorder:* initially 10 mg each morning, increased gradually in steps of 10 mg to usual dose of 40 mg daily (maximum: 60 mg daily; elderly: 40 mg daily); child and adolescent under 18 years: not recommended.

Adverse effects: Nausea, insomnia, dry mouth, headache, asthenia, constipation, diarrhea, dizziness, ejaculation disorder, tremor, extrapyramidal reactions, palpitations, myalgia, sexual dysfunction, weight loss or gain, serotonin syndrome.**Drug and food interactions:** Similar to fluoxetine

Patient information: Similar to fluoxetine

SERTRALINE**Dosage form and strength:** *Tablets:* 25mg, 50mg, 100mg**Indications:** Major depressive disorder, OCD, panic disorder, PTSD, social

anxiety disorder

Contraindications/Precautions: Hypersensitivity, history of mania. Similar to fluoxetine. Pregnancy category C. Use cautiously during lactation, history of mania.

Dosage schedule: Adults: major depression, OCD: initial 50mg PO every day; may increase by 25mg at 1 week intervals; not to exceed 200mg every day. Panic disorder, PTSD, social anxiety disorder: Initial 25mg PO every day, may increase by 25mg at 1 week intervals, not to exceed 200mg every day. Pediatric: <6 yrs: safety and efficacy not established; 6-12 yrs: 25 mg PO daily initially; 12-17 yrs: 50mg PO daily initially, may increase by 50mg daily at 1 week intervals to no more than 200mg daily; give HS if somnolence experienced.

Adverse effects: See under fluoxetine

Drug and food interactions: See under fluoxetine

Patient information: See under fluoxetine

7.8.1.4 Serotonin Antagonists and reuptake Inhibitors (SARIs)

TRAZODONE HYDROCHLORIDE

Dosage form and strength: *Tablets:* 25mg, 50mg, 100mg

Indications: Depressive illness particularly when sedation is required, anxiety

Contraindications/Precautions: Hypersensitivity, recovery period after MI, concurrent ECT. Similar to amitriptyline; pregnancy category C

Dosage schedule:

- *Depression:* initially 150mg (elderly 100mg) daily in divided doses after food or as a single dose at bed time, may be increased to 300mg daily; hospital patient: up to maximum 600 mg daily in divided doses; child: not recommended.
- *Anxiety:* 75 mg daily, increasing if necessary to 300 mg daily; child: not recommended.

Adverse effects: Similar to amitriptyline but fewer anticholinergic and cardiovascular effects, rarely priapism.

Drug and food interactions: Similar to amitriptyline

Patient information: Discontinue if prolonged or inappropriate erection occurs. Take medicine at bedtime to reduce day time sleepiness.

7.8.1.5 Serotonin Norepinephrine Reuptake Inhibitors (SNRIs)

DULOXETINE

Dosage form and strength: *Capsules and gastro-resistant capsules,* as duloxetine hydrochloride: 20mg, 30 mg, 40 mg, 60 mg

Indications: Major depressive disorder, generalized anxiety disorder, diabetic neuropathy, moderate to severe stress urinary incontinence

Contraindications/Precautions: Breastfeeding women, hepatic impairment. In patients with bleeding disorders, cardiac disease, hypertension (avoid if uncontrolled); in patients with history of mania, seizures, raised intra-ocular pressure, susceptibility to angle-closure glaucoma, renal impairment;

pregnancy, elderly. Dose should be reduced over at least 1–2 weeks and not stopped abruptly

Dosage schedule:

- *Major depressive disorder, adult:* 60 mg once daily; Generalized anxiety disorder, adult: Initially 30 mg once daily, increased if necessary to 60 mg once daily; maximum 120 mg per day;
- *Diabetic neuropathy, adult:* 60 mg once daily, discontinue if inadequate response after 2 months; review treatment at least every 3 months, maximum dose to be given in divided doses; maximum 120 mg per day;
- *Moderate to severe stress urinary incontinence, adult (female):* 40 mg twice daily, patient should be assessed for benefit and tolerability after 2–4 weeks, alternatively initially 20 mg twice daily for 2 weeks, this can minimize side effects, then increased to 40 mg twice daily, the patient should be assessed for benefit and tolerability after 2–4 weeks.

Adverse effects: Abdominal pain, anorexia, nausea, vomiting, constipation or diarrhoea, weight changes, flatulence, dry mouth, dyspepsia. Abnormal dreams, insomnia, anxiety, palpitation, sweating, tremor, dizziness, drowsiness, fatigue, headache, hot flush, paraesthesia, sexual dysfunction, visual disturbances, hypersensitivity reactions.

Drug and food interactions: Caution with concomitant use of drugs that increase risk of bleeding.

Patient information: It may increase suicidal thinking and behavior.

VENLAFAXINE

Dosage form and strength: *Tablets and modified-release tablets*, as venlafaxine hydrochloride: 37.5 mg, 75 mg, 150 mg

Indications: Major depression, generalized anxiety disorder, social anxiety disorder

Contraindications/Precautions: Conditions associated with high risk of cardiac arrhythmia, uncontrolled hypertension. Diabetes, heart disease (monitor blood pressure), history of bleeding disorders, history of epilepsy, history or family history of mania, susceptibility to angle-closure glaucoma, pregnancy (C), breastfeeding, renal impairment, hepatic impairment. Associated with a higher risk of withdrawal effects compared with other antidepressants, so, dose should be reduced over several weeks. Gastro-intestinal disturbances, headache, anxiety, dizziness, paraesthesia, tremor, sleep disturbances, and sweating are most common features of withdrawal if treatment stopped abruptly or if dose reduced markedly.

Dosage schedule:

- *Major depression, oral dose in adult:* Initially 75 mg daily in 2 divided doses, then increased if necessary up to 375 mg daily, dose to be increased if necessary at intervals of at least 2 weeks, faster dose titration may be necessary in some patients; maximum 375 mg per day.
- *Generalized anxiety disorder, social anxiety disorder:* oral dose in adults: 75 mg once daily, increased if necessary up to 225 mg once daily, dose to be increased at intervals of at least 2 weeks; maximum 225 mg per day.

Adverse effects: Abnormal dreams, insomnia, anxiety, nervousness, palpitation, sweating, tremor, confusion, dizziness, drowsiness, paraesthesia,

sensory disturbances, asthenia, hypertonia, dependence, headache, hypertension. Anorexia, vomiting, weight changes, constipation. Changes in serum cholesterol, difficulty with micturition, dry mouth, menstrual disturbances, mydriasis, sexual dysfunction, vasodilatation, visual disturbances, yawning.

Drug and food interactions: Concomitant use of drugs that increase risk of bleeding.

Patient information: May affect performance of skilled tasks (e.g. driving).

7.8.1.6 Tricyclic antidepressants and related drugs

AMITRIPTYLINE

Dosage form and strength: Tablets: 10 mg, 25 mg, 75 mg

Indications: Depressive illness, nocturnal enuresis

Contraindications/Precautions: Angle closure glaucoma, known history of QTc prolongation, recent MI, heart failure, manic phase and severe liver disease. Cardiovascular diseases, prostatic hyperplasia, history of seizure, safety not established in children less than 12 yrs, pregnancy category C. Increased risk of suicidal thinking and behavior especially in children, adolescents and young adults (24 yrs), so patient should be monitored closely for changes in behavior. Avoid concurrent use with MAOI (discontinue 2 week before starting amitriptyline). Fluoxetine should be stopped 5 weeks before starting amitriptyline.

Dosage schedule: *Depression:* adult: 75 mg PO (elderly and adolescent: 25-75 mg) daily in divided doses or as a single dose at bed time, increase gradually as necessary to maximum 150-200 mg; child <16 years: not recommended.

Adverse effects: Suicidal thoughts, lethargy, sedation, blurred vision, dry eyes, dry mouth, constipation, urinary retention, arrhythmia, hypotension, possibilities of extrapyramidal symptoms and Neuroleptic Malignant Syndrome.

Drug and food interactions: May cause hypotension, tachycardia and potentially fatal reactions when used with MAOI. Concurrent use with SSRI may result in toxicity and should be avoided. Concurrent use with clonidine may result in hypotensive crisis and should be avoided. Not to be used with linezolid and IV methylene blue.

Patient information: Take medicine at bedtime to reduce day time sleepiness. Consult your physician in case of features like salivation, rigidity, tremor, unusual movements of body parts (features of EPS). Increase fluid and fibers in diet to avoid constipation. Raise slowly from bed.

CLOMIPRAMINE

Dosage form and strength: Tablet 10mg, 25mg, 50mg

Indications: Depression, OCD

Contraindications/Precautions: BPH, urinary retention, GI retention, hyperthyroidism, seizure disorder, brain tumor, respiratory impairment. Safety not established in children.

Dosage schedule: *Depression:* initial 10 mg daily, increase gradually as necessary to 30-50 mg daily in divided doses or single dose HS; max. 250

mg daily; elderly: initially 10 mg daily increase carefully over approximately 10 days to 30-75 mg daily; child: not recommended. OCD: 25 mg PO initially gradually increase to 100 mg per day (divided with meals) over two weeks then, may increase further to 250 mg per day maximum; may be given as single daily dose HS once tolerated; child: not recommended.

Adverse effects: Xerostomia, headache, constipation, ejaculation failure, impotence, fatigue, nausea, wt. gain, hepatotoxicity, anti-cholinergic effects

Drug and food interactions: See under Amitriptyline

Patient information: See under Amitriptyline

DOSULEPIN (DOTHIEPIN)

Dosage form and strength: *Tablet:* 75 mg; *capsule* 25 mg

Indications: Depressive illness (particularly where sedation is required)

Contraindications/Precautions: Acute porphyrias, during the manic phase of bipolar disorder, arrhythmias, heart block, immediate recovery period after myocardial infarction. Cardiovascular disease, chronic constipation, diabetes, epilepsy, history of bipolar disorder, history of psychosis, hyperthyroidism (risk of arrhythmias), increased intra-ocular pressure, patients with a significant risk of suicide, phaeochromocytoma (risk of arrhythmias), prostatic hypertrophy, susceptibility to angle-closure glaucoma, urinary retention, pregnancy, hepatic impairment. Should be withdrawn gradually and not abruptly.

Dosage schedule: Oral, adult: initially 75 mg daily in divided doses or once daily (at bedtime), increased if necessary to 150 mg daily gradually; up to 225 mg daily in some circumstances (e.g. hospital use); elderly: initially 50-75 mg daily in divided doses or once daily (at bedtime), increased gradually if necessary to 75-150 mg daily; up to 225 mg daily in some circumstances (e.g. hospital use)

Adverse effects: Dysarthria, extrapyramidal symptoms, paralytic ileus, tremor, anxiety, confusion, increased intraocular pressure, sleep disturbances. Patient information: Drowsiness may affect the performance of skilled tasks (e.g. driving). Effects of alcohol enhanced.

IMIPRAMINE

Dosage form and strength: *Tablet* 25 mg and 75 mg

Indications: Depression, nocturnal enuresis

Contraindications/Precautions: Hypersensitivity, acute recovery of post-MI, angle closure glaucoma, known history of QTc prolongation. Pre-existing cardiovascular disease, seizure disorder, BEP, urinary and GI retention, hyperthyroidism, brain tumor and respiratory impairment. Safety not established in children <6 yrs.

Dosage schedule:

- *Depression:* initially up to 75 mg daily in divided doses, increase gradually to 150-200 mg (up to 300 mg in hospital patient); up to 150 mg may be given in single dose at bedtime; Elderly: initial 10 mg, increase gradually up to 30-50 mg daily; Child: Not recommended.
- *Nocturnal enuresis child:* 7 yrs: 25 mg HS; 8-11 yrs: 25-50 mg HS; >11 yrs: 50-75 mg HS. Maximum period of treatment (including gradual withdrawal)

3 months.

Adverse effects: Seizures, dizziness, somnolence, pseudomembranous colitis, diarrhea, nausea, vomiting, allergic reactions including anaphylaxis.

Drug and food interactions: Similar to Amitriptyline

Patient information: Do not discontinue abruptly after prolonged high dosage. Similar to Amitriptyline.

NORTRYPTYLIN

Dosage form and strength: Tablet 25mg

Indications: Depression, nocturnal enuresis

Contraindications/Precautions: Acute recovery phase following MI, angle closure glaucoma, alcohol intolerance. Use cautiously in pre-existing cardiovascular disease, history of seizures, asthma, history of prolong QTc interval; pregnancy category D

Dosage schedule: Adult, oral: 30-50mg (elderly 30mg) daily in single or divided doses, increased gradually as necessary to maximum 100mg daily. Nocturnal enuresis, child 7 yrs: 10mg; 8-11 yrs: 10-20mg; >11 yrs: 25-35mg at night; maximum period of treatment including withdrawal: 3 months.

Adverse effects: See under amitriptyline but less sedating

Drug and food interactions: See under amitriptyline

7.8.2 Antipsychotics

7.8.2.1 First generation

CHLORPROMAZINE

Dosage form and strength: Tablet: 25mg, 50mg, 100mg and 200mg

Indications: Schizophrenia and other psychosis, mania, violent or dangerously impulsive behavior, intractable hiccup.

Contraindications/Precautions: Hypersensitivity, cross-sensitivity with other phenothiazines may occur, angle-closure glaucoma, liver impairment, concurrent pimozide use, lactation. Use cautiously in DM, CNS tumors, epilepsy, respiratory distress, prostatic hyperplasia. Monitor for the development of neuroleptic malignant syndrome (fever, respiratory distress, tachycardia, convulsions, hyper/hypotension, pallor, tiredness, muscle stiffness, loss of bladder control).

Dosage schedule: Oral for schizophrenia and other psychoses, mania, short term adjunctive treatment of severe anxiety, psychomotor agitation, excitement, and violent or dangerously impulsive behavior: initially 25 mg 3 times daily (or 75 mg at night) adjusted according to response, to usual maintenance dose of 75-300 mg daily (up to 1 g daily may be required in psychoses); child 1-5 years: 0.5 mg/kg every 4-6 hours (maximum 40 mg daily); 6-12 years: one third to half adult dose (maximum 75 mg daily); elderly, (or debilitated) one third to half adult dose. Intractable hiccup: 25-50 mg 3-4 times daily.

Adverse effects: Sedation, extra-pyramidal symptoms, blurred vision, dry eyes, constipation, dry mouth, anorexia, hepatitis, urinary retention, photosensitivity, rashes, allergic reactions, hypotension, tachycardia,

hyperthermia, galactorrhoea, amenorrhoea, agranulocytosis, leukopenia.

Patient information: Medication may cause drowsiness; caution patients to avoid driving or other activities requiring alertness. Protect skin from sunlight. Do not take antacids 2 hours before or after taking this drug. Maintain oral hygiene. Inform doctor in case of fever, rashes, change in color of urine and stool.

FLUPHENAZINE DECANOATE

Dosage form and strength: *Injection:* 25mg/ml in sesame oil (IM use only; should be protected from light)

Indications: Acute and chronic psychosis, schizophrenia, mania.

Contraindications/Precautions: Hypersensitivity, cross-sensitivity with other phenothiazines, liver disease; Safety is not established in children < 6 months of age. Lactation: not recommended; pregnancy: use only if potential benefits justifies potential risk to fetus, seizure disorder.

Dosage schedule: *Maintenance in schizophrenia and other psychoses:* by deep IM injection, into the gluteal muscle, test dose 12.5 mg (6.25 mg in elderly) then after 4-7 days 12.5-100 mg repeated at intervals of 14-35 days, adjusted according to response; Child: not recommended.

Adverse effects: see under chlorpromazine

Drug and food interactions: Concurrent use with anti-arrhythmics, pimozide, erythromycin, clarithromycin, fluoroquinolones and TCAs increases the risk of arrhythmias. Additive hypotension with antihypertensives. Additive CNS depression with other CNS depressants

Patient information: see under chlorpromazine

HALOPERIDOL

Dosage form and strength: *Injection:* 5 mg per ml; *oral solution:* 2 mg per ml; *Tablets:* 1.5 mg, 5 mg, 10 mg and 20 mg.

Indications: Acute and chronic psychotic disorder including schizophrenia, drug induced psychosis; delirium; schizophrenic patient who require long term parenteral (IM) antipsychotic therapy; management of aggression and violence; considered 2nd line treatment after failure with atypical antipsychotic therapy.

Contraindications/Precautions: Hypersensitivity, liver/CVS disease, angle-closure glaucoma. Pregnancy (safety not established), seizure disorder. Same as chlorpromazine.

Dosage schedule:

- *Oral for schizophrenia and other psychoses, mania, short term adjunctive management of psychomotor agitation, excitement and violent or dangerously impulsive behavior:* initially 1.5-3 mg (3-5 mg in severely affected or resistant patients), 2-3 times daily; in resistant schizophrenia up to 30 mg daily may be needed; adjusted according to response to lowest effective maintenance dose (as low as 5- 10 mg daily). Elderly (or debilitated): initially half adult dose; child: initially 25-50 micrograms/kg daily to a maximum of 10 mg. Short-term adjunctive management of severe anxiety: adults 500 micrograms twice daily.
- *Intractable hiccups:* 1.5 mg 3 times daily adjusted according to response;

child: not recommended. By IM or IV injection: 2-10 mg, subsequent doses being given every 4-8 hours according to response to a maximum 18 mg daily; severely disturbed patients may require initial dose of up to 18 mg; child: not recommended.

Adverse effects: Seizures, extra-pyramidal symptoms, confusion, drowsiness, restlessness, tardive dyskinesia, blurred vision, dry eyes, dry mouth, anorexia, hepatitis, respiratory depression, hypotension, tachycardia, hyperpyrexia, constipation, urinary retention, impotence, photosensitivity, hypersensitivity, rashes, agranulocytosis, anaemia, leucopenia, amenorrhoea, galactorrhoea, gynaecomastia, neuroleptic malignant syndrome.

Drug and food interactions: Hypotension with antihypertensives, nitrates or alcohol. Increase CNS depression with other CNS depressants. Increase anticholinergic effects with drugs having anti-cholinergic properties including anti-histamines, anti-depressants, atropine, phenothiazines, quinidine, disopyramide.

Patient information: Advise patient not to take thioridazine within two hrs of antacids/ antidiarrhoeal medications.

TRIFLUOPERAZINE

Dosage form and strength: Tablets: 5mg, 10mg

Indications: Psychoses like schizophrenia, schizo-affective disorders, short term anxiety disorder

Contraindications/Precautions: Hypersensitivity, CNS depression like coma, parkinsonism, epilepsy, angle closure glaucoma, bone marrow failure (blood dyscrasias), severe liver and cardiac diseases. Pregnancy and lactation only when benefits outweigh the risks. Should be used in low doses in elderly and children. Monitor weight and BMI regularly, monitor for development of NMS.

Dosage schedule: Adult: start with 5 mg twice daily and increase by 5 mg after 1 week, then after interval of 3 days, to a maximum of 20-40 mg/day (40 mg/day only in severe cases); child: 5 mg/day in divided doses.

Adverse effects: CNS depression, extrapyramidal symptoms like dystonia, akathisia is marked, anticholinergic symptoms like urinary retention and constipation, photosensitivity, α - blocking properties can cause hypotension and dizziness.

Drug and food interactions: Antacids decrease absorption. Additive hypotension with ingestion of alcohol and antihypertensives. May cause dizziness, so drive cautiously.

Patient information: Can be taken with food, milk or water to minimize gastric irritation. Do not skip or double the dose. Use sunscreen for photosensitivity. Increase fluids and fibers in diet to avoid constipation. Rinse mouth frequently to avoid dry mouth.

7.8.2.2 Second generation

AMISULPRIDE

Dosage form and strength: Tablet: 50 mg, 100 mg, 200 mg, 400 mg; Oral solution 100 mg/ml

Indications: Acute psychotic episode in schizophrenia, schizophrenia with predominantly negative symptoms.

Contraindications/Precautions: CNS depression, comatose states, phaeochromocytoma, pre-pubertal children, prolactin dependent tumours. Cautious use in pregnant or breastfeeding women, in patients with renal impairment.

Dosage schedule:

- *Acute psychotic episode in schizophrenia*, oral, adult: 400–800 mg daily in 2 divided doses, adjusted according to response; maximum 1.2 g per day.
- *Schizophrenia with predominantly negative symptoms*, oral, adult: 50–300 mg daily.

Adverse effect: Anxiety, bradycardia.

ARIPIPRAZOLE

Dosage form and strength: *Tablets:* 5 mg, 10 mg, 15 mg, 30 mg; *orodispersible tablets:* 10 mg, 15 mg; *oral solution:* 1 mg/ml; *solution for injection:* 7.5 mg/ml; *powder and solvent for suspension for injection:* 400 mg.

Indications: Acute episode of schizophrenia, maintenance in schizophrenia, treatment and recurrence prevention of mania.

Contraindications/Precautions: CNS depression, comatose state, phaeochromocytoma, IM preparation not to be used in children. Cerebrovascular disease, elderly (reduce initial dose), pregnancy, breastfeeding, hepatic impairment.

Dosage schedule:

- *Maintenance in schizophrenia:* in patients stabilized with oral aripiprazole, initially by IM injection, adult: 400 mg every 1 month, to be injected into the gluteal muscle, minimum of 26 days between injections;
- *Schizophrenia:* initially oral, adult: 10–15 mg once daily (max. per dose 30 mg once daily);
- *Treatment and recurrence prevention of mania:* oral, adult: 15 mg once daily, increased if necessary up to 30 mg once daily;
- *Control of agitation and disturbed behaviour in schizophrenia:* IM, adult: initially 5.25–15 mg for 1 dose, alternatively usual dose 9.75 mg for 1 dose, followed by 5.25–15 mg after 2 hours if required, maximum 3 injections daily, maximum daily combined oral and parenteral dose 30 mg.

Adverse effects: Anxiety, hypersalivation, malaise, oropharyngeal/laryngospasm and dysphagia, dizziness, drowsiness, constipation, headache, insomnia, weight gain, rarely depression and dry mouth. With intramuscular use erythema, nodules, pain at injection site, swelling.

Patient information: Orodispersible tablets should be placed on the tongue and allowed to dissolve, or be dispersed in water and swallowed.

CLOZAPINE

Dosage form and strength: *Tablet:* 25mg and 100mg

Indications: Schizophrenia unresponsive/intolerant to standard therapy with other anti-psychotics (refractory cases), to reduce recurrent suicidal behavior in schizophrenic patient.

Contraindications/Precautions: Hypersensitivity, bone marrow depression,

severe CNS depression, epilepsy, granulocytopenia; lactation: safety not established. Use cautiously in malnourished patients or patients with cardiovascular, hepatic, renal diseases, diabetes and seizure disorder; children <16yrs (safety not established). Monitor patients' mental status (orientation, mood, behavior) before and periodically during therapy. Assess fasting blood glucose and cholesterol levels initially and throughout therapy. Monitor weight and BMI regularly. Monitor CBC before initiating therapy and regularly thereafter. Monitor for signs of myocarditis (unexplained fatigue, dyspnea, tachypnea, fever, chest pain, palpitation, ECG changes and/or tachycardia during 1st month of therapy). If these occur, clozapine should be discontinued. Clozapine lowers the seizure threshold. Institute seizure precaution for patients with history of seizure disorder.

Dosage schedule: Schizophrenia, adult over 16 years: 12.5 mg once or twice (elderly 12.5 mg once) on first day then 25-50 mg (elderly 25-37.5 mg) on second day then increased gradually (if well tolerated) by 25-50 mg (in elderly: maximum 25 mg) daily over 14-21 days up to 300 mg daily in divided doses.

Adverse effects: Neuroleptic malignant syndrome, seizures, dizziness, sedation, visual disturbances, hypotension, tachycardia, hypertension, hyperglycemia, constipation, nausea, vomiting, weight gain, rash, agranulocytosis, leukopenia, fever, extra-pyramidal symptoms (less frequently than other typical neuroleptics).

Drug and food interactions: Use with lithium increases the risk of adverse CNS reactions including seizures. Phenytoin, nicotine and rifampin decrease levels and hence decrease efficacy. Caffeine containing herbs (cola, nut, tea, coffee) increases serum levels and side effects.

Patient information: Inform patient that cigarette smoking can decrease clozapine levels increasing the risk for relapse. Caution patient to avoid driving or other activities requiring alertness. Instruct patient to notify health care professional promptly if unexplained fatigue, dyspnea, tachypnea, chest pain, palpitation, sore throat, fever, lethargy, weakness, malaise or flu like symptoms occur or if pregnancy is planned or suspected.

OLANZAPINE

Dosage form and strength: Tablets: 2.5mg, 5mg, 7.5mg, 10mg, 15mg, 20mg

Indications: Schizophrenia, mania (used alone or along with lithium or valproate), treatment resistant depression (with fluoxetine).

Contraindications/Precautions: Hypersensitivity, angle-closure glaucoma, acute MI, severe hypotension or bradycardia and breastfeeding (lactation: safety not established; pregnancy category C). Should be used with caution in DM, prostatic hypertrophy, hepatic, renal impairment and pregnancy.

Dosage schedule: adult over 18 years: 5-20 mg daily (adjust as required)

Adverse effects: Neuroleptic malignant syndrome, seizures, suicidal thoughts, agitation, dizziness, headache, restlessness, sedation, weakness, amblyopia, rhinitis, cough, dyspnea, hypotension, tachycardia, constipation, dry mouth, increased appetite and weight gain, decreased libido, urinary incontinence, leucopenia, neutropenia, photosensitivity, amenorrhoea, galactorrhoea, gynecomastia, hyperglycemia, goiter, dyslipidemia, hypertonia, joint pain,

tremor.

Drug and food interactions: Effect decreased by concurrent carbamazepine, omeprazole or rifampin. Increased hypotensive effect with anti-hypertensives. Increased CNS depression with alcohol or other CNS depressions. Antagonizes the effects of levodopa and other dopamine agonist. Nicotine can decrease its levels.

Patient information: Caution to avoid driving or other activities requiring alertness. Change position slowly to avoid orthostatic hypotension. Caution patient to avoid taking alcohol. Notify if pregnancy is planned. Calorie controlled diet, inform excessive weight gain.

QUETIAPINE

Dosage form and strength: *Tablets:* 25 mg, 100 mg, 150 mg, 200 mg, 300 mg; *Modified-release tablets:* 50 mg, 150 mg, 200 mg, 300 mg, 400 mg

Indications: Schizophrenia, treatment and prevention of mania/depression in bipolar disorder, adjunctive treatment of major depression.

Contraindications/Precautions: Avoid in breastfeeding women. Cerebrovascular disease, elderly, patients at risk of aspiration pneumonia, treatment of depression in patients under 25 years (increased risk of suicide); caution in pregnancy and hepatic impairment.

Dosage schedule:

- *Schizophrenia*, oral immediate release tablets, adults: 25 mg twice daily for day 1, then 50 mg twice daily for day 2, then 100 mg twice daily for day 3, then 150 mg twice daily for day 4, then, adjusted according to response, usual dose 300–450 mg daily in 2 divided doses, rate of dose titration may need to be slower and the daily dose lower in elderly patients; maximum 750 mg per day; oral modified-release medicines, adult: 300 mg once daily for day 1, then 600 mg once daily for day 2, then, adjusted according to response, usual dose 600 mg once daily, maximum dose under specialist supervision; maximum 800 mg per day; elderly: Initially 50 mg once daily, adjusted according to response. Adjusted in steps of 50 mg daily.
- *Treatment of mania in bipolar disorder*, oral immediate release tablets, adult: 50 mg twice daily for day 1, then 100 mg twice daily for day 2, then 150 mg twice daily for day 3, then 200 mg twice daily for day 4, then adjusted in steps of up to 200 mg daily, adjusted according to response, usual dose 400–800 mg daily in 2 divided doses, the rate of dose titration may need to be slower and the daily dose lower in elderly patients; maximum 800 mg per day. Using modified-release tablets, adult: 300 mg once daily for day 1, then 600 mg once daily for day 2, then, adjusted according to response, usual dose 400–800 mg once daily; elderly: Initially 50 mg once daily, adjusted according to response, adjusted in steps of 50 mg daily;
- *Treatment of depression in bipolar disorder*, oral immediate-release medicines, adult: 50 mg once daily for day 1, dose to be taken at bedtime, then 100 mg once daily for day 2, then 200 mg once daily for day 3, then 300 mg once daily for day 4, then, adjusted according to response; usual dose 300 mg once daily, the rate of dose titration may need to be slower and the daily dose lower in elderly patients; maximum 600 mg per day; using oral modified-release medicines, adult: 50 mg once daily for day 1,

dose to be taken at bedtime, then 100 mg once daily for day 2, then 200 mg once daily for day 3, then 300 mg once daily for day 4, then, adjusted according to response; usual dose 300 mg once daily; maximum 600 mg per day;

- *Prevention of mania and depression in bipolar disorder*, oral immediate-release medicines, adult: Continue at the dose effective for treatment of bipolar disorder and adjust to lowest effective dose; usual dose 300–800 mg daily in 2 divided doses; using modified-release medicines, adult: Continue at the dose effective for treatment of bipolar disorder and adjust to lowest effective dose; usual dose 300–800 mg once daily;
- *Adjunctive treatment of major depression*, oral modified-release medicines, adult: 50 mg once daily for 2 days, dose to be taken at bedtime, then 150 mg once daily for 2 days, then, adjusted according to response, usual dose 150–300 mg once daily; Elderly: Initially 50 mg once daily for 3 days, then increased if necessary to 100 mg once daily for 4 days, then adjusted in steps of 50 mg, adjusted according to response, usual dose 50–300 mg once daily, dose of 300 mg should not be reached before day 22 of treatment.

Adverse effects: Asthenia, dysarthria, irritability, sleep disorders, suicidal behaviour (particularly on initiation), increased appetite, dyslipidemia, peripheral oedema, SJS/TEN.

RISPERIDONE

Dosage form and strength: Tablet: 1mg, 2mg, 3mg, 4mg

Indications: Acute and chronic schizophrenia (in adults and adolescent), mania

Contraindications/Precautions: Hypersensitivity and breast-feeding. Use with caution in pregnancy, hepatic and renal impairment and patients at risk of aspiration; Children: safety not established. Same as olanzapine. Monitor for EPS. May cause increase serum prolactin level. Monitor CBC during initial months of therapy.

Dosage schedule: *Psychosis:* 2 mg in 1-2 divided doses on first day then 4 mg in 1-2 divided doses on second day; usual dose range 4-6 mg daily; elderly (or in hepatic or renal impairment) initially 500 micrograms twice daily increased in steps of 500 micrograms twice daily to 1-2 mg twice daily; child under 15 years: not recommended.

Adverse effects: Weight gain, hyperprolactinemia (menstrual disturbances, gynaecomastia), priapism, cerebrovascular accidents, tachycardia, neutropenia, thrombocytopenia, sedation, neuroleptic malignant syndrome, suicidal thoughts, pharyngitis, rhinitis, cough.

Drug and food interactions: Decreases anti-parkinsonism effects of levodopa and carbidopa. Clozapine increases the effects of risperidone. Patient information: See under olanzapine. Advise patient and family to notify health care professional if thoughts of suicide, depression and anxiety, or if sore throat, fever, unusual bleeding, bruising, rashes, tremors and symptoms of hyperglycemia occur.

7.8.3 Drugs used for Attention Deficit Hyperactivity Disorder (ADHD)

ATOMOXETINE

Dosage form and strength: Capsule: 10 mg, 18 mg, 25 mg, 40 mg, 60 mg, 80 mg, 100 mg; as hydrochloride

Indications: Attention deficit hyperactivity disorder

Contraindications/Precautions: Pheochromocytoma, severe cardiovascular/cerebrovascular disease. Cardiovascular/cerebrovascular disease, QT-interval prolongation, hypertension, tachycardia, structural cardiac abnormalities, aggressive behavior, emotional lability, history of seizures, mania, psychosis, susceptibility to angle-closure glaucoma, pregnancy, breastfeeding, hepatic impairment. Takers should be informed about the risk and told to report clinical worsening, suicidal thoughts or behaviour, irritability, agitation, or depression.

Dosage schedule: Child 6–17 years (>70 kg): initially 40 mg daily for 7 days, increased according to response; maintenance 80 mg daily, total daily dose given either as a single dose in the morning or in 2 divided doses with last dose no later than early evening; maximum 120 mg per day; child 6–17 years (<70 kg): initially 500 micrograms/kg daily for 7 days, increased according to response; maintenance 1.2 mg/kg daily, total daily dose may be given either as a single dose in the morning or in 2 divided doses with last dose no later than early evening, high daily doses to be given under the direction of a specialist; maximum 1.8 mg/kg per day; maximum 120 mg per day; adult (<70 kg): initially 500 µg/kg daily for 7 days, dose is increased according to response; maintenance 1.2 mg/kg daily, total daily dose may be given either as a single dose in the morning or in 2 divided doses with last dose no later than early evening, high daily doses to be given under the direction of a specialist; maximum 1.8 mg/kg per day; maximum 120 mg per day; adult (>70 kg): initially 40 mg daily for 7 days, dose is increased according to response; maintenance 80–100 mg daily, total daily dose may be given either as a single dose in the morning or in 2 divided doses with last dose no later than early evening, high daily doses to be given under the direction of a specialist; maximum 120 mg per day

Adverse effects: Abdominal pain, dyspepsia, anorexia, nausea, vomiting, flatulence, constipation, anxiety, depression, irritability, sweating, tachycardia, palpitations, tremor, sleep disturbances, dizziness, drowsiness, paraesthesia, lethargy, dermatitis, dry mouth, flushing, headache, increased blood pressure, mydriasis, prostatitis, rash, sexual dysfunction, taste disturbances, urinary dysfunction.

Drug and food interactions: Avoid concomitant use of drugs that prolong QT interval.

BUPROPION

See under 'Drugs used in smoking cessation'

7.8.4 Drugs used for dementia

DONEPEZIL HYDROCHLORIDE

Dosage form and strength: *Tablets:* 5 mg, 10 mg; *orodispersible tablet:* 5 mg, 10 mg; *oral solution:* 1mg/ml oral

Indications: Mild to moderate dementia in Alzheimer's disease

Contraindications/Precautions: Hypersensitivity to donepezil and piperidine derivatives. Asthma, chronic obstructive pulmonary disease, sick sinus syndrome, supraventricular conduction abnormalities, susceptibility to peptic ulcers, hepatic impairment. Can cause unwanted dose related cholinergic effects and should be started at a low dose and the dose increased according to response and tolerability.

Dosage schedule: Mild to moderate dementia in Alzheimer's disease, oral, adult: initially 5 mg once daily for one month, then increased if necessary up to 10 mg daily

Adverse effects: Anorexia, nausea, vomiting, diarrhoea, urinary incontinence, abnormal dreams, agitation, headache, insomnia, dizziness, hallucinations, fatigue, muscle cramps, syncope, pruritus, rash, peptic ulcers, seizures

Drug and food interactions: Increased risk of neuroleptic malignant syndrome with concomitant antipsychotic treatment

Patient information: Doses to be given at bedtime

MEMANTINE HYDROCHLORIDE

Dosage form and strength: *Tablets:* 5 mg, 10 mg, 15 mg, 20 mg; *oral solution:* 10mg/ml

Indications: Moderate to severe dementia in Alzheimer's disease

Contraindications/Precautions: Severe hepatic/renal impairment. History of convulsions, renal impairment. Discontinue use if signs of hypersensitivity. Use cautiously in patients with cardiovascular diseases, hepatic and renal impairment.

Dosage schedule: Oral, adult: initially 5 mg once daily, increased in steps of 5 mg at weekly intervals; maximum 20 mg per day

Adverse effects: Constipation, dizziness, drowsiness, dyspnea, headache, hypertension, depression, psychosis, pancreatitis, suicidal ideation.

Drug and food interactions: Carbonic anhydrase inhibitors increase the level of memantine.

RIVASTIGMINE

Dosage form and strength: *Capsules:* 1.5 mg, 3mg, 4.5mg, 6mg; *oral solution:* 2mg/ml; *transdermal patch:* 4.6 mg/24 hour, 9.5 mg/24 hour, 13.3 mg/24 hour

Indications: Mild to moderate dementia in Alzheimer's disease, mild to moderate dementia in Parkinson's disease

Contraindications/Precautions: Hypersensitivity. Conduction abnormalities, sick sinus syndrome, duodenal ulcers, gastric ulcers, history of asthma and COPD, history of seizures, risk of fatal overdose with patch administration errors, renal/hepatic impairment, bladder outflow obstruction.

Dosage schedule: *Mild to moderate dementia in Alzheimer's disease*, oral, adult: initially 1.5 mg twice daily, increased in steps of 1.5 mg twice daily, at intervals of at least 2 weeks according to response and tolerance; usual dose 3–6 mg twice daily (max. per dose 6 mg twice daily), if treatment interrupted for more than several days, retitrate from 1.5 mg twice daily. *Mild to moderate dementia in Parkinson's disease*, oral, adult: same as for dementia in Alzheimer's.

Adverse effects: Abdominal pain, anorexia, dyspepsia, nausea, vomiting, diarrhoea, weight loss, agitation, insomnia, anxiety, confusion, headache, dizziness, drowsiness, bradycardia, extrapyramidal symptoms, malaise, sweating, tremor, increased salivation, urinary incontinence, worsening of Parkinson's disease.

Drug and food interactions: Enhance the bradycardic effect of beta blockers.

Patient information: Advise to remove the previous day's patch before applying new patch

7.8.5 Drugs used for psychoactive substance use disorder

7.8.5.1 Drugs used for alcohol dependence

7.8.5.1.1 Drugs used for acute withdrawal

CHLORDIAZEPOXIDE

See under 'Sedatives/hypnotics'

DIAZEPAM

See under 'Sedatives/hypnotics'

LORAZEPAM

See under 'Sedatives/hypnotics'

7.8.5.1.2 Drugs used for relapse prevention

DISULFIRAM

Dosage form and strength: *Tablets:* 250mg, 500mg

Indication: Alcoholism

Contraindications/Precautions: Ethanol, metronidazole, paraldehyde, any alcohol containing products; severe cardiac disease, coronary occlusion, psychosis. Use cautiously in diabetes, hyperthyroidism, seizures, nephritis, hepatic impairment. Produces above mentioned reactions with concomitant ethanol ingestion. Never administer to a patient in a state of alcohol intoxication or without patient's full knowledge. Alcohol must not be consumed for at least 24 hrs before initiating treatment. Assess motivation support system and cognitive ability before starting therapy.

Dosage schedule: 500mg PO daily initially for 1-2 weeks; not to exceed 500mg/day; maintenance: 250mg PO daily (125-500mg); continue therapy until self-control has been established; child: not recommended.

Adverse effects: Drowsiness, fatigue, headache, impotence, metallic taste, acneiform eruptions, rash, hepatitis, polyneuritis, peripheral neuropathy, optic neuritis, psychotic disorder

Drug and food interactions: Above mentioned reactions with alcohol

Patient information: To inform patient not to take alcohol during the treatment in any form (e.g. perfume, after shave, lotion, cough syrup, pickles with alcohol as preservatives, etc) for at least 14 days following last intake. Concomitant alcohol use may lead to alcohol-disulfiram reaction (blurred vision, chest pain, confusion, dizziness, fainting, tachycardia, sweating, seizure, death); visit health care facility immediately if this occurs.

NALTREXONE

See under 'Opioid antagonists'

TOPIRAMATE

See under 'Anticonvulsants'

7.8.5.2 Drugs used for opioid dependence

7.8.5.2.1 Antagonist for relapse prevention

NALTREXONE

See under 'Opioid antagonists'

7.8.5.2.2 Drugs used for acute withdrawal

CODEINE

See under 'Opioid analgesics'

CLONIDINE

See under 'Centrally acting antihypertensives'

7.8.5.2.3 Substitution therapy

BUPRENORPHINE

See under 'Opioid analgesics'

METHADONE

See under 'Opioid analgesics'

7.8.5.3 Drugs used in smoking cessation

BUPROPION

Dosage form and strength: Sustained release tablet: 150mg, as hydrochloride

Indications: Smoking cessation, major depression (immediate release, sustained release, extended release), seasonal affective disorder (extended release).

Contraindications/Precautions: History of anorexia/bulimia, seizures, CNS tumor. Use cautiously in severe hepatic cirrhosis, mild to moderate hepatic impairment, head trauma and prior seizure history, CNS tumor, concomitant medicine lowering seizure threshold. Pregnancy category C; use cautiously in lactation. Increased risk of suicidal thinking and behavior especially in children, adolescents and young adults (<24yrs); so patients should be monitored closely for changes in behavior. Avoid concurrent use with MAO-I (discontinue 2 weeks before starting bupropion).

Dosage schedule: Adult, oral: Start 1-2 weeks before target stop date, initially 150 mg daily for 6 days, then 150 mg twice daily (maximum single dose 150 mg, maximum daily dose 300 mg; minimum 8 hours between doses); maximum period of treatment 7-9 weeks; discontinue if abstinence not achieved at 7 weeks; child and adolescent under 18 years: not recommended.

Adverse effects: Headache, dry mouth, anorexia, nausea, weight loss/gain, insomnia, anxiety, agitation, tremor, palpitation, dizziness, nervousness, sinusitis, pharyngitis, abdominal pain, constipation or diarrhea, tinnitus, myalgia, sweating, rash, chest pain

Drug and food interactions: Increase risk of adverse reactions with MAO-I. Not to be used with linezolid or IV methylene blue.

Patient information: Consult therapist in case of suicidal ideation. Take the last dose of the day before 5 pm to minimize insomnia. Crushing, dividing or chewing the tablet may increase the chances of side effects. Avoid consumption of alcohol.

7.8.6 Mood stabilizers

CARBAMAZEPINE

GABAPENTINE

LAMOTRIGINE

See under 'Anticonvulsants'

LITHIUM

Dosage form and strength: Tablet: 300mg, 450mg

Indications: Prophylaxis and treatment of mania, prophylaxis of bipolar disorder, selected cases of hyperthyroidism.

Contraindications/Precautions: Hypothyroidism, heart disease especially sick sinus syndrome and various heart blocks, renal diseases, electrolyte imbalance and myasthenia gravis; pregnancy, lactation, children. Should be used with caution in elderly patients, in patients with renal or cardiovascular disease or severe dehydration. Lithium should be used during pregnancy only in life-threatening situations or severe disease. Regularly monitor serum lithium levels, thyroid/renal function tests.

Dosage schedule: Up to 1.5 g daily in single or divided doses; subsequent doses in accordance with the plasma concentration of lithium.

Adverse effects: Nausea and vomiting, drowsiness, confusion, headache, fits, ataxia, oedema, weight gain, fine tremor, polydipsia, acne.

Drug and food interactions: Indomethacin, ibuprofen, mefenamic acid, naproxen, diclofenac, ACE inhibitors, angiotensin-II receptor antagonists

have been reported to increase serum lithium concentrations by reducing excretion of lithium.

Patient information: Avoid drinking coffee as caffeine decreases lithium blood levels and effects. Drink plenty of water and monitor salt intake (make it uniform). In case of excessive fluid loss (e.g. diarrhoea, vomiting, excessive sweating), correct it immediately with ORS. Do not take missed dose after crossing 2 hours from scheduled dose. Control calorie intake and monitor blood glucose levels.

SODIUM VALPROATE

See under 'Valproic acid' under 'Anticonvulsants'

7.8.7 Sedatives/hypnotics

7.8.7.1 Benzodiazepines

ALPRAZOLAM

Dosage form and strength: Tablet: 0.25mg, 0.5mg and 1mg

Indications: Anxiety disorders, agoraphobia, panic disorders, depression

Contraindications/Precautions: Respiratory depression, severe hepatic impairment, children, angle closure

glaucoma. Should be used with caution in pregnancy and breast-feeding and patients with hepatic or renal disease. Monitor respiratory function, watch for signs and symptoms of tolerance and dependence in debilitated and elderly patients.

Dosage schedule: 0.25 to 0.5 mg three times daily by mouth, increased where necessary up to a total daily dose of 3 mg. In elderly or debilitated patients, an initial dose of 0.25 mg twice or thrice daily.

Adverse effects: Drowsiness, dizziness, ataxia, confusion, physical dependence (more with short-acting agents), changes in libido.

Drug and food interactions: Concomitant use with ACE inhibitors, alpha-blockers and angiotensin-II receptor antagonists will produce enhanced hypotensive effects. Increases sedative effect of opioid analgesics and general anaesthesia.

Patient information: Patients should be warned that benzodiazepine may impair mental alertness and may cause dependence if used beyond prescription. Avoid alcohol use. Do not share medicine to others.

CHLORDIAZEPOXIDE

Dosage form and strength: Tablets: 10mg, 25 mg

Indications: Anxiety disorders, alcohol withdrawal, phobias, psychosomatic disorders

Contraindications/Precautions: See under alprazolam

Dosage schedule:

- *For anxiety:* 10 mg 3 times daily increased if necessary to 60-100 mg daily in divided doses; elderly (or debilitated): half adult dose; child: not recommended.
- *For alcohol withdrawal:* 10-50 mg 4 times daily, gradually reducing over 7-10

days.

Adverse effects: See under alprazolam

Drug and food interactions: See under alprazolam

Patient information: See under alprazolam. Do not discontinue abruptly.

Notify if pregnancy is planned or suspected.

CLOBAZAM

See under 'Anticonvulsants'

CLONAZEPAM

See under 'Anticonvulsants'

DIAZEPAM

See under 'Anticonvulsants'

LORAZEPAM

Dosage form and strength: *Injection:* 2mg/ml; *Tablet:* 1mg and 2mg

Indications: Anxiety disorders, seizure disorder (all types), status epilepticus, alcohol withdrawal.

Contraindications/Precautions: See under alprazolam.

Dosage schedule:

- *Oral, for anxiety:* 1-4 mg tab daily in divided doses; elderly (debilitated): half adult dose;
- *Insomnia associated with anxiety:* 1-2 mg at bed time. By IM or slow IV injection (into a large vein) for acute panic attacks: 25-30 micrograms/kg repeated every 6 hours if necessary; child: not recommended.

Adverse effects: See under alprazolam

Drug and food interactions: See under alprazolam

Patient information: See under alprazolam

7.8.7.2 Non-benzodiazepines

ZOLPIDEM

Dosage form and strength: *Tablet:* 5 mg and 10 mg in form of tartrate

Indication: Insomnia

Contraindications/Precautions: Children, hypersensitivity, severe hepatic/pulmonary insufficiency, myasthenia gravis, obstructive sleep apnea, pregnancy (C), breast feeding. Use with caution in depression, hepatic impairment, elderly, renal impairment

Dosage schedule: 10 mg at bed time; elderly: 5 mg; child: not recommended.

Adverse effects: Diarrhoea, nausea, vomiting, vertigo, dizziness, headache, drowsiness, nightmares, asthenia, memory disturbances, depression, confusion, diplopia, tremor, ataxia

Patient information: See under alprazolam

Section II - Chapter 8

Drugs used for Anesthesia & Critical care

8.1 *General anaesthetics & Oxygen*

8.1.1 *Inhalational anaesthetics*

Halothane
Isoflurane
Nitrous oxide
Oxygen
Sevoflurane

8.1.2 *Intravenous anaesthetics*

Diazepam
Ketamine
Midazolam
Propofol
Thiopental sodium

8.2 *Local anaesthetics*

Bupivacaine
Lidocaine (lignocaine)
Prilocaine hydrochloride
Procaine hydrochloride

8.3 *Preanaesthetic medications*

8.3.1 *Anticholinergics*

Atropine

8.3.2 *Benzodiazepines*

Diazepam
Lorazepam
Midazolam

8.3.3 *Opioid analgesics*

Fentanyl
Morphine

8.3.4 *Others*

Metochlopramide
Omeprazole
Promethazine
Ranitidine

8.4 *Neuromuscular blockers*

Pancuronium
Rocuronium
Vecuronium

8.5 *Anticholinesterase*

Neostigmine

8.1 General anaesthetics & Oxygen

8.1.1 Inhalational anaesthetics

HALOTHANE

Dosage form and strength: *Volatile liquid:* 50 ml, 200 ml and 250 ml

Indication: Induction and maintenance of general anaesthesia

Contraindications/Precautions: History of unexplained jaundice or pyrexia in a patient following exposure to halothane. Avoid repeated exposure to halothane in less than three months. Careful anaesthetic history should be taken to determine previous exposure and previous reaction to halothane.

Dosage schedule: Induction done using a special calibrated vaporizer, increased gradually to 2-4% in oxygen or nitrous oxide-oxygen; child: 1.5-2%; maintenance: 0.5-2%.

Adverse effects: Nausea and vomiting, acidosis, dehydration and fever in children may predispose to convulsions under ether anaesthesia. Use of halothane may cause excessive bleeding during caesarean section and post-partum haemorrhage.

Drug and food interactions: With adrenaline, heart is sensitized to the actions of catecholamines.

ISOFLURANE

Dosage form and strength: *Volatile liquid:* 100 ml and 250 ml

Indication: Induction and maintenance of general anesthesia (usually not preferred for induction due to ether like odor)

Contraindications/Precautions: Hypersensitivity to isoflurane and halogenated agents, genetic susceptibility to malignant hyperthermia. Coronary artery disease; should not be used as a sole agent of induction in pt. with ventricular dysfunction, pregnancy category C, use cautiously in lactation. Adequate data not developed to establish its application in obstetrical anesthesia, safety and efficacy not established in pediatric.

Dosage schedule: Using a special calibrated vaporizer.

- *Induction:* increased gradually from 0.5 % to 3%, in oxygen or nitrous oxide-oxygen.

- *Maintenance:* 1-2.5% in nitrous oxide-oxygen, an additional 0.5 -1% may be required when given with oxygen alone.

Adverse effects: Nausea, vomiting, shivering, dose dependent hypotension, arrhythmia, respiratory depression rare, risk of perioperative hyperkalemia and malignant hypertension (especially in patients with latent as well as overt neuromuscular disease, particularly Duchenne's muscular dystrophy more vulnerable)

Drug and food interactions: Concomitant use of succinylcholine has been associated with hyperkalemia as well as potentiation of muscle relaxant action

NITROUS OXIDE

Dosage form and strength: *Gaseous form*

Indication: Used as a carrier gas for more powerful general anesthetic drugs

like desflurane and sevoflurane

Contraindications/Precautions: Pneumothorax, pneumoperitoneum, middle ear or sinus disease, bowel obstruction. Should be used cautiously in 1st and 2nd trimester of pregnancy and in patient with decreased level of consciousness or in violently disturbed psychiatric patient

Dosage schedule: Mixture with 50% O₂ during labor

Adverse effects: Megaloblastic anemia due to Vit. B₁₂ and folate deficiency; teratogenic (avoid in 1st and 2nd trimester)

Drug and food interactions: When given with other strong anesthetic drugs like desflurane and isoflurane, effect of both drugs increases

OXYGEN

Dosage form and strength: *Inhalational gas (medicinal gas)*

Indication: Along with inhalational anesthesia, cluster headache, hyperbaric oxygen (decompression sickness and air or gas embolism, gas gangrene, necrotising fasciitis, radiation therapy), respiratory failure.

Contraindications/Precautions: High concentrations of oxygen should be avoided in patients whose respiration is dependent upon hypoxic drive. To be stored under pressure in metal cylinder of the type conforming to appropriate safety regulations. Valves and taps should not be lubricated with oil or grease. Any fire or spark is highly dangerous in the presence of increased oxygen concentrations especially when oxygen is used under pressure.

Dosage schedule:

- *During anesthesia and other situation (unless mentioned):* Oxygen given by means of nasal prongs or via a face mask; these can usually deliver concentrations of up to 60%. Tight-fitting anaesthetic-type masks, or delivery via an endotracheal tube or oxygen tent, can provide higher concentrations of up to 100%.
- *Respiratory failure:* Face masks at 5 L/min Tight-fitting anaesthetic-type masks if concentration higher than 60% is required
- *Cluster headache:* Inhalation: 100% oxygen
- *Hyperbaric oxygen therapy:* Intermittent inhalation: hyperbaric oxygen therapy, which involves the of 100% oxygen under a pressure of greater than 1 atmosphere in a specialized chamber

Note: Oxygen via nasal prongs @2 L/min is given as domiciliary O₂ treatment in COPD patients

Adverse effects: Concentrations greater than 80% have a toxic effect on the lungs leading to pulmonary congestion, exudation and atelectasis. Retinopathy of prematurity. With Hyperbaric oxygen therapy: barotrauma (ear or sinus trauma, tympanic membrane rupture, or rarely pneumothorax or air embolism); oxygen toxicity (CNS toxicity or pulmonary toxicity); and reversible visual changes.

Drug interaction: With bleomycin: serious toxicity.

SEVOFLURANE

Dosage form and strength: *Volatile liquid: 0.5-3%*

Indication: Anesthesia

Contraindications/Precautions: Should not be used as a sole agent for

induction in patients with ventricular dysfunction. Susceptibility to malignant hyperthermia, hypersensitivity, lack of ventilatory support. In patients with anemia, hepatic impairment, myxedema, renal impairment; in patients with QTc prolongation; in paediatric patients; pregnancy category B, myasthenia gravis

Dosage schedule: *Surgical anaesthesia:* Inhalation, 0.5 months full term neonate: 3.3 % in O₂; 1-6 months: 3% in O₂; 6 mo-3 years: 2.8% in O₂ or 2% with 65% H₂O / 35% O₂; 3-12 years: 2.5% in O₂ or 2.5% with 65% H₂O / 35% O₂; 12-15 years: 2.6% in O₂ or 1.4% with 65% H₂O / 35% O₂; 15-25 years: 2.6% in O₂ or 1.4% with 65% H₂O / 35% O₂; 25-40 years: 2.1% in O₂ or 1.1% with 65% H₂O / 35% O₂; 40-60 years: 1.7% in O₂ or 0.9% with 65% H₂O / 35% O₂; 60-80 years: 1.4% in O₂ or 0.7% with 65% H₂O / 35% O₂

Adverse effects: Malignant hyperthermia, dose-dependent hypotension, bradycardia, tachycardia, hypotension, HTN, apnea, increased BUN, increased ALT, respiratory irritation, nephrotoxicity, glycosuria, proteinuria.

Drug and food interactions: Concomitant use of succinylcholine has been associated with hyperkalemia.

8.1.2 Intravenous anaesthetics

DIAZEPAM

See under Drugs acting on the Central Nervous System

KETAMINE

Dosage form and strength: *Injection:* 10 mg/ml and 100 mg/ml

Indication: Induction and maintenance of anesthesia for minor surgical or diagnostic procedures; Analgesia for painful procedures of short duration for patients at risk of hypotension and bronchospasm

Contraindications/Precautions: In patients with epilepsy, hypertension and in patients with increased ICP. Use cautiously in: CNS abnormalities, CNS masses, or hydrocephalus (may increase ICP), increased intra-ocular pressure, coronary artery disease, catecholamine depletion, hypertension and tachycardia (monitor cardiac function cautiously), chronic alcoholic patients or acutely intoxicated; Pregnancy (C). Too rapid administration will cause respiratory depression. Do not put diazepam or barbiturate in same syringe/bag along with ketamine. Avoid mechanical stimulation of the pharynx if ketamine used alone. Use require patient monitoring, to be administered only by experienced personnel; in non-intubated and/or non-mechanically ventilated patients, appropriate equipment and qualified personnel should be immediately available to use appropriate equipment for rapid institution of respiratory and/or cardiovascular support.

Dosage schedule:

- *By IM injection, for short procedures:* Initially 6.5-13 mg/kg (10 mg/kg usually produces 12-25 minutes of surgical anaesthesia).
- *Diagnostic manoeuvres and procedures not involving intense pain:* Initially 4 mg /kg by IV injection over at least 60 seconds.
- *Short procedures:* Initially 1-4.5 mg/kg (2 mg/kg usually produces 5-10 minutes of surgical anaesthesia) by IV infusion of a solution containing 1

mg/ml.

• *Longer procedures*: Induction: total dose of 0.5-2 mg/kg; maintenance (using microdrip infusion), 10-45 micrograms/kg/minute, rate adjusted according to response.

Adverse effects: Emergence reactions (dream like state, vivid imagery, hallucinations and/or delirium, hypertension, increased cardiac output, increased ICP, tachycardia, tonic clonic movements, increased salivation. Dependence and tolerance with prolonged use, withdrawal syndrome with psychotic features on discontinuation of drug.

Drug and food interactions: With diazepam, may cause ventricular tachycardia or ventricular fibrillation.

MIDAZOLAM

Dosage form and strength: *Oromucosal solution*: 5 mg/ml, 10 mg/2 ml; *Solution for injection*: 1 mg/ml, 10 mg/5 ml; *Solution for infusion*: 50 mg/50 ml, 100 mg/50 ml

Indications: Status epilepticus, febrile convulsions, conscious sedation for procedures, sedative in combined anaesthesia, premedication, sedation of patient receiving intensive care, confusion and restlessness in palliative care, convulsions in palliative care

Contraindications/Precautions: CNS depression, compromised airway, severe respiratory depression. Cardiac disease, children (particularly if cardiovascular impairment), concentration of midazolam in children under 15 kg not to exceed 1 mg/mL, debilitated patients (reduce dose), hypothermia, hypovolemia (risk of severe hypotension), neonates, risk of airways obstruction and hypoventilation in children under 6 months (monitor respiratory rate and oxygen saturation), vasoconstriction. Caution in hepatic and renal impairment. To be avoided in breastfeeding women. Midazolam has a fast onset of action, recovery when used for sedation, is faster than for other benzodiazepines such as diazepam, but may be significantly longer in the elderly, in patients with a low cardiac output, or after repeated dosing.

Dosage schedule:

- *Status epilepticus /Febrile convulsions*: by buccal administration; Child 1-2 months: 300 micrograms/kg (max. per dose 2.5 mg), then 300 micrograms/kg after 10 minutes (max. per dose 2.5 mg) if required, Child 3-11 months: 2.5 mg, then 2.5 mg after 10 minutes if required, Child 1-4 years: 5 mg, then 5 mg after 10 minutes if required, Child 5-9 years: 7.5 mg, then 7.5 mg after 10 minutes if required, Adult: 10 mg, then 10 mg after 10 minutes if required
- *Conscious sedation for procedures*: by slow intravenous injection, Adult: Initially 2-2.5 mg, to be administered 5-10 minutes before procedure at a rate of approximately 2 mg/minute, increased in steps of 1 mg if required, usual total dose is 3.5-5 mg; maximum 7.5 mg per course, Elderly: Initially 0.5-1 mg, to be administered 5-10 minutes before procedure at a rate of approximately 2 mg/minute, increased in steps of 0.5-1 mg if required; maximum 3.5 mg per course
- *Sedative in combined anaesthesia*: initially by intravenous injection, Adult: 30-100 micrograms/kg, repeated if necessary, alternatively (by continuous intravenous infusion) 30-100 micrograms/kg/hour, Elderly: Lower doses

needed.

- *Premedication*: by deep intramuscular injection; Adult: 70–100 micrograms/kg, to be administered 20–60 minutes before induction, for debilitated patients, use elderly dose, Elderly: 25–50 micrograms/kg, to be administered 20–60 minutes before induction by intravenous injection, Adult: 1–2 mg, repeated if necessary, to be administered 5–30 minutes before procedure, for debilitated patients, use elderly dose, Elderly: 0.5 mg, repeated if necessary, to be administered 5–30 minutes before procedure, repeat dose slowly as required
- *Induction of anaesthesia (but rarely used)*: by slow intravenous injection
 - ▶ Adult: 150–200 micrograms/kg daily in divided doses (max. per dose 5 mg), dose to be given at intervals of 2 minutes, maximum total dose 600 micrograms/kg, for debilitated patients, use elderly dose, Elderly: 50–150 micrograms/kg daily in divided doses (max. per dose 5 mg), dose to be given at intervals of 2 minutes, maximum total dose 600 micrograms/kg
- *Sedation of patient receiving intensive care*: initially by slow intravenous injection, Adult: Initially 30–300 micrograms/kg, dose to be given in steps of 1–2.5 mg every 2 minutes, then (by slow intravenous injection or by continuous intravenous infusion) 30–200 micrograms/kg/hour, reduce dose (or reduce or omit initial dose) in hypovolaemia, vasoconstriction, or hypothermia, lower doses may be adequate if opioid analgesic also used
- *Confusion and restlessness in palliative care*: by subcutaneous infusion; Adult: Initially 10–20 mg/24 hours, adjusted according to response; usual dose 20–60 mg/24 hours
- *Convulsions in palliative care*: by continuous subcutaneous infusion; Adult: Initially 20–40 mg/24 hours.
- Note: It is advisable to keep the patient supine during i.v use and throughout the procedure. Midazolam should be given in reduced doses in elderly and debilitated patients.

Adverse effects: Decreased respiratory rate, apnea, drowsiness, seizure-like activity, nausea/vomiting, cough, pain at injection site, headache, sedation, hiccoughs, delirium, euphoria.

PROPOFOL

Dosage form and strength: *Injection*: 10 mg/ml and 20 mg/ml

Indications: Induction and maintenance of anesthesia, sedation for surgical and diagnostic procedures.

Contraindications/Precautions: Lack of ventilator support, severe cardiac dysfunction, documented hypersensitivity, egg allergy, soybean/soy allergy, sedation of ventilated children and adolescents <17 years, use in labor and delivery (cause neonatal depression). Proper aseptic technique imperative (drug vehicle capable of supporting rapid growth of organisms). Risk of potentially fatal propofol infusion syndrome in ICU patients. Pregnancy category B. Closely monitor patients with anemia, hepatic impairment, myxedema or renal impairment. Do not give bolus to ASA III/IV patients; rapid bolus will increase cardiorespiratory effects. Anxiety, agitation, resistance to mechanical ventilation may occur with abrupt withdrawal. Monitor for propofol infusion syndrome

Dosage schedule:

- *Induction of anesthesia: by IV injection:* 1.5-2.5 mg/kg (1-1.5 mg/kg in those >55 years) at the rate of 20-40mg every 10 seconds; child 3-16 yrs: 2.5-3.5 mg/kg IV over 20-30 seconds.
- *Maintenance of anesthesia: by IV injection:* 25-50mg repeated according to response or by IV infusion: 4-12 mg/kg/hour; child >3yrs by IV infusion: 9-15 mg/kg/hr.
- *Sedation for surgical and diagnostic procedures:* initially by IV injection over 1-5 minutes, 0.5-1 mg/kg;
- *Maintenance: by IV infusion:* 1.5-4.5 mg/kg/hour; child and adolescent under 17 years: not recommended.

Adverse effects: Bradycardia, hypotension, apnea, involuntary movements, injection site burning/ stinging/ pain, respiratory acidosis during weaning, hypertriglyceridemia, nausea, vomiting, hiccups.

Drug and food interactions: Additive CNS and respiratory depression with alcohol, antihistamines, opioid analgesics, and sedative/ hypnotics

THIOPENTAL SODIUM

Dosage form and strength: Powder for injection : 0.5 g, 1 g

Indications: Induction of anesthesia, rapid control of convulsions like status epilepticus

Contraindications/Precautions: Porphyria, known hypersensitivity, breast feeding, hypotension, status asthmaticus, severe cardiovascular diseases, hepatic or renal dysfunction. Anesthesia is deeper whenever protein binding is less, e.g. in liver disease. Slight extravasation of drug outside the vein can lead to severe pain, necrosis and gangrene. Never give into the arteries. Should be used freshly after opening. Pregnancy (C).

Dosage schedule: *Induction of anesthesia:* Adult dose: 100-150 mg (4-6 ml of 2.5% solution); can be repeated after 30-60 sec depending on response; Child dose: 2-7 mg/kg

Adverse effects: Respiratory and myocardial depression, cardiac arrhythmias, bronchospasm and laryngospasm with cough, rash, prolonged somnolence.

Drug and food interactions: Chemically reacts with succinylcholine; so, never give in same syringe.

8.2 Local anaesthetics**BUPIVACAINE**

Dosage form and strength: Injection: 0.25%, 0.5%

Indications: local infiltration, peripheral nerve block, epidural block, sympathetic block.

Contraindications/Precautions: Hypersensitivity. The drug should be used with caution in severely debilitated patients and in those with liver disease, renal impairment, pregnancy, impaired cardiac condition, in patients with myasthenia gravis and severe shock. Bupivacaine should not be used for IV anesthesia because it can prolong QT interval and lead to tachycardia or cardiac depression and should not be used for obstetric paracervical block.

Dosage schedule: Adjusted according to the site of operation and response of patient;

- *Local infiltration:* 0.25% (up to 60 ml); peripheral nerve block: 0.25% (maximum 60 ml), 0.5% (maximum 30 ml).
- *Epidural block surgery, lumbar:* 0.5% (maximum 20 ml); caudal: 0.5% (maximum 30 ml);
- *Labour, lumbar:* 0.25-0.5% (maximum 12 ml of either).

Adverse effects: Headache, bradycardia, hypotension, cardiac arrhythmias, cardiac arrest, anxiety, restlessness, tremor, dizziness, respiratory arrest. Hypersensitivity reactions manifested by oedema, status asthmaticus or anaphylactoid reaction.

LIDOCAINE (LIGNOCAINE)

Dosage form and strength: *Gel:* 2% w/v; *Injection:* 1%, 2%, 5% w/v

Indications: Arrhythmia, See under bupivacaine

Contraindications/Precautions: Hypersensitivity, 3rd degree heart block. See Bupivacaine, Pregnancy (B). Lignocaine should be stored at a temperature of 8-15° C. Any of the gel not used in a single application should be discarded.

Dosage schedule: Adjusted according to site of operation and response of patient.

- *Infiltration, by injection:* maximum dose 200 mg (or 500 mg with solution which also contains adrenaline; maximum dose of adrenaline 500 µg).
- *Nerve blocks with adrenaline 1 in 200,000:* 1% to a maximum of 40 ml.
- *Surface anaesthesia, usual strength:* for mouth, throat and upper gastrointestinal tract, maximum 200 mg.
- *Surface anaesthesia of urethra:* 2% gel, maximum 400 mg.

Adverse effects: See bupivacaine

PRILOCAINE HYDROCHLORIDE

Dosage form and strength: *Injection:* 3%

Indications: Infiltration for dentistry, nerve block

Contraindications/Precautions: Hypersensitivity. See lidocaine, pregnancy (C)

Dosage schedule: Adjusted according to site of operation and response of patient. 100-200 mg/minute to maximum 400 mg

Adverse effects: See Lidocaine

Drug and food interactions: Synergistic effect with timolol

PROCAINE HYDROCHLORIDE

Dosage form and strength: *Injection:* 3% w/v

Indications: Infiltration, peripheral nerve block, sympathetic nerve block, spinal anaesthesia

Contraindications/Precautions: See bupivacaine

Dosage schedule: Adjusted according to site of operation and response of patient. By injection, up to 1g (200ml of 0.5% solution or 100ml of 1% solution)

Adverse effects: See Bupivacaine

8.3 Preanaesthetic medications

8.3.1 Anticholinergics

ATROPINE

See under Atropine [OP poisoning management]

8.3.2 Benzodiazepines

DIAZEPAM

See under 'Drugs acting on the Central Nervous System'

LORAZEPAM

See under 'Drugs acting on the Central Nervous System'

MIDAZOLAM

See under 'Intravenous anaesthetics'

8.3.3 Opioid analgesics

FENTANYL

Dosage form and strength: 0.05 mg/ml

Indications: Induction and maintenance of anesthesia, analgesia (pre-operative and post-operative)

Contraindications/Precautions: Hypersensitivity, myasthenia gravis, within 2 hours of MAOI use. Pregnancy, breast feeding, geriatric patients, increased ICP, seizure disorders, cardiac dysrhythmias, severe respiratory disorders. Do not use fentanyl within 2 weeks of use of MAOIs.

Dosage schedule:

- *IV for spontaneous respiration:* Adult: 50-100 µg then 50 µg as required; children: 3-5 µg/kg, then 1 µg as required;
- *For assisted ventilation:* Adult: 0.3-3.5 mg then 100-200 µg as required; children: 15 µg/kg, then 1-3 µg as required

Adverse effects: confusion, delirium or sometimes paradoxical excitation, post-operative depression and drowsiness, bradycardia, arrest, hypotension or HTN, arrhythmias, respiratory depression, arrest, laryngospasm, blurred vision, double vision, miosis, nausea, vomiting, constipation, biliary spasm, urinary retention, rash, diaphoresis, muscle rigidity

Drug and food interactions: With MAOI, may produce unpredictable, potentially fatal reactions. CYP3A4 inhibitors increase plasma levels leading to increased risk of CNS and respiratory depression.

MORPHINE

See under 'Drugs acting on the Central Nervous System'

8.3.4 Others

METOCHLOPRAMIDE

See under 'Drugs used in gastrointestinal system'

OMEPRAZOLE

See under 'Drugs used in gastrointestinal system'

PROMETHAZINE

See under 'Drugs used in gastrointestinal system'

RANITIDINE

See under 'Drugs used in gastrointestinal system'

8.4. Neuromuscular blockers

PANCURONIUM

Dosage form and strength: *Solution:* 2 mg/ml in 2 ml ampoule

Indications: Neuromuscular blockade (long duration) during surgery/intubation/intensive care

Contraindications/Precautions: Avoid in neuromuscular disease, hypersensitive to drug &/or bromides. For use ventilator support is mandatory. Hepatic impairment: Possibly slower onset, higher dose requirement, and prolonged recovery time. Renal impairment: prolonged duration of block. If CrCl 10-50 mL/min then administer 50% normal dose, if CrCl <10 mL/min then avoid use. Pregnancy (C)

Dosage schedule:

- *Neuromuscular blockade (long duration) during surgery and intubation:* intravenous injection, adult: Initially 100 mcg/kg, then 20 mcg/kg as required
- *Neuromuscular blockade (long duration) during intensive care:* intravenous injection, adult: Initially 100 mcg/kg, initial dose is optional, then 60 mcg/kg every 60-90 minutes. Doses at extremes of body-weight: To avoid excessive dosage in obese patients, dose should be calculated on the basis of ideal bodyweight

Adverse effects: Acute myopathy (after prolonged use in intensive care), hypertension, tachycardia

Drug and food interaction: With or following an opioid, sedative or anesthetic agent- additive/synergistic effects

ROCURONIUM BROMIDE

Dosage form and strength: *Solution:* 10 mg/ml

Indications: Neuromuscular blockade (intermediate duration) during surgery/intubation/intensive care

Contraindications/Precautions: Avoid in neuromuscular disease, hypersensitive to drug &/or bromides. For use ventilator support is mandatory. Hepatic impairment: reduce dose. Renal impairment: reduce maintenance dose; prolonged paralysis. Pregnancy (C)

Dosage schedule:

- *Neuromuscular blockade (intermediate duration) during surgery and intubation*: intravenous injection, adult: Initially 600 mcg/kg; intravenous injection maintenance 150 mcg/kg, OR intravenous infusion, adult: maintenance 300–600 mcg/kg/hour, adjusted according to response. Intravenous injection, elderly: Initially 600 mcg/kg, maintenance 75–100 mcg /kg, OR maintenance (intravenous infusion) up to 400 mcg/kg/hour, adjusted according to response.
- *Neuromuscular blockade (intermediate duration) during intensive care*: intravenous injection, adult: Initially 600 mcg/kg, initial dose is optional; intravenous infusion maintenance 300–600 mcg/kg/hour for first hour, then by intravenous infusion, adjusted according to response.
- To avoid excessive dosage in obese patients, dose should be calculated on the basis of ideal bodyweight.

Adverse effects: Anaphylactoid reactions, acute myopathy (after prolonged use in intensive care), bronchospasm, hypotension, skin flushing, tachycardia

Drug and food interaction: With or following an opioid, sedative or anesthetic agent- additive/synergistic effects

VECURONIUM

Dosage form and strength: *Solution*: 10 mg/ml

Indications: Neuromuscular blockade (intermediate duration) during surgery/ intubation

Contraindications/Precautions: Avoid in neuromuscular disease, hypersensitive to drug &/or bromides. For use ventilator support is mandatory. Hepatic impairment: reduce dose in severe impairment. Renal impairment: use caution. Pregnancy (C)

Dosage schedule: *Neuromuscular blockade (intermediate duration) during surgery and intubation*: intravenous injection, adult: 80–100 mcg/kg; maintenance: intravenous injection: 20–30 mcg/kg, adjusted according to response, maximum dose in caesarean section:100 micrograms/kg. OR, maintenance: intravenous infusion: 0.8–1.4 mcg/kg/minute, adjusted according to response.

To avoid excessive dosage in obese patients, dose should be calculated on the basis of ideal bodyweight.

Reconstitute each vial with 5 mL Water for Injections to give 2 mg/mL solution; alternatively reconstitute with up to 10 mL Glucose 5% or Sodium Chloride 0.9% or Water for Injections- unsuitable for further dilution if not reconstituted with Water for Injections. For continuous intravenous infusion, dilute reconstituted solution to a concentration up to 40 mcg/L with Glucose 5% or Sodium Chloride 0.9%; reconstituted solution can also be given via drip tubing.

Adverse effects: Anaphylactoid reactions, acute myopathy (after prolonged use in intensive care), bronchospasm, hypotension, skin flushing, tachycardia

Drug and food interaction: With or following an opioid, sedative or anesthetic agent- additive/synergistic effects

8.5. Anticholinesterase

NEOSTIGMINE

Dosage form and strength: *Tablet:* 15 mg. *Solution for injection:* 2.5 mg/ml ampoules, 10 mg/ml in 50mg/5ml vials

Indications: Treatment of myasthenia gravis, reversal of non-depolarising (competitive) neuromuscular blockade

Contraindications/Precautions: Renal impairment: reduce dose. Pregnancy and breast feeding: use with caution

Dosage schedule:

- *Treatment of myasthenia gravis:* oral, adult: Initially 15-30 mg, dose repeated at suitable intervals throughout the day, total daily dose 75-300 mg, maximum dose: 180 mg daily. Subcutaneous injection or by intramuscular injection, adult: 1-2.5 mg, dose repeated at suitable intervals throughout the day (usual total daily dose 5-20 mg)
- *Reversal of non-depolarising (competitive) neuromuscular blockade:* intravenous injection, adult: 2.5 mg (max. per dose 5 mg), repeated if necessary after or with glycopyrronium or atropine, to be given over 1 minute

Adverse effects: Anaphylactoid reactions, acute myopathy (after prolonged use in intensive care), bronchospasm, hypotension, skin flushing, tachycardia

Drug and food interaction: With or following an opioid, sedative or anesthetic agent- additive/synergistic effects

Section II - Chapter 9

Drugs used in Musculoskeletal & Joint Disorders

9.1 *Drugs used in gout*

Allopurinol
Colchicine
Febuxostat
Probenecid
Sulfinpyrazone

9.2 *Disease modifying anti-rheumatic drugs (DMARDs)*

Abatacept
Adalimumab
Anakinra
Etanercept
HCQS (Hydroxychloroquine sulfate)
Infliximab
Leflunomide
Methotrexate
Penicillamine
Rituximab
Sulfasalazine
Tocilizumab
Tofacutinib

9.3 *Non-steroidal anti-inflammatory drugs (NSAIDs)*

9.3.1 *Non-selective COX inhibitors*

Aceclofenac
Aspirin
Diclofenac
Flurbiprofen
Ibuprofen
Indomethacin
Mefenamic acid
Naproxen
Paracetamol
Piroxicam

9.3.2 *Selective COX-2 inhibitors*

Celecoxib
Etoricoxib

9.4 *Drug used in osteoarthritis and osteoporosis*

9.4.1 *Anthraquinone*

Diacerein

9.4.2 *Bisphosphonates*

Alendronate

Etidronate
Ibandronate
Pamidronate
Risedronate
Zoledronate

9.5 Skeletal muscle relaxants

9.5.1 Centrally acting muscle relaxants

Baclofen
Dexmedetomidine
Midazolam
Tizanidine
Denosumab

9.1 Drugs used in gout

ALLOPURINOL

Dosage forms and strength: *Tablets:* 100 mg, 300 mg

Indications: Primary hyperuricemia of gout, secondary hyperuricemia due to haematological malignancies or anti-neoplastic therapy; especially useful for high uric acid levels and recurrent renal stones.

Contraindications/Precautions: Known hypersensitivity. Caution use in pregnancy, breast feeding, hepatic and renal impairment, elderly and children. Liberal fluid intake is advocated during treatment. Pregnancy category C. Risk of hypersensitivity may increase with concomitant administration of thiazides.

Dosage schedule:

- *Adults:* 300 mg/ day after meal, gradually increased at weekly intervals to maximum of 800 mg/day, *maintenance dose:* 200- 300 mg in mild case, 400-600 mg in moderate to severe case
- *Children:* use only if benefit outweighs risk 150-300 mg/day once daily.

Adverse effects: Nausea, vomiting, diarrhoea, gastric irritation, maculopapular rash, rarely exfoliative dermatitis and Steven's Johnson syndrome, arthralgia, myalgia, fever, malaise, aplastic anaemia, alopecia, acute hepatic failure, intestinal nephritis.

Drugs and food interaction: Risk of hypersensitivity increased with aspirin, azathioprine, benazepril, captopril, dienogest/estradiol valerate, enalapril, ethinylestradiol, levonorgestrel intrauterine/oral, medroxyprogesterone, theophylline, valproic acid, warfarin. During concomitant treatment, reduce dosages of azathioprine and mercaptopurine to 25-33% of usual.

Patient information: Maintain fluid intake necessary to yield urine output of at least 2 L/day in adults.

COLCHICINE

Dosage forms and strength: *Tablet:* 0.5 mg

Indications: Treatment of acute gout, prophylaxis of recurrent acute attacks, during initiation of allopurinol therapy.

Contraindications/Precautions: Known hypersensitivity, previous failed response, blood disorders, GI disturbance, renal diseases, elderly, cardiac disease, pregnancy (C), lactation.

Dosage schedule:

- *Acute:* 1 mg initially followed by 0.25-0.5 mg 2-3 hourly until attack is controlled/ diarrhoea starts (max. dose 4 mg)
- *Prophylaxis:* 0.5 mg/day, short-term prophylaxis during initial allopurinol (0.5 mg BD)

Adverse effects: GI disturbance, bloody diarrhoea, abdominal cramps, toxic doses cause kidney damage, intestinal bleeding, CNS depression, respiratory failure, muscular paralysis, chronic therapy cause agranulocytosis, myopathy and hair loss

Drugs and food interaction: Clarithromycin, darunavir, itraconazole, ritonavir, telithromycin aspirin, atorvastatin, carbamazepine.

Patient information: Take medicine with meal. Do a routine blood test in between medication. Report if bloody diarrhoea occurs.

FEBUXOSTAT

Dosage forms and strength: *Tablet:* 40 mg, 80 mg.

Indication: Chronic gout.

Contraindications/Precautions: Co-administration with theophylline, pregnancy (C), azathioprine, mercaptopurine, congestive heart failure, ischemic heart disorders, transplant recipients, monotherapy in acute gouty arthritis.

Dosage schedule: *Initially:* oral - 40 mg/day; *maintenance:* 40-80 mg/day (increased if serum uric acid >6 mg/ml after 2 weeks, use prophylactic colchicine or NSAID for at least 3 months after starting febuxostat to avoid precipitating acute attack).

Adverse effects: Elevated liver function tests, GI disturbances, headache, oedema, rash, other uncommon like arthralgia, atrial fibrillation, bronchitis.

Drug and food interaction: Azathioprine, mercaptopurine, theophylline (increases their level so contraindicated).

Patient information: Lab and/or medical tests (such as uric acid blood levels, liver function tests) may be done while you are taking this medication.

PROBENECID

Dosage form and strength: *Tablet:* 500 mg

Indications: Chronic gout, secondary hyperuricemia due to drugs or diseases, prolong penicillin action in subacute bacterial endocarditis (SABE) and gonorrhoea.

Contraindications/Precautions: Peptic ulcer, hypersensitivity, history of renal calculi, renal impairment, may precipitate an acute gouty attack, used concomitantly with NSAID or colchicine, pregnancy (B), lactation.

Dosage schedule:

- *Gout:* 250 mg BD x 1 week followed by 500 mg BD
- *Gonorrhoea:* 1 g oral with 2 g cefotaxime IM BD

Adverse effects: Gastric irritation, hypersensitivity, overdose: - seizures and respiratory failure

Drugs and food interaction: See under colchicine.

Patient information: Discontinue if allergic reaction occurs. Take plenty of fluid. Take with milk, food and antacid.

SULPHINPYRAZONE

Dosage form and strength: *Tablet:* 100 mg and 200 mg

Indications: Same as probenecid

Contraindications/Precautions: Same as probenecid

Dosage schedule: 100-200 mg/day taken with food initially; increased to 600-800 mg/day over 2-3 weeks. Continue till serum acid concentration is normal then reduce dose for maintenance.

Adverse effects: Acute renal failure, GI bleeding and ulceration, elevated liver enzymes, jaundice, hypersensitivity.

Drug and food interaction: See under colchicine

Patient information: Discontinue if allergic reaction occurs.

9.2 Disease modifying anti-rheumatic drugs (DMARDs)**ABATACEPT**

Dosage form and strength: *Injection:* 125 mg/ml SC, 250 mg/vial IV.

Indications: Moderate to severe RA, psoriatic arthritis, DM (I).

Contraindications/Precautions: In COPD patients (due to higher risk of infection), hypersensitivity, pregnancy (C), latent TB, do not give live vaccines < 3 months after discontinuation.

Dosage schedule:

- *Wt. <60 kg:* 50mg IV on day 1 followed by 125 mg on day 2 and then weekly thereafter or 500 mg IV 2 weekly for 3 doses then 4 weekly;
- *Wt. 60-100 kg:* 750mg IV on day 1 then 125 mg on day 2 then weekly;
- *Wt. >100kg:* 1000mg IV on day 1 then 125 mg on day 2 then weekly.

Adverse effects: Infection, nasopharyngitis, headache, nausea, cough, backpain, hypertension, dyspepsia, UTI, rash, pain in extremity.

ADALIMUMAB

Dosage form and strength: *Injection:* 40 mg/0.8 ml solution for injection pre-filled syringes

Indications: Moderate to severe active rheumatoid arthritis (in combination with methotrexate or alone if methotrexate inappropriate), severe active and progressive rheumatoid arthritis (in combination with methotrexate or alone if methotrexate inappropriate), active and progressive psoriatic arthritis, severe active ankylosing spondylitis, severe active Crohn's disease, severe active ulcerative colitis.

Contraindications/ Precautions: Moderate heart failure, severe infection/ active tuberculosis. Children should be brought up to date with current immunisation schedule before initiating therapy, demyelinating disorders (risk of exacerbation), development of malignancy, do not initiate until active infections are controlled (discontinue if new serious infection develops), hepatitis B virus-monitor for active/ severe plaque psoriasis. Screening for latent TB infection/chronic viral infection before starting therapy (CXR, HBsAG, antiHIV, Mantoux test)

Dosage schedule:

- *Moderate to severe active rheumatoid arthritis:* (oral)- 40 mg every 2 weeks, dose to be increased after achieving remission only in patients receiving adalimumab alone.
- *Active and progressive psoriatic arthritis, severe active ankylosing spondylitis:* by SC- 40 mg every 2 weeks, discontinue treatment if no response within 12 weeks.
- *Severe active Crohn's disease:* by SC - 40mg once in 2weeks, taper to once in 1-2 month upon remission.
- *Severe active Crohn's disease (accelerated regimen):* by SC- initially 160 mg, dose can alternatively be given as divided injections over 2 days, then 80 mg after 2 weeks; maintenance 40 mg every 2 weeks, increased if necessary to 40 mg once weekly, maximum 40 mg administered at a single site, review treatment if no response within 12 weeks of initial dose.
- *Severe active ulcerative colitis:* by SC- initially 160 mg, dose can alternatively be given as divided injections over 2 days, then 80 mg after 2 weeks;

maintenance 40 mg every 2 weeks, increased if necessary to 40 mg once weekly, maximum 40 mg administered at a single site, review treatment if no response within 8 weeks of initial doses.

Adverse effects: Anxiety, benign tumours, chest pain, cough, dehydration, dermatitis, dizziness, dyspepsia, dyspnoea, electrolyte disturbances, eye disorders, flushing, gastrointestinal haemorrhage, haematuria, hyperlipidaemia, hypertension, hyperuricaemia, impaired healing, mood changes, musculoskeletal pain, oedema, onychosis, paraesthesia, rash, renal impairment, skin cancer, sleep disturbances, tachycardia, vomiting, ingestion site pain, congestive cardiac failure, reactivation of latent TB infection.

Drugs and food interactions: Increased risk of side-effects when adalimumab given with abatacept, avoid concomitant use of adalimumab with anakinra.

ANAKINRA

Dosage form and strength: *Injection:* 100 mg/ 0.067 ml

Indication: Rheumatoid arthritis (combination with methotrexate) which hasn't responded to methotrexate alone.

Contraindications/ Precautions: Neutropenia, hypersensitivity to drug, live vaccine. History of asthma (risk of severe infections), predisposition to infection, elderly, renal impairment, chronic infections, immunosuppression. Discontinue if severe infection develops and don't initiate during active infections. Pregnancy (B).

Dosage schedule: 100 mg once daily

Adverse effects: Neutropenia, antibody formation, headache, infection, injection site reactions, malignancy.

Drugs and food interactions: Lenalidomide, thalidomide.

ETANERCEPT

Dosage form and strength: *Injection:* 25 mg/ml and 50 mg/ml

Indications: Ankylosing arthritis, rheumatoid arthritis, polyarticular idiopathic juvenile arthritis, plaque psoriasis.

Contraindications/Precautions: Acute serious infection, sepsis hypersensitivity. Concomitant use of live vaccines

Dosage schedule:

- *Ankylosing spondylitis:* 50 mg SC once weekly or 25 mg SC twice weekly, if twice weekly doses should be given on same day or 3-4 days apart;
- *Acute rheumatoid arthritis:* 50 mg SC once weekly;
- *Psoriatic arthritis:* 50 mg SC once weekly;
- *Plaque psoriasis:* initial- 50 mg SC twice weekly for 3 months, maintenance- 50 mg SC once weekly.

Adverse effects: Serious infection and malignancy risk, headache, rhinitis, haematological disorders.

Drugs and food interaction: Concurrent cyclophosphamide therapy

HYDROXYCHOLOROQUINE SULFATE (HCQs)

Dosage form and strength: *Tablet:* 200 mg

Indications: Early and mild acute rheumatoid arthritis, dermatologic conditions caused or aggravated by sunlight.

Contraindications/ Precautions: Hypersensitivity to 4-aminoquinoline derivatives, retinal or visual field changes 4-aminoquinoline compounds, long term therapy in children, pregnancy (C). Acute porphyria, elderly, G6PD deficiency, neurological disorders (especially in history of epilepsy), may aggravate myasthenia gravis, psoriasis, shouldn't be used for psoriatic arthritis, discontinue if ocular toxicity suspected, retinal changes may progress even after cessation of therapy.

Dosage schedule: Oral- 400mg once daily 4-6 weeks; maintenance dose- 200mg oral daily

Adverse effects: GI disturbances, headache, pruritus, rashes, skin reactions, convulsions, discoloration of skin hair, nails and mucous membranes, ECG changes, ototoxicity, retinal damage and keratopathy.

Drugs and food interaction: Avoid concurrent use of hepatotoxic drugs

INFLIXIMAB

Dosage and strength: *Injection:* 100 mg/vial

Indications: Severe active Crohn's Disease, severe active ulcerative colitis, rheumatoid arthritis (in combination with methotrexate), ankylosing spondylitis, psoriatic arthritis, plaque psoriasis

Contraindications/Precautions: Heart failure, severe infection, conception is avoided during and at least 6 months after the last dose, active TB. Caution in people with demyelinating disorders, history of colon cancer (in inflammatory bowel disease), history of prolonged immunocompromised/PUVA treatment in pts. with psoriasis, pregnancy category B.

Dosage schedule:

- *Rheumatoid Arthritis (In combination with methotrexate):* IV initially 3 mg/kg then 3 mg/kg after 4 weeks then 3mg/kg q8 weekly, increased only if response is inadequate after 12 weeks, increased in steps of 1.5 mg/kg q8 weekly, max. 7.5 mg/kg q8 weekly;
- *Crohn's disease and ulcerative colitis, ankylosing spondylitis, psoriatic arthritis:* initially 5 mg/kg then 5 mg/kg after 2 weeks then 5 mg/kg after 4 weeks, maintenance- 5 mg/kg q 8 weekly.

Adverse effects: Risk of infection (TB, HBV), hypersensitivity, injection site reaction, long term use in cancer like lymphoma and skin cancer, alopecia, diarrhoea, GI haemorrhage, dizziness, palpitation, psoriasis, rash (Stevens-Johnson-Syndrome), paraesthesia.

Drugs and food interaction: Abatacept, adalimumab, alefacept, anakinra, anthrax vaccine, azathioprine, BGC vaccine live, cyclosporine, diphtheria & tetanus toxoids, etanercept, haemophilus influenzae type b vaccine, hepatitis A vaccine inactivated, hydroxychloroquine sulphate, Japanese encephalitis virus vaccine, measles (rubeola) vaccine.

LEFLUNOMIDE

Dosage form and strength: *Tablet:* 10 mg, 20mg

Indications: Active rheumatoid arthritis, active psoriatic arthritis

Contraindications/Precautions: Active serious infection, severe hypoproteinaemia, liver disease, hepatitis B or C seropositive, severe immunodeficiencies, hypersensitivity to leflunomide, concomitant live virus vaccine, pregnancy (X), lactation. Avoid in significant anaemia, old age, active

TB, impaired bone marrow function, leukopenia, thrombocytopenia, monitor liver enzymes, CBC and electrolyte levels.

Dosage schedule:

- *Moderate to severe active rheumatoid arthritis and active psoriatic arthritis:* adult- 10-20mg once a day.
- *Refractory polyarticular juvenile idiopathic arthritis:* up to 10 mg once a day

Adverse effects: Abdominal pain, diarrhoea, nausea, vomiting, hepatotoxicity, rashes, dry skin, alopecia, pruritic, oral mucosal disorders, dizziness, headache, hypertension, paraesthesia, leukopenia, thrombocytopenia, tenosynovitis, malignant weight loss.

Drugs and food interaction: Hepatotoxic drugs, other DMARDs.

Patient information: Avoid pregnancy for 3 years if on leflunomide or detoxification/drug wash out with cholestyramine advised.

METHOTREXATE

Dosage form and strength: *Tablet:* 2.5 mg, 5 mg, 7.5 mg, 10 mg and 15 mg;
Injection: 25 mg/ml

Indications: Rheumatoid arthritis, choriocarcinoma, acute leukaemia in children, psoriasis, organ transplantation, juvenile idiopathic arthritis, active scleroderma, musculoskeletal predominant SLE.

Contraindications/Precautions: Pregnancy (X), alcoholism, alcoholic liver disease, immunodeficiency, pre-existing blood dyscrasias, hypersensitivity. Elderly patient monitors closely for signs of hepatic, renal and bone marrow toxicity (taking with folic acid 1 mg/day significantly reduces toxicity). Pregnancy (X): Use folic acid 5 mg once a week preceding methotrexate.

Dosage schedule:

- *Severe active RA in adult resistant to 1st line treatment:* adult -15 mg/week to 25 mg/week (increases by 5 mg every 4 to 6 weeks);
- *Paediatrics:* 5-7.5 mg/week to 15mg/week, increases by 2.5mg every 4 to 6 weeks.

Adverse effects: Bone marrow toxicity causing pancytopenia, desquamation and bleeding in GIT (mucositis). On long term use pneumonitis, pulmonary fibrosis and hepatic cirrhosis.

PENICILLAMINE

Dosage form and strength: *Tablet:* 250 mg; *Capsule:* 125 mg, 250 mg

Indications: Wilson's disease, autoimmune hepatitis, cystinuria, chronic lead and arsenic poisoning.

Contraindications/Precautions: Lupus erythematosus, simultaneous with gold therapy. Neurologic involvement in Wilson's disease, hematologic disorders, pregnancy category D

Dosage schedule:

- *Wilson's disease:* 1.5-2 g/day in divided doses, *maintenance dose:* 0.75-1g/day for 1 year (max. 2g/day);
- *Autoimmune hepatitis:* 500mg/day in divided doses, increased slowly over 3 months to maintenance of 1.25g/day;
- *cystinuria:* 1g/day individual doses

Adverse effects: Anorexia, nausea, taste loss, SLE and myasthenia gravis may be precipitated, proteinuria and kidney damage, thrombocytopenia,

rash, Stevens-Johnson syndrome, bone marrow depression.

Drugs and food interaction: Ferrous fumarate, ferrous gluconate, MgSO₄ sodium bicarbonate.

RITUXIMAB

Dosage form and strength: *Injection:* 10 mg/ml

Indications: Moderate to severe active RA not responsive to methotrexate alone, non-Hodgkin's Lymphoma, CLL, refractory lupus/lupus nephritis, vasculitis, intestinal lung disease.

Contraindications/Precautions: Hypersensitivity. Caution in angina, arrhythmia, pregnancy category C.

Dosage schedule: *Rheumatoid arthritis:* 1g iv infusion separated by 2 weeks on D₁ and D₁₅ then similar two doses after 6 months, continue in similar fashion according to clinical response. Pre-medicate with glucocorticoid 30 mins before infusion to reduce infusion reaction

Adverse effects: Hypertension, hypercholesterolemia, arthralgia, tumour lysis syndromes in NHL, pruritus, urticaria, URTI, dyspepsia, nausea and abdominal pain, risk of reactivation of hepatitis B, PML (Progressive multifocal Leukoencephalopathy), Steven Johnsons syndrome, cardiac arrest and chest pain, neuropathy.

Drugs and food interaction: Concomitant cisplatin- fatal infusion reaction (angioedema) within 24 hrs may occur, especially with 1st dose.

Patient information: Avoid pregnancy for at least 12 months after treatment has finished, greater risk of cardiac problems/ lung problems in elderly, caution while driving, do not have immunisation without consent of doctor.

SULFASALAZINE

Dosage form and strength: *Tablet:* 500 mg

Indications: Rheumatoid arthritis, inflammatory bowel disease, ankylosing spondylitis, juvenile chronic arthritis.

Contraindications/Precautions: Porphyria, sulfer allergy. Caution in bronchial asthma, blood dyscrasias, pregnancy category B (D if used for prolonged periods or near term), increased risk of neural tube defects and neonatal jaundice.

Dosage schedule:

• *Rheumatoid arthritis:* oral- 2-3 g/day (enteric coated)

• *Crohn's disease:* 3-6 g/day.

Adverse effects: Anorexia, nausea/vomiting, GI distress, headache, reversible oligospermia, haemolytic anaemia, rash and pruritus.

TOCILIZUMAB

Dosage form and strength: *Injection:* 20 mg/ml; *Pre-filled syringes:* 0.9 mg/ml

Indication: Moderate to severe active RA

Contraindications/Precautions: Hypersensitivity, discontinue therapy if ANC (absolute neutrophilic count) <500/mm³, thrombocytopenia <50,000/mm³ and ALT/AST > 5 times upper limit of normal, diverticulitis. Do not give live vaccines.

Dosage schedule:

- *IV infusion:* 4-8 mg/kg q4weekly (max. dose is 800 mg per dose);
- *SC infusion:* wt. <100 kg: 162 mg every other week, wt. >100 kg: 162 mg per week.

Adverse effects: Infections, gastritis, elevated lipid levels, infusion related skin reactions.

Drugs and food interaction: See under methotrexate.

TOFACUTINIB

Dosage form and strength: *Tablet:* 5 mg, 11 mg extended release

Indications: Moderate to severe active RA with inadequate response to methotrexate, psoriatic arthritis, refractory JIA and refractory seropositive arthritis.

Contraindications/Precautions: Diverticulitis, lymphocytes <500/mm³, neutrophil <500/mm³ and Hb <8.0 g/dl. Pregnancy category C.

Dosage schedule: 5 mg twice a day or 11 mg once daily.

Adverse effects: Infections

Drugs and food interaction: Do not exceed 5 mg/day in renal and hepatic impairment and when using with CYP3A4 inhibitors like fluconazole, erythromycin and omeprazole. Do not give live vaccines. May produce toxicity when coadministered with CYP3A4 inhibitors.

9.3 Non-steroidal anti-inflammatory drugs (NSAIDs)

NSAIDs have analgesic and anti-inflammatory effects. Differences in anti-inflammatory activity between NSAIDs are small, but there is considerable variation in individual patient's response. About 60% of patients will respond to any NSAIDs. Among the rest, those who do not respond to one may respond to another.

Indications: Analgesic, antipyretic, anti-inflammatory, antithrombotic, closure of ductus arteriosus in newborn.

Contraindications/ Precautions: GI bleeding, hepatic and renal impairment, coma, seizure.

Adverse effects: Gastric mucosal damage, bleeding, Na⁺ and water retention, prolongation of labor, asthma and anaphylactoid reactions in susceptible individuals.

Drugs and food interaction: Oral anticoagulants, lithium oral hypoglycaemic agents, phenytoin, methotrexate, digoxin, aminoglycosides.

9.3.1 Non-selective cyclo-oxygenase (COX) inhibitors**ACELECOFENAC**

Dosage form and strength: *Tablet:* 100 mg, 200 mg (SR)

Indications: Rheumatoid arthritis, osteoarthritis, ankylosing spondylitis, analgesic, fibromyalgia.

Contraindications/Precautions: Active gastro-intestinal bleeding, active gastro-intestinal ulceration, history of gastrointestinal bleeding related to previous NSAID therapy, history of gastro-intestinal perforation related to previous NSAID therapy, history of recurrent gastro-intestinal haemorrhage,

history of recurrent gastro-intestinal ulceration, severe heart failure.

Allergic disorder, avoid in acute porphyria's, cardiac impairment, coagulation defects, connective tissue disorder, Chron's disease, elderly, history of cardiac failure, hypertension, left ventricular dysfunctions, oedema, ulcerative colitis, pregnancy, breastfeeding, hepatic and renal impairment.

Dosage schedule: 100 mg twice daily (child- not recommended)

Adverse effects: Allergy and cross-sensitivity, exacerbation of symptoms of asthma, angioedema, raised blood pressure, colitis, pancreatitis, hearing disturbance, tinnitus, vertigo.

Drugs and food interaction: See under NSAIDs as general.

ASPIRIN

Dosage form and strength: *Tablets:* 50 mg, 75 mg and 300 mg; *Dispersible tablets:* 350 mg.

Indications: Mild to moderate pain and fever, rheumatic fever.

Contraindications/Precautions: Haemophilia, previous or active peptic ulcer, children and adolescents under 16 years, breast-feeding, gout, heart disease, high blood pressure, congestive heart failure, erosive gastritis, peptic ulcer, impaired renal and hepatic function, asthma, third trimester of pregnancy.

Dosage schedule:

• *Mild to moderate pain and pyrexia:* 300-900 mg every 4-6 hours when necessary, maximum 4 g daily; *child and adolescent:* not recommended.

Adverse effects: Dyspepsia, epigastric distress, gastrointestinal bleeding, mucosal lesions (erosive gastritis, gastric ulcer), tinnitus and hearing loss by high dose aspirin, prolongation of bleeding time, hypersensitivity reactions with skin rashes and asthma.

Drugs and food interaction:

- Acetazolamide: Increased risk of toxicity with high-dose aspirin
- Antacids (Aluminum hydroxide, Magnesium hydroxide): Excretion of acetylsalicylic acid increased by alkaline urine
- Dexamethasone: Increased risk of gastrointestinal bleeding and ulceration.
- Enalapril: Antagonism of hypotensive effect, risk of renal impairment when acetylsalicylic acid given in doses of over 300mg daily.
- Heparin: Enhanced anticoagulant effect.
- Hydrocortisone: Increased risk of gastrointestinal bleeding and ulceration
- Ibuprofen: Avoid concomitant use (increased adverse effects); antiplatelet effect of acetylsalicylic acid possibly reduced
- Methotrexate: Reduced excretion of methotrexate
- Metoclopramide: Enhanced effect of acetylsalicylic acid (increased rate of absorption)
- Phenytoin: Enhancement of effect of phenytoin
- Prednisolone: Increased risk of gastrointestinal bleeding and ulceration
- Spironolactone: Antagonism of diuretic effect
- Valproate: Enhancement of effect of valproate
- Warfarin: Increased risk of bleeding due to antiplatelet effect

Patient information: Avoid alcohol ingestion, GI bleeding may occur. Report symptoms of hepatotoxicity, renal toxicity, visual changes, ototoxicity, allergic reactions, bleeding (long-term therapy). Medication is not to be given

to children or teens with flulike symptoms or chickenpox because Reye's syndrome may develop.

DICLOFENAC

Dosage forms and strength:

- Diclofenac sodium: *Tablet*: 50 mg and 100 mg; *Injection*: 25 mg/ml; *Gel*: 3%
- Diclofenac potassium: *Tablet*: 25 mg, 50 mg

Indications: Rheumatic disease, osteoarthritis, juvenile arthritis, acute gout, post-operative pain, dysmenorrhea.

Contraindications/Precautions: Active gastro-intestinal bleeding or ulceration, cerebrovascular disease, history of gastro-intestinal bleeding or perforation related to previous NSAID therapy, ischemic heart disease, heart failure, peripheral arterial disease, third trimester of pregnancy, onset of labour (delayed and duration may be increased), history of hypersensitivity reactions to aspirin or other NSAIDs, breast-feeding, renal or cardiac or hepatic impairment

Dosage schedule:

- *Adult*: oral-75-150 mg daily in 2-3 divided doses preferably after food, by deep IM into the gluteal muscle;
- *Acute exacerbations and postoperative pain*: 75 mg once daily (twice daily in severe cases) for maximum of 2 days;
- *Ureteric colic*: oral- 75 mg then a further 75 mg after 30 minutes if necessary by IV-75 mg repeated after 4-6 hours for maximum 2 days.
- Maximum total dose by any route 150 mg.
- *In child (1 year or over) for juvenile arthritis (oral)*: 1-3 mg/kg daily in divided doses.

Adverse effects: Hypersensitivity reactions like rashes, angioedema, bronchospasm, dizziness, headache, drowsiness, fluid retention (precipitating congestive heart failure) and raised blood pressure, gastro-intestinal discomfort like nausea, vomiting, diarrhoea, gastro-intestinal ulceration and bleeding, haematuria, hearing disturbances like tinnitus and vertigo, insomnia, nervousness, renal failure (especially in patients with pre-existing renal impairment), NSAIDs induced headache.

Drugs and food interactions: *Increase-* Hyperkalaemia with potassium-sparing diuretics, increase- anticoagulant effect-anticoagulants, NSAIDs, platelet inhibitors, salicylates, thrombolytics, SSRIs, increase-toxicity-phenytoin, lithium, cyclosporine, methotrexate, digoxin, increases- GI side effects-aspirin, other NSAIDs, bisphosphonates, corticosteroids; *decrease-* antihypertensive effect-beta-blockers, diuretics, ACE inhibitors, decrease-effect of diuretic.

Patient information: To take with food, milk or antacids to avoid GI upset. To avoid aspirin, alcoholic beverages, NSAIDs, or other over the counter drugs medications unless approved by prescriber. Do not lie down for 15-30min after taking medication. Monitor weight and report gain greater than 1kg/24hrs.

FLURBIPROFEN

Dosage form and strength: *Tablets (coated)*: 50 mg, 100 mg and 200 mg.

Indications: Rheumatic disease, other musculoskeletal disorders, mild to

moderate pain including dysmenorrhea, post-operative pain.

Contraindications/Precautions: Breast-feeding, renal or cardiac or hepatic impairment; Lab test (Hgb, LFT, KFT, audiometry and eye test) should be under taken regularly. Monitor for GI bleeding.

Dosage schedule: Oral- 150 -200 mg daily in divided doses, increased in acute conditions to 300 mg daily.

• *Dysmenorrhea:* initially 100 mg then 50-100 mg every 4-6 hours, maximum 300 mg daily.

Adverse effects: Similar to ibuprofen but more gastro-intestinal adverse effects than ibuprofen.

Drugs and food interaction: See under NSAIDs as general.

IBUPROFEN

Dosage form and strength: *Tablet:* 200 mg, 400 mg; *Oral liquid:* 100mg/5ml.

Indications: Rheumatoid arthritis, osteoarthritis, primary dysmenorrhea, dental pain, musculoskeletal disorders, fever, migraine.

Contraindications/Precautions: Pregnancy (D) 3rd trimester, hypersensitivity to this product, NSAIDs, asthma, severe renal and hepatic disease. Pregnancy(C) 1st and 2nd trimester, breastfeeding, children, geriatric patients, bleeding disorders, GI disorders, cardiac disorders.

Dosage schedule: *Adult-* initially 1.2-1.8 g daily in 3-4 divided doses preferably after food, increased if necessary to maximum of 2.4 g daily, maintenance dose of 0.6-1.2 g daily may be adequate; *child* - 20-30 mg/kg daily in divided doses (juvenile arthritis up to 40 mg/kg daily), not recommended for children under 5 kg.

Adverse effects: Gastrointestinal irritation, bleeding, hypersensitivity reactions like rash, angioedema, bronchospasm, pruritic, photosensitivity and photophobia, tinnitus, dizziness, headache, fluid retention, vertigo.

Drugs and food interaction: See under NSAIDs as general

Patient information: To use sunscreen, sunglasses, and protective clothing to prevent photosensitivity, report blurred vision, ringing, roaring in ears, so that eye and hearing tests should be done during long-term therapy, avoid driving, other hazardous activities if dizziness or drowsiness occurs, avoid alcohol, NSAIDs, salicylates, bleeding may occur.

INDOMETHACIN

Dosage form and strength: *Capsules:* 25 mg, 50 mg, 75 mg; *Modified-release capsules:* 75 mg; *Suppositories:* 100 mg.

Indications: Rheumatic disease and other musculoskeletal disorders, acute gout, dysmenorrhea, closure of ductus arteriosus.

Contraindications/Precautions: Active gastro-intestinal bleeding, active gastro-intestinal ulceration, history of gastrointestinal bleeding related to previous NSAID therapy, history of gastro-intestinal perforation related to previous NSAID therapy, history of recurrent gastro-intestinal hemorrhage (two or more distinct episodes), history of recurrent gastro-intestinal ulceration (two or more distinct episodes), severe heart failure, pregnancy(D) 3rd trimester, neonates, aortic coarctation, salicylate/NSAID hypersensitivity, lactating mother. Heart failure, allergic disorders, cardiac impairment, cerebrovascular disease, coagulation defects, connective tissue disorders,

Crohn's. disease, elderly, epilepsy, ischemic heart disease, parkinsonism, peripheral arterial disease, psychiatric disturbances, risk factors for cardiovascular events, ulcerative colitis, uncontrolled hypertension, child, hepatic impairment, renal impairment. During prolonged therapy ophthalmic and blood examinations particularly advisable.

Dosage schedule:

- *Pain and moderate to severe inflammation in rheumatic disease and other musculoskeletal disorders: oral using immediate-release medicines- 50-200 mg daily in divided doses; by rectum-100 mg twice daily if required, dose to be administered at night and in the morning, combined oral and rectal treatment, maximum total daily dose 150-200 mg*
- *Oral using modified-release medicines-75 mg 1-2 times a day.*
- *Acute gout: oral using immediate-release medicines- 150-200 mg daily in divided doses;*
- *Oral using modified-release medicine-75 mg 1-2 times a day.*
- *Dysmenorrhea: oral using immediate-release medicines- up to 75 mg daily;*
- *Oral using modified-release medicines- 75 mg daily.*

Adverse effects: General side-effects: See under diclofenac, specific side-effects: with oral use- nausea; with rectal use- suppositories may cause occasional bleeding and rectal irritation

Drugs and food interaction: See under NSAIDs as general.

Patient information: Dizziness may affect performance of skilled tasks (e.g. driving). Take medication with full glass of water. Remain with upright position for 15-30min after administration of medication. Avoid concomitant use with alcohol. Inform if rash, itching, abdominal pain, black colour stool.

MEFENAMIC ACID

Dosage form and strength: *Tablet: 500 mg, capsule 250 mg; Oral suspension: 50 mg/5ml*

Indications: Rheumatoid arthritis, osteoarthritis, postoperative pain, pain during dysmenorrhea/ menorrhagia.

Contraindications/Precautions: Active gastro-intestinal bleeding and ulceration, history of recurrent gastro-intestinal bleeding or ulceration, inflammatory bowel disease, severe heart failure, lactating mother, allergic disorder, acute porphyria, cardiac impairment, cerebrovascular disease, coagulation defect, connective tissue disorder, Chron's disease, ulcerative colitis, uncontrolled hypertension, pregnancy category C and D.

Dosage schedule: *Pain and inflammation in rheumatoid arthritis and osteoarthritis/postoperative pain/mild to moderate pain/acute pain including dysmenorrhea/menorrhagia: 500 mg 3 times a day.*

Adverse effects: Diarrhea (withdraw treatment), rashes (withdraw treatment), stomatitis, fatigue, paresthesia, aplastic anemia, glucose intolerance, thrombocytopenia.

Drugs and food interaction: See under NSAIDs as general.

NAPROXEN

Dosage form and strength: *Tablet: 500 mg, 750 mg, 250 mg (SR)*

Indications: Rheumatic disease, musculoskeletal disorders, dysmenorrhea, acute gout.

Contraindications/Precautions: Active gastro-intestinal bleeding and ulceration, history of recurrent gastro-intestinal bleeding or ulceration, inflammatory bowel disease, severe heart failure, pregnancy category C and D. Uncontrolled hypertension, allergic disorders, cardiac impairment, Chron's disease, ulcerative colitis, breastfeeding, children <2-year, geriatric patients.

Dosage schedule:

- *Pain and inflammation in rheumatic disease:* 0.5-1 g daily in 1-2 divided doses.
- *Pain and inflammation in musculoskeletal disorders / dysmenorrhea:* initially 500 mg, then 250 mg every 6-8 hours as required, maximum dose after the first day 1.25 g daily.
- *Acute gout:* initially 750 mg then 250 mg every 8 hours until attack has passed.

Adverse effects: See under NSAIDs as general.

Drugs and food interaction: See under NSAIDs as general.

Patient information: To report blurred vision, ringing, roaring in ears (may indicate toxicity). To avoid driving and other hazardous activities if dizziness or drowsiness occurs.

PARACETAMOL

Dosage form and strength: *Pediatric oral solution:* 150 mg/ml in a suitable flavored vehicle; *Oral suspension:* 125mg/5ml, tablet 500 mg; *Injection:* 150 mg/ml; *Rectal suppositories:* 120, 325, 650 mg; *Infusion:* 1000mg/100ml.

Indications: Mild to moderate pain or fever, arthralgia, dental pain, dysmenorrhea, headache, myalgia, osteoarthritis.

Contraindications/Precautions: Hypersensitivity, pregnancy B and C, breastfeeding, geriatric patients, anemia, renal/hepatic disease, chronic alcoholism. May cause hepatic toxicity at doses 0.4 g/day with chronic use,

Dosage schedule:

- *Mild to moderate pain /pyrexia: adult-oral-0.5–1 g every 4-6 hours, maximum 4 g per day, by IV - adult (body-weight 10–50 kg):* 15 mg/kg every 4–6 hours, dose to be administered over 15 minutes, maximum 60 mg/kg per day, *adult (body-weight 50 kg and above):* 1 g every 4-6 hours, dose to be administered over 15 minutes, maximum 4 g per day, *by rectum-adult-0.5-1 g every 4–6 hours, maximum 4 g per day.*
- *Mild to moderate pain in patients with risk factors for hepatotoxicity: by IV- adult (body-weight 50 kg and above):* 1 g every 4-6 hours, dose to be administered over 15 minutes, maximum 3 g per day.
- *Pain/ pyrexia with discomfort: oral-children -10-15 mg/kg/dose every 4-6 hours and do not exceed more than 5 doses.*

Adverse effects: See under indomethacin.

Drugs and food interaction: Avoid use with salicylates, renal adverse reactions: NSAIDs, salicylates, increase-hypoprothrombinemia-warfarin, long-term use, high doses of acetaminophen, increase-hepatotoxicity-barbiturates, alcohol, carbamazepine, hydantoins, rifampin, rifabutin, isoniazid, zidovudine, lamotrigine, imatinib, decrease-absorption of paracetamol, colestipol, cholestyramine.

Patient information: Not to exceed recommended dosage. May be used when breastfeeding, short-term, recognize signs of chronic overdose: bleeding,

bruising, malaise, fever, sore throat, do not self-medicate for more than 10 days without consultation with physician.

PIROXICAM

Dosage form and strength: *Orodispersible tablet:* 20 mg; *Capsule:* 10 mg, 20 mg; *Gel:* 0.5%

Indications: Rheumatoid arthritis, juvenile rheumatoid arthritis, osteoarthritis, ankylosing spondylitis, musculoskeletal conditions.

Contraindications/Precautions: Inflammatory bowel disease. Increase risk of asthma, cardiac disease, CHF, hepatic and renal impairment, HTN. For topical preparations apply with gentle massage only. Piroxicam orodispersible tablets can be taken by placing on the tongue and allowing to dissolve or by swallowing.

Dosage schedule:

- *Rheumatoid arthritis/Osteoarthritis/Ankylosing spondylitis:* Up to 20 mg once daily.
- *Pain relief in musculoskeletal conditions / treatment in knee or hand osteoarthritis (adjunct)to the skin:* apply 3-4 times a day, 0.5% gel to be applied, review treatment after 4 weeks.

Adverse effects: Indigestion, upper respiratory infection, headache, diarrhea, nausea, abdominal pain, edema, anemia, dizziness. With topical use-photosensitivity, rash (discontinue use if develops).

Drugs and food interaction: See under NSAIDs as general.

Patient information: For topical preparations, patients and their care taker should be advised to wash hands immediately after use, patients should be advised against excessive exposure to sunlight of area treated in order to avoid possibility of photosensitivity, drink at least 6-8 glass of water, do not breastfeed.

9.3.2 Selective COX-2 inhibitors

CELECOXIB

Dosage form and strength: *Capsules:* 50, 100, 200 and 400 mg

Indications: Acute pain and primary dysmenorrhoea, ankylosing spondylitis, osteoarthritis, rheumatoid arthritis.

Contraindications/Precautions: Aspirin allergy, chronic hepatitis, perioperative pain resulting from coronary artery bypass graft surgery. Congestive heart failure, hypertension, asthma, bleeding disorder, bronchospasm, duodenal/gastric/peptic ulcer, renal impairment, pregnancy category C and D, lactation. Increased risk of adverse cardiovascular events and skin reactions, risk of gastro-intestinal bleeding, ulceration, perforation.

Dosage schedule:

- *Acute pain and primary dysmenorrhoea:* initially 400 mg oral then 200 mg as required;
- *Ankylosing spondylitis:* 200 mg/day up to 400 mg/day;
- *Osteoarthritis:* 200 mg/day,
- *Rheumatoid arthritis:* 100-200mg/day.

Adverse effects: Headache, hypertension, fever, dyspepsia, flatulence, peripheral oedema, pharyngitis.

Drugs and food interaction: Enalapril, ketorolac, methotrexate, aceclofenac, aluminium hydroxide, lisinopril, amiloride, aspirin, atenolol.

ETORICOXIB

Dosage form and strength: *Tablets:* 30 mg, 60 mg, 90 mg and 120 mg

Indications: Ankylosing spondylitis, osteoarthritis, rheumatoid arthritis, acute gout.

Contraindications/Precautions: Hypersensitivity, active GI ulceration or bleeding, inflammatory bowel disease, heart failure, ischaemic heart disease, peripheral arterial disease, cerebrovascular disease, uncontrolled HTN, history of bronchospasm, acute rhinitis, nasal polyps, children, lactation. Renal and hepatic impairment.

Dosage schedule:

- *Osteoarthritis:* 30 mg once daily increased to 60 mg once daily;
- *Rheumatoid arthritis & ankylosing spondylitis:* 90 mg once daily;
- *Acute gout:* 120 mg once daily, max duration- 8 days.

Adverse effects: Stevens-Johnson syndrome, exfoliative dermatitis and toxic epidermal necrolysis, upper GI ulceration, perforation and bleeding, alveolar osteitis, oedema/fluid retention, dizziness, headache, palpitations, arrhythmia, HTN, asthenia/fatigue, flu-like disease, bronchospasm, ecchymosis, increased ALT and AST.

9.4 Drug used in osteoarthritis and osteoporosis

9.4.1 Anthraquinone

DIACEREIN

Dosage form and strength: *Tablet:* 50 mg

Indications: Osteoarthritis.

Contraindications/Precautions: Pregnancy category B, lactation, hypersensitivity to anthraquinone derivatives. Hepatic and renal impairment. Monitor CBC, LFT and urinalysis every 6 month.

Dosage schedule: *Oral* -50mg twice daily

Adverse effects: Diarrhea, pain abdomen, nausea, vomiting, intense yellow coloring of urine.

Drugs and food interaction: Decrease absorption with aluminum and/or magnesium hydroxide antacids, increase risk of diarrhea with laxative, antibiotics. Avoid co-admin with fibers and phytates.

Patient information: Should be taken with food or immediately after food.

9.4.2 Bisphosphonates

ALENDRONATE

Doses form and strength: *Tablet:* 5 mg, 10 mg, 35 mg, 40 mg, 70 mg

Indications: Osteoporosis, Paget's disease

Contraindications/Precautions: Hypersensitivity, hypocalcaemia, oesophageal stricture or achalasia. If allergy to bisphosphonate oesophageal narrowing/blockage, low blood Ca^{2+} level, serum kidney problem. Pregnancy, breastfeed, taking herbal preparation, dietary supplements.

Doses schedule: 5-10 mg OD, 35-70 mg weekly

Adverse effect: Heart burn, gastric erosion, retrosternal pain, flatulence, headache, body ache, fall in serum Ca^{2+} level.

Drugs and food interaction: NSAID, prednisolone, angiogenesis inhibitors (bevacizumab), calcium, iron, antacids, tea, coffee, fruits juice.

Patient information: Should be taken in empty stomach in morning and not to lie down or take food at least for 30 min to prevent oesophagitis.

ETIDRONATE

Dosage form and strength: *Tablet:* 200 mg, 400 mg

Indications: Paget's disease, total hip replacement, spinal cord injury, prevention of PTH-induced bone resorption, myositis ossificans.

Contraindications/Precautions: Osteomalacia, hypersensitivity, oesophagus stricture and achalasia, Enterocolitis, renal impairment, GI irritation, esophagitis, oesophageal ulcer and erosion.

Dosage schedule:

- *Paget's disease:* oral- 5-10 mg/kg qday not to exceed 6 months;
- *Total hip replacement:* oral- 20 mg/kg qday one month pre- and three months post-surgery (4 months total).

Adverse effects: Convulsion, fever, hypocalcaemia, hypomagnesemia, hypophosphatemia, bone pain, abnormal renal function.

Drugs and food interaction: Aluminium hydroxide, calcium carbonate, calcium gluconate, sodium bicarbonate.

IBANDRONATE

Dosage form and strength: *Tablet:* 150 mg; *Prefilled syringe:* 1 mg/ml

Indications: Treatment and prevention osteoporosis in postmenopausal women.

Contraindications/Precautions: Hypersensitivity, uncorrected hypocalcaemia, oesophageal achalasia and stricture, pregnancy, lactation, esophagitis, dysphagia, oesophageal ulcer, renal impairment. Adequate intake of calcium and vitamin D is recommended

Dosage schedule: *Oral:* 150 mg every month or 3 mg IV every 3 months administered over 15-30 seconds.

Adverse effects: URI, back pain, dyspepsia, bronchitis, asthenia, diarrhoea, dizziness, myalgia tooth disorder, UTI.

Drugs and food interactions: Human parathyroid hormone, calcium carbonate and gluconate, ferrous fumarate.

Patient information: Do not lie down after taking medications.

PAMIDRONATE

Dosage form and strength: *Powder:* 30 mg; *Injection:* 3 mg/ml, 6 mg/ml, 9 mg/ml

Indications: Prevention of androgen deprivation induced osteoporosis, hypercalcemia of malignancy, Paget's disease, osteolytic bone metastasis of breast cancer, multiple myeloma

Contraindications/Precautions: Pregnancy category D, lactation, hypersensitivity. Renal impairment, electrolyte abnormalities, myelosuppression.

Doses schedule:

- *Hypercalcemia of malignancy*: 90 mg single dose IV infusion over 2-24 hours;
- *Paget's disease*: 30 mg IV infusion over 4 hours qday for 3 consecutive days;
- *Osteolytic bone metastases of breast cancer and multiple myeloma*: 90 mg IV infusion over 4 hours qmonth.

Adverse effects: Anaemia, UTI, hypokalaemia, hypophosphatemia, hypocalcaemia, hypomagnesemia, seizure, HTN, osteonecrosis

Drugs and food interaction: See under ibandronate

RISEDRONATE

Dosage form and strength: *Tablet*: 5 mg, 30 mg, 35 mg, 150mg; *Delayed release tablet*: 35 mg

Indications: Postmenopausal osteoporosis, glucocorticoid-induced osteoporosis, Paget's disease, osteoporosis in men, osteogenesis imperfecta (orphan).

Contraindications/Precautions: Hypersensitivity, angioedema, generalized rash, bullous skin reactions, Stevens-Johnson syndrome, toxic epidermal necrolysis, hypocalcemia, esophagus stricture and achalasia, dysphagia, esophagitis, esophageal or gastric ulcer, osteonecrosis of the jaw.

Dosage schedule:

- *Postmenopausal osteoporosis*: oral -5 mg once daily or 35 mg once weekly or 150 mg once monthly;
- *Glucocorticoid-induced osteoporosis*: oral- 5 mg/day;
- *Paget's disease*: oral- 30 mg/day for 2 months.

Adverse effects: Arthralgia, diarrhea, headache, nausea, constipation, rash, abdominal pain, hypertension, dyspepsia, flulike syndrome, depression, chest pain, dizziness, pharyngitis, rhinitis, prostatic hyperplasia, hypocalcemia, dyspnea, gastritis, nephrolithiasis, hypophosphatemia, arrhythmia.

Drugs and food interaction: See under ibandronate.

ZOLEDRONATE

Dosage form and strength: *Injectable solution*: 4 mg/5 mL and 5 mg/100 mL

Indications: Hypercalcemia, cancer chemotherapy, multiple myeloma, osteoporosis.

Contraindications/Precautions: Pregnancy, hypersensitivity, urticaria, angioedema, and anaphylactic reaction or shock hypocalcemia, severe renal impairment.

Dosage schedule:

- *Hypercalcemia of malignancy*: no more than 4 mg IV (infused over >15 minutes) once may be repeated in 7 days;
- *Multiple myeloma, bone metastases from solid tumours*: 4 mg IV (infused over >15 minutes) every 3-4 weeks;
- *Osteoporosis, prevention in postmenopausal women*: 5 mg IV over >5 minutes every 2 years.

Adverse effects: Bone pain, nausea, fever, fatigue, anaemia, vomiting, constipation, dyspnoea, diarrhoea, anorexia, arthralgia, headache, dizziness, insomnia, urinary tract infection, anxiety, hypophosphatemia, hypokalaemia, hypotension, hypomagnesemia, rash

Drugs and food interaction: See under ibandronate.

9.5 Skeletal muscle relaxants

9.5.1 Centrally acting muscle relaxants

BACLOFEN

Dosage form and strength: *Tablet:* 10 mg, 20 mg; *Oral solution:* 1 mg/ml.

Indications: Pain of muscle spasm in palliative care, hiccup due to gastric distension in palliative care, chronic severe spasticity resulting from disorders such as multiple sclerosis or traumatic partial section of spinal cord, severe chronic spasticity unresponsive to oral anti-spastic drugs.

Contraindications/Precautions: Active peptic ulceration, pregnancy category C, breastfeeding, geriatric patients, peptic ulcer disease, renal/hepatic disease, stroke, seizure disorder, diabetes mellitus.

Dosage schedule:

- *Pain of muscle spasm in palliative care:* oral- 5–10 mg three times a day;
- *Hiccup due to gastric distension in palliative care:* oral- 5 mg twice daily;
- *Chronic severe spasticity resulting from disorders such as multiple sclerosis or traumatic partial section of spinal cord:* oral- initially 5 mg 3 times a day gradually increased, maintenance up to 60 mg daily in divided doses, review treatment if no benefit within 6 weeks of achieving maximum dose, maximum 100 mg per day;
- *Severe chronic spasticity unresponsive to oral anti-spastic drugs (or where side-effects of oral therapy unacceptable) or as alternative to ablative neurosurgical procedures (specialist use only):* intrathecal injection- test dose 25–50 micrograms to be given over at least 1 minute via catheter or lumbar puncture then increased in steps of 25 micrograms (max. per dose 100 micrograms) not given more often than every 24 hours to determine appropriate dose then dose titration phase most often using infusion pump (implanted into chest wall or abdominal wall tissues) to establish maintenance dose (ranging from 12 micrograms to 2 mg daily for spasticity of spinal origin or 22 micrograms to 1.4 mg daily for spasticity of cerebral origin) retaining some spasticity to avoid sensation of paralysis.

Adverse effects: Agitation, anxiety, ataxia, cardiovascular depression, confusion, depression, dizziness, drowsiness, dry mouth, euphoria, gastrointestinal disturbances, hallucinations, headache, hyperhidrosis, hypotension, insomnia myalgia, nightmares, rash respiratory depression, sedation, seizure, tremor, urinary disturbances, visual disorders.

Drugs and food interaction: Increase CNS depression with alcohol, tricyclics, opiates, barbiturates, sedatives, hypnotics, MAOIs, increase hypotension with anti-hypertensives.

Patient information: Not to discontinue medication quickly, hallucinations, spasticity, tachycardia will occur, product should be tapered off over 1-2 week, not to take with alcohol, other CNS depressants, avoid hazardous activities if drowsiness, dizziness occurs, notify prescriber if nausea, headache, tinnitus, insomnia, confusion, constipation, inadequate, painful urination continues.

DEXMEDETOMIDINE

Dosage form and strength: *Injection:* 100 µg/ml.

Indications: Maintenance of sedation during intensive care.

Contraindications/Precautions: Pregnancy, breastfeeding, hepatic impairment. Dexmedetomidine should only be administered by or under the direct supervision of personnel experienced in its use with adequate training in anaesthesia and airway management, cardiac function needs to be monitored, respiratory function also needs to be monitored in cases of non-intubated cases.

Dosage schedule: *Maintenance of sedation during intensive care: IV infusion-* 0.7 microgram/kg/hour adjusted according to response, usual dose 0.2-1.4 microgram/kg/hour.

Adverse effects: Agitation, blood pressure changes, bradycardia, changes in blood sugar, dry mouth, hyperthermia, myocardial infarction, myocardial ischemia, nausea, tachycardia, vomiting, abdominal distension, AV block, decreased cardiac output, dyspnoea, hallucination, hypoalbuminemia, metabolic acidosis, thirst.

MIDAZOLAM

See under Anaesthesia

TIZANIDINE

Dosage form and strength: *Tablet:* 2 mg, 4 mg.

Indications: Spasticity associated with multiple sclerosis or spinal cord injury or disease.

Contraindications/Precautions: Pregnancy category C, breastfeeding, elderly, children, geriatric patients, hypotension, renal/hepatic disease. Monitor liver function monthly for first four months and in those who develop unexplained nausea, anorexia or fatigue.

Adverse effects: Somnolence, dizziness, speech disorder, dyskinesia, nervousness, hallucination, psychosis, hypotension, bradycardia, dry mouth, vomiting, increased ALT, abnormal LFTs, constipation, blurred vision, urinary frequency, pharyngitis, rhinitis, tremor, rash, muscle weakness.

Dosage schedule: *Spasticity associated with multiple sclerosis or spinal cord injury or disease:* Initially 2 mg for 1 dose, then increased in steps of 2 mg/24 hours every 3-4 days in divided doses, adjusted according to response, usual dose up to 24 mg daily in 3-4 divided doses, maximum 36 mg per day.

Drugs and food interaction:

CNS depression—alcohol, other CNS depressants

Increase: Tizanidine levels—other CYP1A2 inhibitors (acyclovir, amiodarone, famotidine, mexiletine, enoxacin, norfloxacin, propafenone, tacrine, verapamil, zileuton, oral contraceptives ciprofloxacin), fluvoxamine, avoid concurrent use.

Increase: Hypotension—anti-hypertensives

Increase: Effect of rasagiline

Patient information: To rise slowly from lying or sitting to upright position to prevent orthostatic hypotension, to ask for assistance if dizziness, sedation occur, to avoid drinking alcohol, to avoid operating machinery, driving until effects known, to discontinue gradually.

DENOSUMAB

Dosage form and strength: 60 mg/mL (1 mL prefilled syringe or 1mL vial); 70 mg/mL (120 mg/1.7 mL vial).

Indications: Osteoporosis, androgen deprivation induced bone loss, giant cell tumour, hypercalcemia of malignancy.

Contraindications/Precautions: History of systemic hypersensitivity, urticaria, pre-existing hypocalcaemia, children, pregnancy, lactation. Serious infections (including cellulitis) and dermatologic reactions (e.g., dermatitis, rashes, eczema), hypersensitivity (including anaphylaxis).

Dosage schedule:

- *Osteoporosis: Prolia-* 60 mg SC every 6 months, supplement with calcium 1000 mg/day and vitamin D 400 IU/day;
- *Androgen deprivation induced bone loss: men with prostate cancer-* 60 mg SC every 6 months; *Giant cell tumour:* 120 mg SC every 4 weeks with additional 120 mg on days 8 and 15 during first month of therapy,
- *Hypercalcemia of malignancy:* 120 mg SC q4wk

Adverse effects: Back pain, extremity pain, musculoskeletal pain, hypercholesterolemia, cystitis, upper respiratory tract infection, new malignancies, sciatica, nonfatal serious infection, bone pain, anaemia, upper abdominal pain, rash, flatulence, osteonecrosis of jaw, pruritus, hypocalcaemia.

Drugs and food interaction: Daclizumab, influenza virus vaccine, abatacept, adalimumab, alefacept, alemtuzumab, anakinra, azathioprine, beclomethasone, cholera vaccine, cisplatin, cortisone cyclophosphamide, cyclosporine, fluorouracil, hydrocortisone, hydroxychloroquine sulphate, imatinib, leflunomide, meningococcal group B vaccine, mercaptopurine, methotrexate, methylprednisolone, mitomycin, mycophenolate, prednisolone, tacrolimus, vinblastine, vincristine.

Section II - Chapter 10

Drugs used in Infections

10.1 *Anti-amoebic and Anti-giardial drugs*

Diloxanide furoate
Metronidazole
Secnidazole
Tinidazole

10.2 *Antibacterial (other than antitubercular and antileprotic drugs)*

10.2.1 *Cell wall synthesis inhibitors*

10.2.1.1 *Cephalosporins*

Cefaclor
Cefadroxil
Cefalexin
Cefazolin
Cefepime
Cefixime
Cefoperazone
Cefotaxime
Cefpodoxime
Ceftazidime
Ceftriaxone
Cefuroxime

10.2.1.2 *Penicillins*

Amoxicillin
Amoxicillin/clavulanate
Ampicillin
Ampicillin/sulbactam
Bacampicillin
Benzyl penicillin (penicillin G)
Carbenicillin
Cloxacillin
Flucloxacillin
Phenoxy methyl penicillin (penicillin V)
Piperacillin
Piperacillin/tazobactam

10.2.2 *Protein synthesis inhibitors*

10.2.2.1 *Aminoglycosides*

Amikacin
Gentamicin
Neomycin

10.2.2.2 *Chloramphenicol*

10.2.2.3 *Lincosamide derivative*

Clindamycin

10.2.2.4 *Oxazolidinones*

Linezolid

10.2.2.5 Macrolides

Azithromycin
Clarithromycin
Erythromycin

10.2.2.6 Quinolones and fluoroquinolones

Ciprofloxacin
Levofloxacin
Moxifloxacin
Nalidixic acid
Norfloxacin
Ofloxacin

10.2.2.7 Sulphonamides

Cotrimoxazole: sulphamethoxazole and trimethoprim

10.2.2.8 Tetracyclines

Doxycycline
Minocycline
Oxytetracycline
Tetracycline

10.2.3 Glycopeptide antibacterials

Vancomycin

10.3 Antifungal drugs

Amphotericin B
Clotrimazole
Fluconazole
Griseofulvin
Itraconazole
Ketoconazole
Nystatin

10.4 Antihelminthic drugs

Albendazole
Mebendazole
Miltefosine
Niclosamide
Pentamidine
Piperazine
Praziquantel
Pyrantel pamoate
Sodium stibogluconate

10.5 Antileprotic drugs

Clofazimine
Dapsone
Rifampicin

10.6 Antimalarials

Artemether with lumefantrine
Artesunate
Chloroquine
Mefloquine
Primaquine
Quinine
Sulfadoxine and pyrimethamine

10.7 Anti-tubercular drugs**10.7.1 First line drugs**

Ethambutol
Isoniazid
Pyrazinamide
Rifampin
Streptomycin

10.7.2 Second line drugs

Bedaquiline
Capreomycin
Cycloserine
Ethionamide
Kanamycin
P-aminosalicylic acid (pas)

10.8 Anti-virals**10.8.1 Antihepatitis agents**

Entecavir
Peginterferon alfa
Sofosbuvir

10.8.2 Antih herpes virus agents

Acyclovir

10.8.3 Anti-influenza agents

Oseltamivir

10.8.4 Antiretroviral agents

Didanosine
Efavirenz
Indinavir
Lamivudine
Lopinavir+ ritonavir
Nelfinavir
Nevirapine
Ritonavir
Saquinavir
Stavudine
Tenofovir disoproxil
Zidovudine

10.1 Anti-amoebic and Anti-giardial drugs

DILOXANIDE FUROATE

Dosage form and strengths: *Tablet:* 500 mg

Indications: Asymptomatic cyst passers and extra intestinal amoebiasis (together with tissue amoebicide).

Contraindication/Precautions: Pregnancy, breastfeeding.

Dosage schedule: Adult: 500 mg every 8 hours for 10 days. Child: 20 mg/kg daily in 3 divided doses for 10 days.

Adverse effects: Flatulence, nausea, vomiting, diarrhoea, pruritus, urticaria.

METRONIDAZOLE

Dosage form and strengths: *Injection:* 500 mg/100 ml; *Oral suspension:* 100 mg/5 ml, and 200 mg/5 ml; *Tablet:* 200 mg, 400 mg and 600 mg.

Indications: Giardiasis, amoebic dysentery and extra-intestinal amoebiasis including amoebic liver abscess, *Trichomonas vaginalis*, *Giardia lamblia*, *Helicobacter pylori*, *Balantidium coli* and anaerobic bacterial infections, treatment and prevention of surgical and gynaecological sepsis due to colonic anaerobes particularly *Bacteroides fragilis*.

Contraindication/Precaution: Pregnancy (1st trimester), breastfeeding, hypersensitivity. Second and third trimester: Pregnancy (B), geriatric patients, candida infections, heart failure, fungal infections, dental disease, bone marrow depression, hematologic disease, GI/renal/hepatic impairment, contracted visual field, CNS disorders. Nursing mothers should not breast feed during treatment with high dose. Avoid alcohol or preparation containing alcohol during use or for 4-8 hours after use of this product.

Dosage schedule:

- *Invasive intestinal amoebiasis:* oral 800 mg every 8 hours for 5 days; Child 1-3 years: 200 mg every 8 hours; 3-7 years: 200 mg every 6 hours: 7-10 years: 400 mg every 8 hours.
- *Extra-intestinal amoebiasis (including liver abscess) and symptomless amoebic cyst passers:* oral, 400-800 mg every 8 hours for 5-10 days, child 1-3 years: 100-200 mg every 8 hours: 3-7 years: 100-200 mg every 6 hours, 7-10 years: 200-400 mg every 8 hours.
- *Giardiasis:* oral, 2 g daily for 3 days or 400 mg 3 times daily for 5 days; child 1-3 years 500 mg daily for 3 days, 3-7 years 600-800 mg daily, 7-10 years 1 g daily.
- *Anaerobic infections (usually treated for 7 days):* oral, 800 mg initially then 400 mg every 8 hours, by intravenous infusion: 500 mg every 8 hours; child any route 7.5 mg/kg every 8 hours. Leg ulcers and pressure sores: oral, 400 mg every 8 hours for 7 days.
- *Bacterial vaginosis:* oral, 400 mg twice daily for 5-7 days or 2 g as a single dose.
- *Acute ulcerative gingivitis:* oral, 200 mg every 8 hours for 3 days; child 1-3 years: 50 mg every 8 hours for 3 days; 3-7 years: 100 mg every 12 hours, 7-10 years: 100 mg every 8 hours.
- *Surgical prophylaxis:* oral, 400 mg started 2 hours before surgery, up to 3 further doses of 400 mg may be given every 8 hours for high-risk procedure; child 7.5 mg/kg 2 hours before surgery; up to 3 further doses of 7.5 mg/

kg may be given every 8 hours for high-risk procedures. By intravenous infusion, 500 mg shortly before surgery, child 7.5 mg/kg every 8 hours.

Adverse effects: Metallic taste, nausea, headache, furred tongue, dizziness, vertigo, dark brown urine and reversible peripheral neuropathy. Metronidazole is carcinogenic in rats and mice but no clinical evidence of increased susceptibility to malignancy has been reported in patients. The large dose of drug should be used during pregnancy only when clearly needed.

Drug and food interactions: Avoid use with zalcitabine, norfloxacin, disulfiram. Disulfiram-like reactions have occurred in patients who have ingested alcohol concurrently with these drugs. Potentiation of the effects of oral anticoagulant have been reported.

SECNIDAZOLE

Dosage form and strength: *Tablet:* 500 mg

Indications: Trichomoniasis, amoebiasis, giardiasis, invasive (hepatic) amoebiasis

Contraindications/Precautions: Hypersensitivity to secnidazole or other nitroimidazole derivatives. Avoid chronic use

Dosage schedule:

- *Trichomoniasis, amoebiasis, giardiasis:* oral, adult: single dose 2000 gm. Oral, children: single dose 30 mg/kg.
- *Invasive (hepatic) amoebiasis:* oral, adult: 1.5 g daily in single or divided doses for 5 days. Oral, children: 30 mg/kg daily in single or divided doses for 5 days

Adverse effects: Vulvovaginal candidiasis, nausea, headache, dysgeusia, diarrhea, vomiting, abdominal pain, vulvovaginal pruritus

TINIDAZOLE

Dosage form and strengths: *Tablet:* 300 mg, 500 mg, 1 gram; *Suspension:* 150 mg/ml, *Injection* 200 mg/100 ml.

Indications: Amoebic infections, bacterial vaginosis, acute ulcerative colitis, intestinal amoebiasis

Contraindications/Precaution: Pregnancy (C), breastfeeding, hypersensitivity, Children, geriatric, hepatic disease, CNS depression, blood dyscrasias, candidiasis, seizures, viral infection, alcoholism.

Dosage schedule:

- *Anaerobic infections:* oral, 2 g initially, followed by 1 g daily or 500 mg twice daily, usually for 5-7 days.
- *Bacterial vaginosis and acute ulcerative gingivitis:* single 2 g dose.
- *Abdominal surgery prophylaxis:* single 2 g dose approximately 12 hours before surgery.
- *Intestinal amoebiasis:* 2 g daily for 2-3 days; Child: 50-60 mg/kg daily for 3 days.
- *Amoebic involvement of liver:* 1.5-2 g daily for 3-6 days; Child: 50-60 mg/kg daily for 5 days.
- *Urogenital trichomoniasis and giardiasis:* single 2 g dose; Child: single dose of 50-75 mg/kg (repeated once if necessary).

Adverse effects: See under metronidazole.

Drug and food interaction: Don't use within 2 weeks of use of disulfiram. Clonidine and ketoconazole increases effects of tinidazole. Phenobarbital, rifampin, phenytoin, cholestyramine, oxytetracycline decreases effects. Increases action of anti-coagulants, cyclosporine, tacrolimus, hydantoins, and lithium.

10.2 Anti-bacterial (other than anti-tubercular and anti-leprotic drugs)

10.2.1 Cell wall synthesis inhibitors

10.2.1.1 Cephalosporins

CEFACTOR

Dosage form and strengths: *Capsule:* 250 mg, 500 mg; *Oral suspension:* 125 mg/5 ml.

Indications: Susceptible infections due to sensitive gram-positive and gram-negative bacteria, pneumonia, lower UTI.

Contraindications/Precautions: Cephalosporins have cross-allergenicity with penicillins (about 10% cases) so it should be avoided in patients who have had hypersensitivity reaction to penicillins. Prolonged use of cephalosporins may result in the overgrowth of non-susceptible organisms especially *Pseudomonas*, *Enterococci* or *Candida*.

Dosage schedule: 250 mg every 8 hours, doubled for severe infection; maximum 4 g daily. Child over one month: 20 mg per kg daily in 3 divided doses, doubled for severe infections, maximum 1 g daily.

Adverse effects: Hypersensitivity reactions including urticaria, pruritus, rash, fever, joint pain and exfoliative dermatitis. Anaphylaxis occurs rarely. Nausea, vomiting, diarrhoea, positive coomb's test, elevated liver enzymes levels and rarely thrombocytopenia or neutropenia.

CEFADROXIL

Dosage form and strengths: *Capsule:* 500 mg, 1000 mg; *Tablet:* 125 mg, 250 mg; *Oral suspension:* 125 mg/5 ml, and 250 mg/ml.

Indication: Skin and soft tissue infection, uncomplicated UTI, pharyngitis, tonsillitis, endocarditis, renal impairment.

Contraindications/Precautions Hypersensitivity. See under cefaclor.

Dosage schedule: 250 mg oral every 6 hours or 500 mg every 8-12 hours increased to 1-1.5 g every 6-8 hours for severe infections; child: 30 mg/kg daily in divided doses, doubled for severe infections, maximum 100 mg/kg daily.

• *Prophylaxis of recurrent urinary tract infection in adult:* 125 mg at night.

Adverse effect: See under cefaclor.

CEFALEXIN (Cephalexin)

Dosage form and strengths: *Capsule:* 250 mg, 500 mg; *Tablet:* 125 mg; *Oral suspension:* 125 mg/5 ml, 250 mg/5 ml.

Indications: Susceptible infections due to sensitive gram-positive and gram-negative bacteria, pneumonia, lower UTI.

Contraindications/Precautions: See under cefaclor.

Dosage schedule: 250 mg oral every 8 hours, doubled for severe infection; maximum 4 g daily. Child >1 month: 25-50 mg per kg daily in 3 divided doses, doubled for severe infections, maximum 1 g daily.

• *Prophylaxis of recurrent urinary tract infection:* adult: 125 mg at night; child: 10 mg/kg at night.

Adverse effects: See under cefaclor.

Drug and food interaction: Increases effects of anticoagulants (use cautiously); increases toxicity of aminoglycosides, loop diuretics, probenecid. Decreases effects of oral contraceptives, use alternative methods of contraception.

CEFAZOLIN

Dosage form and strengths: *Powder for injection:* IV/IM: 1 g, 2 g, 500 mg.

Indication: Surgical prophylaxis, susceptible infections due to sensitive gram-positive and gram-negative bacteria, pneumonia, lower UTI.

Contraindications/Precaution: Dose must be adjusted in severe renal insufficiency with caution in patient with seizure.

Dosage schedule: *Intramuscular injection or intravenous injection or infusion:* 0.5-1 g every 6-12 hours; Child: 25-50 mg/kg daily in divided doses, increased to 100 mg/kg daily in severe infection.

Adverse effects: See under cefaclor.

CEFEPIME

Dosage form and strengths: *Vial:* 1 g and 2 g.

Indications: See under cefaclor.

Contraindications/Precautions: See under cefaclor.

Dosage schedule: Intravenous injection, 2 g every 12 hours. Child: 100-150 mg/kg/day

Adverse effects: See under cefaclor.

CEFIXIME

Dosage form and strengths: *Capsule/tablet:* 100 mg, 200 mg, 400 mg; *Syrup:* 100 mg/5 ml

Indications: See under cefaclor.

Dosage schedule:

Adult and child over 10 years: 200-400 mg daily in 1-2 divided doses, child: 8 mg/kg in 1-2 divided doses.

Gonorrhoea: 400 mg as a single dose.

Adverse effects: See under cefaclor.

CEFOPERAZONE

Dosage form and strengths: *Vial:* 1 g, 2 g.

Indications: Pelvic infections, urinary-tract infections, bone and joint infections.

Contraindications/Precautions: It may produce disulfiram like reaction with alcohol.

Dosage schedule: By intramuscular or intravenous injection: 1-2 g (base) every 12 hours.

Adverse effects: See under cefaclor.

CEFOTAXIME

Dosage form and strengths: *Powder for injection:* 250 mg, 500 mg and 1 g.

Indications: Upper respiratory tract infection, uncomplicated UTI, gonorrhea.

Dosage schedule: By intramuscular or intravenous injection 1 g every 12 hours. Severe infections, 2 g every 6 hours, exceptionally, for life threatening infection due to less sensitive organism. Child: 100-150 mg/kg/day in 3-4 divided doses (max. 200 mg/kg/day).

Adverse effects and precautions: See under cefaclor.

CEFPODOXIME

Dosage form and strengths: *Oral suspension:* 50 mg/ml, 100 mg/ml; *Tablet:* 100 mg, 200 mg

Indications: Upper and lower respiratory tract infections, uncomplicated urinary tract infections, skin and soft tissue infections, uncomplicated gonorrhea.

Contraindication and Precautions: Documented hypersensitivity, renal impairment

Dosage schedule:

- *Upper respiratory-tract infections:* 100 mg twice daily (200 mg twice daily in sinusitis) for 10 days; child: 8 mg /kg/day in 2 divided doses.
- *Uncomplicated urinary-tract infections:* 100 mg twice daily (200 mg twice daily in uncomplicated upper urinary-tract infections); Child: 8 mg/kg/day in 2 divided doses.
- *Uncomplicated gonorrhea:* 200 mg as a single dose.
- *Skin infection:* 400 mg oral BD 7-14 days.

Adverse effects: See under cefaclor.

CEFTAZIDIME

Dosage form and strengths: *Powder for injection:* 250 mg, 500 mg, 1 g.

Indications: See under cefpodoxime.

Dosage schedule: By deep intramuscular injection or intravenous injection or infusion: 1 g every 8 hours; Severe case: 2 g every 12 hours; child up to 2 months: 25-60 mg/kg daily in 2 divided doses; Over 2 months: 30 -100 mg/kg daily in 2-3 divided doses, up to 150 mg/kg daily (maximum 6 g daily) in immunocompromised or meningitis.

- *Pseudomonal lung infection in cystic fibrosis:* Adult with normal renal function: 100-150 mg/kg daily in 3 divided doses; Child: upto 150 mg/kg daily (maximum 6 g daily) in 3 divided doses; preferably i.v.
- *Urinary tract and less severe infections:* 0.5-1 g every 12 hours.
- *Surgical prophylaxis, prostatic surgery:* 1 g at induction of anesthesia repeated if necessary when catheter is removed.
- *Febrile neutropenia:* IV/IM: 2 g every 8hrs.

Adverse effects and precautions: See under cefaclor.

CEFTRIAXONE

Dosage form and strengths: *Injection:* IV/IM: 250 mg, 500 mg, 1000 g, 2 g

Indications: See under cefpodoxime, epiglottitis.

Contraindications and Precautions: Hypersensitivity, hyperbilirubinemic neonates particularly those who are premature; neonates <28 days if they

receive calcium containing iv products. Risk of fatal calcium-ceftriaxone precipitant formation in lungs and kidneys of term and preterm neonates. May increase INR, especially in nutritionally deficient patients.

Dosage schedule: By deep intramuscular injection, or by intravenous injection over 2-4 minutes, or by intravenous infusion, 1 g daily as single dose; 2-4 g daily as a single dose in severe infection.

- *Surgical prophylaxis:* 1 g 30 min before procedure.
- *Early syphilis:* IM 500 mg daily for 10 days. Susceptible infection due to sensitive gram positive and gram negative bacteria IM/IV 1 g daily, in severe form:-2-4 g daily.
- *Meningitis:* Child 1 month – 11 yrs.: IV 50-75 mg/kg single dose or in 2 divided doses (max. 100 mg/kg/day). Neonates: use with cautions.
- *Epiglottitis:* oral, intravenous: 1 g twice in a day, then step down to 200 mg BD cefixime + oral steroid stat (hydrocortisone).

Adverse effects: CNS: headache, dizziness, weakness, fever, seizures. GI: nausea, vomiting, deranged LFT, abdominal pain. Hematological: leukopenia, thrombocytopenia, agranulocytosis, rash, urticaria, anaphylaxis, toxic epidermal necrolysis.

Food and drug interaction: Increase cyclosporine level. Increase bleeding-anticoagulants, thrombolytic, NSAIDs. Increase toxicity-aminoglycosides, probenecid. Decrease absorption-iron rich cereals.

CEFUROXIME

Dosage form and strengths: *Oral suspension:* 125 mg/5 ml, 250 mg/5 ml; *Tablet* 250 mg, 500 mg; *Powder for injection:* 750 mg, 1.5 g, 7.5 g, 75 g, 225 g.

Indications: Surgical prophylaxis. It is more active against *Haemophilus influenzae* and *Neisseria gonorrhoeae*, tonsillitis and pharyngitis.

Contraindications/Precautions: If diabetic, use blood glucose test. To complete the course of dose.

Dosage schedule: Oral (as cefuroxime axetil), 250 mg twice daily in most infections including mild to moderate respiratory tract infections.

- *Urinary-tract infections:* 125 mg twice daily, doubled in pyelonephritis.
- *Gonorrhoea:* 1 g as a single dose. Child: IV 50-100 mg/kg/day and Oral 20-40 mg/kg/day. Adult: 750 mg every 6-8 hrs, increase if necessary up to 1.5 g every 6-8 hrs, increased dose for severe infection.
- *Surgical prophylaxis:* 1.5 g by intravenous injection at induction; may be supplemented with 750 mg intramuscularly or intravenous every 8 hrs if required for up to 3 doses.
- *Tonsillitis and pharyngitis:* adult, 250 mg oral once daily for 4 days, child: 10 mg/kg PO BID for 4-10 days.

Adverse effects: See under cefaclor.

Drug and food interaction: Increase effect/toxicity: aminoglycoside, furosemide, probenecid. Increase bleeding risk: anticoagulants, thrombolytics, and antiplatelets. Decrease oral contraceptive if possible use alternative one. Decrease absorption of cephalosporin: antacid. Decrease effect of cephalosporin: H₂ blockers

10.2.1.2 Penicillins

AMOXICILLIN

Dosage form and strengths: *Capsule:* 250 mg and 500 mg; *Dispersible tablets:* 125 mg and 250 mg; *Drops:* 100 mg/1ml, *Injections:* 100 mg, 250 mg, 500 mg; *Oral suspension:* 125 mg/5 ml, 250 mg/5 ml.

Indications: Upper respiratory tracts infections (by *S. pneumoniae*, *S. pyogenes*, *H. influenzae*), otitis media, sinusitis, pneumonia (by *H. influenzae*), pharyngitis, skin and soft tissue infections, genitourinary tract infection, *H. pylori* infection, diphtheria.

Contraindications/Precautions: Documented hypersensitivity to penicillins, cephalosporins, imipenem. Clostridium difficile-associated diarrhoea (CDAD), infectious mononucleosis, suspected bacterial infection, superinfections with bacterial or fungal pathogens, allergy to cephalosporins, carbapenems. Take medication without regard to meals.

Dosage schedule:

- *Ear, nose & throat infections:* mild to moderate: 500 mg oral q12hr or 250 mg oral q8hr for 10-14 days; severe: 875 mg oral q12hr or 500 mg oral q8hr for 10-14 days.
- *Tonsillitis/pharyngitis:* 875 mg oral qday for 10 days, taken within 1 hour after finishing a meal. Lower respiratory tract infections: 875 mg oral q12hr or 500 mg oral q8hr for 10-14 days.
- *Skin & skin structure infections:* mild to moderate: 500 mg oral q12hr or 250 mg oral q8hr; severe: 875 mg oral q12hr or 500 mg oral q8hr.
- *Genitourinary tract infections:* mild to moderate: 500 mg oral q12hr or 250 mg oral q8hr; severe: 875 mg oral q12hr or 500 mg oral q8hr.
- *Helicobacter pylori infection:* Triple therapy: 1 g PO q12hr for 14 days with lansoprazole (30 mg) and clarithromycin (500 mg); dual therapy: 1 g PO q8hr for 14 days with lansoprazole (30 mg) in patients intolerant of, or resistant to, clarithromycin.
- *Diphtheria:* 500 mg TDS for 2 weeks (along with diphtheria antitoxin up to 1,00,000 U IV)

Adverse effects: Anaphylaxis, anaemia, AST/ALT elevation, mucocutaneous candidiasis, diarrhoea, headache, nausea, vomiting, rash, pseudomembranous colitis, serum sickness-like reactions

Drug and food interactions: BCG vaccine live, cholera vaccine, demeclocycline, doxycycline, minocycline, mycophenolate, tetracycline, typhoid vaccine live, acyclovir, allopurinol, aspirin, bendroflumethiazide, chlorothiazide, cyclopenthiiazide, daclizumab, dienogest, estradiolvalerate, estradiol, ethinylestradiol, hydrochlorothiazide, mestranol, methotrexate, metolazone, warfarin, amiloride, azithromycin

AMOXICILLIN with CLAVULANATE

Dosage form and strengths: *Oral suspension:* (125 mg/31.25 mg)/5 ml; *Tablet:* 500 mg (amoxicillin) with 125 mg (clavulanic acid); *Injection,* 1 g (amoxicillin) with 200 mg (clavulanic acid)

Indications: Lower respiratory tract infection (LRTI), chronic obstructive pulmonary disease, acute bacterial sinusitis, acute mastoiditis, animal and human bite wounds, erysipelas, pyelonephritis, skin abscess, tonsillitis and

pharyngitis.

Contraindications/Precautions: Allergy to penicillins, previous history of cholestatic jaundice/hepatic dysfunction associated with amoxicillin/clavulanate. Allergy to cephalosporins, carbapenems. Use caution in hepatic impairment. Hepatic dysfunction (rare in adult) is more common in elderly and/or males and prolonged therapy may increase risk. Take with meals to avoid GI upset, take suspension at start of meal to enhance absorption. In case of dysphagia: may substitute 250 mg/5 ml suspension for 500/125 mg tablet; may substitute 200 mg/5 ml or 400 mg/5 ml suspension for 875/125 mg tablet.

Dosage schedule:

- **LRTI:** Beta lactamase producing strains of *Haemophilus influenza* and *Moraxella catarrhalis*. Mild to moderate: 500/125 mg oral q12hr or 250/125 mg oral q8hr for 10 days. Severe: 875/125 mg oral q12hr or 500/125 mg oral q8hr for 7-10 days. COPD: 500 mg oral q8hr.
- **Acute bacterial sinusitis due to beta lactamase producing strains of *H. influenza* & *M. catarrhalis*:** 2000 mg (2 extended release Tablets) PO q12hr for 10 days.
- **Acute mastoiditis:** 1.2 g IV q8hrly then step down to oral 625 mg q8hrly for total of 10 -14 days.
- **Animal/human bite wounds:** 875 mg oral q12hr or 500 mg oral q8hr for 3-5 days.
- **Erysipelas:** 875 mg oral q12hr or 500 mg oral q8hr for 7-10 days.
- **Diabetic foot:** mild to moderate, localized cellulitis: 2000 mg (2 extended release tablets) PO q12hr for 7-14 days.
- **Group A Streptococci infection:** 40 mg/kg/day PO divided q8hr for 10 days; not to exceed 2000 mg/day.
- **Tonsillitis and pharyngitis:** 500-875 mg oral q12h for 10 days.

Adverse effects: Diarrhea, mycosis, nausea, rash, vomiting, loose stool, candidiasis, vaginitis

Drug and food interactions: Amoxicillin decreases effects of BCG vaccine. Doxycycline, minocycline decreases effects of amoxicillin. Allopurinol may increase potential for hypersensitivity reactions to amoxicillin.

AMPICILLIN

Dosage form and strengths: Capsules: 250 mg, 500 mg. Oral suspension: 125 mg/5 ml, 250 mg/5 ml; Injection: 100 mg, 250 mg, 500 mg.

Indications: Urinary tract infections by *Escherichia coli* and *Proteus mirabilis*, exacerbation of chronic bronchitis and otitis media due to *Streptococcus pneumoniae* and *Haemophilus influenzae* and invasive salmonellosis.

Contraindications/Precautions: Cross allergy with cephalosporins, carbapenems. Adjust dose in renal failure. Pregnancy (B). Lactation: excreted in breast milk, use caution. Prolonged use associated with fungal or bacterial superinfection. Take on an empty stomach (1 hour before or 2 hours after a meal) with a full glass of water.

Dosage schedule: Oral: 0.25-1 g every 6 hours, at least 30 minutes before food.

- **Urinary tract infections:** 500 mg every 8 hours. Intramuscular injection or intravenous injections or infusion: 500 mg every 4-6 hours; higher doses in

meningitis. Child under 10 years: any route, half of adult dose.

Adverse effects: Erythema multiforme, exfoliative dermatitis, rash, urticaria, fever, seizure, diarrhoea, enterocolitis, glossitis, nausea, oral candidiasis, pseudomembranous colitis, stomatitis, vomiting, agranulocytosis, anaemia, eosinophilia, leukopenia, increased AST.

Drug and food interactions: BCG vaccine live, cholera vaccine, demeclocycline, doxycycline, lymecycline, minocycline, mycophenolate, oxytetracycline, tetracycline, typhoid vaccine live.

AMPICILLIN with SULBACTAM

Dosage form and strengths: *Powder for solution:* 1.5 g (ampicillin 1 g/sulbactam 0.5 g), 3 g (ampicillin 2 g/sulbactam 1 g), 15 g (ampicillin 10 g/sulbactam 5 g).

Indications: Gynecological infections, intra-abdominal infections, skin and skin structure infections, orbital cellulitis, pelvic inflammatory disease, pneumonia

Contraindications/Precautions: Hypersensitivity, patient with previous history of cholestatic jaundice/hepatic dysfunction associated with ampicillin sulbactam. Pregnancy (B). Lactation: excreted in breast milk. Caution in patients allergic to Cephalosporins and Carbapenems. Prolonged use is associated with fungal or bacterial superinfection. Hepatotoxicity reported; monitor hepatic function at regular intervals in patients with hepatic impairment. May cause severe skin reactions, such as toxic epidermal necrolysis (TEN), Stevens-Johnson syndrome, exfoliative dermatitis.

Dosage schedule:

- *Gynecologic infections:* 1.5 g (1 g ampicillin + 0.5 g sulbactam) to 3 g (2 g ampicillin + 1 g sulbactam) IV/IM q6hr; not to exceed 12 g/day.
- *Intra-abdominal infections:* 1.5 g (1 g amoxicillin + 0.5 g sulbactam) to 3 g (2 g ampicillin + 1 g sulbactam) IV/IM q6hr; not to exceed 12 g/day.
- *Skin and skin structure infections:* 1.5 g (1 g ampicillin + 0.5 g sulbactam) to 3 g (2 g Ampicillin + 1 g sulbactam) IV/IM q6hr; not to exceed 12 g/day.
- *Orbital cellulitis:* 3 g (2 g ampicillin + 1 g sulbactam) IV q6hr.
- *Pelvic inflammatory disease:* 3 g (2 g ampicillin + 1 g Sulbactam) IV q6hr.
- *Pneumonia (aspiration or community acquired):* 1.5 g (1 g ampicillin + 0.5 g sulbactam) to 3 g (2 g ampicillin + 1 g sulbactam) IV q6hr for 5 or more days.

Adverse effects: Diarrhea, thrombophlebitis, rash, abdominal distension.

Drug and food interactions: Serious, use alternative: BCG vaccine, cholera vaccine. Ampicillin decreases effects of BCG, cholera vaccine by pharmacodynamic antagonism.

BACAMPICILLIN

Dosage form and strengths: *Tablets:* 400 mg

Indications: See under ampicillin.

Contraindications/Precautions: See under ampicillin.

Dosage schedule: 400-800 mg daily; child over 5 years: 200 mg 3 times daily. Uncomplicated gonorrhoea: single dose of 1.6 g together with probenecid 1 g.

Adverse effects: See under ampicillin.

BENZYL PENICILLIN (PENICILLIN G)

Dosage form and strengths: *Injection:* each vial of 150 mg, 300 mg and 600 mg. The powder should be dispersed in water for injection.

Indications: otitis media, meningitis, cellulitis, endocarditis, pneumococcal pneumonia, streptococcal infections, diphtheria.

Contraindications/Precautions: Hypersensitivity: serious and occasionally fatal reactions reported. Only deep IM administration; do not administer IV, SC, or IT. Do not inject near nerve or artery. Pregnancy (B). Caution during lactation and in neonates.

Dosage schedule: IM: 2.4-4.8 g daily in 4 divided doses; premature infant and neonate: 50 mg/kg daily in 2 divided doses; infant (1-4 weeks): 75 mg/kg daily in 3 divided doses; child (1 month-12 years): 100 mg/kg daily in 4 divided doses.

- *Bacterial endocarditis:* 7.2 g daily in 4-6 divided doses.
- *Meningitis:* 2.4 g every 4 hours; premature infant and neonate: 100 mg/kg daily in 2 divided doses.
- *Diphtheria:* 1200 mg IV q6hrly for 2 weeks (along with diphtheria antitoxin up to 1, 00,000 U IV)

Adverse effects: Skin rashes including maculopapular eruptions and exfoliative dermatitis, urticaria, serum-sickness like reactions, Jarisch-Herxheimer reaction, and pseudomembranous colitis.

CARBENICILLIN

Dosage form and strengths: *Injection:* 1 g, 5 g.

Indications: Infections due to *Pseudomonas aeruginosa* and *Proteus species*.

Contraindications/Precautions: Carbenicillin injection should be used immediately after preparation.

Dosage schedule: By slow intravenous injection or rapid infusion: 5 g every 4-6 hours; child: 250-400 mg/kg daily in divided doses. By intramuscular injection: 2 g every 6 hours; child: 50-100 mg/kg daily in divided doses.

Adverse effects: Hypokalaemia, prolonged bleeding time, prolonged prothrombin time, abnormal platelet aggregation and bleeding from gastrointestinal tract.

CLOXACILLIN

Dosage form and strengths: *Capsules:* 250 mg and 500 mg; *Injection:* 500 mg cloxacillin sodium in water for injection; *oral solution:* 125 mg/5 ml.

Indications: Exclusively for infection caused by *Staphylococcus aureus*.

Contraindications/Precautions: Hypersensitivity to penicillin, cephalosporins, imipenem. Concomitant live bacterial vaccines during initial treatment of severe infections. Neonates, pregnancy category B, lactation. Monitor PT if patient is taking warfarin concurrently; prolonged use may result in superinfection; injections should be used immediately after preparation.

Dosage schedule: Per oral: adult 500 mg 4 times daily, doubled in severe infection; by intramuscular injection: 250 mg every 4-6 hours, doubled in severe infection; by slow IV injection or infusion: 1-2 g every 6 hours; child up to 2 years: quarter adult dose; child 2-10 years: half adult dose.

Adverse effects: Abdominal pain, diarrhoea, nausea, anaemia, impaired LFTs, hypersensitivity, nephritis.

FLUCLOXACILLIN

Dosage form and strengths: *Capsule:* 250 mg, 500 mg.

Indications: Otitis externa, furunculosis, pneumonia, impetigo, osteomyelitis, staphylococcal endocarditis.

Contraindications/Precautions: See under benzylpenicillin.

Dosage schedule: Adult, oral: 250-500 mg every 6 hours, at least 30 minutes before food; child under 2 years: quarter adult dose; 2-10 year: half adult dose. Intramuscular injection: 250-500 mg every 6 hours; child under 2 years: quarter adult dose; 2-10 years: half adult dose.

- *Furunculosis:* 1 g every 6hour for 5 days
- *Endocarditis (in combination with another antibacterial) under 85 kg:* 8 g daily in 4 divided doses.

Adverse effects: See under benzylpenicillin.

PHENOXY METHYL PENICILLIN (PENICILLIN V)

Dosage form and strengths: *Oral solution:* 125 mg/5 ml, 250 mg/5 ml, *Tablet:* 250 mg, 500 mg

Indications: *Streptococcal* pharyngitis, actinomycosis, erysipelas, periodontal infections, recurrent rheumatic fever.

Contraindications/Precautions: Allergy to penicillins, cephalosporins, or imipenem. Pregnancy (B), lactation: excreted in breast milk; compatible with breastfeeding. IgE mediated anaphylactic reactions (e.g. urticaria, anaphylaxis) reported in patients with severe renal impairment and in patients with history of severe asthma. Use with caution in neonates; some dosage forms may contain sodium benzoate/benzoic acid, which may cause fatal toxicity (gasping syndrome) when used in large amounts. Monitor renal and hematologic systems. Prolong use may result in superinfection.

Dosage schedule:

- *Streptococcal pharyngitis:* 500 mg oral q12hr or 250 mg oral q6hr for 10 days.
- *Actinomycosis, mild:* 2-4 g/day oral divided q6hr for 8 weeks; surgical: 2-4 g/day oral divided q6hr for 6-12 months.
- *Erysipelas:* 500 mg oral q6hr.
- *Periodontal infections:* 250-500 mg oral q6hr for 5-7 days.
- *Recurrent rheumatic fever prophylaxis:* 250 mg oral q12hr.

Adverse effects: Diarrhea, nausea, oral candidiasis, vomiting, seizure, anemia, interstitial nephritis, hypersensitivity, anaphylaxis, positive coombs reaction.

Drug and food interactions: Penicillin V decreases effects of live BCG Vaccine (use alternative). Demeclocycline, doxycycline, minocycline decreases effects of penicillin V (use alternative).

PIPERACILLIN

Dosage form and strengths: *Powder for injection:* 2 g, 3 g, 4 g, 40 g.

Indications: Urinary tract infection (uncomplicated), community acquired pneumonia, acute cholangitis, uncomplicated gonorrhea, *Pseudomonas*

infections

Contraindications/Precautions: Allergy to penicillins, cephalosporins, imipenem. Pregnancy (B), lactation. Risk of bleeding complications, especially in renal impairment. Monitor renal, hepatic and especially hematopoietic functions during prolonged treatment. IV/IM preparation: reconstitute each gram w/5 ml NS, D5W or other compatible diluents. Slight darkening does not indicate potency loss. IV/IM administration: Slow direct injection over 3-5 min OR intermittent infusion in at least 50ml over 20-30min. IM at upper outer quadrant of buttock. Combined use of piperacillin/tazobactam and vancomycin may be associated with an increased incidence of acute kidney injury. Headache, fever, injection site pain may occur.

Dosage schedule:

- *Usual dosage range:* IV 3-4 g/dose q4-6hr; not to exceed 24 g/24hr IM 2-3 g/dose q6-12hr; not to exceed 24 g/24hr.
- *Urinary tract infection:* 6-8 g/day IV/IM (100 to 125 mg/kg/day) divided q6-12hr.
- *Community acquired pneumonia:* 6-8 g/day IV/IM (100-125 mg/kg/day) divided q6-12hr.
- *Acute cholangitis:* 4 g IVq6hr. Uncomplicated gonorrhea: 2 g once with 1 g probenecid 30 min before injection.
- *Pseudomonas infections:* 4 g IV/IM q4hr. In case of renal impairment: CrCl 20-40ml/min: 3-4 g q8hr. CrCl<20ml/min: 3-4 g q12hr.

Adverse effects: Seizure, rash, hemolytic anemia, interstitial nephritis, injection site pain, headache, fever, prolonged prothrombin time.

Drug and food interactions: Piperacillin increases effects and toxicity of antithrombin alfa, argatroban, bivaluridin, dalteparin, heparin, vancomycin. Azithromycin, doxycycline decreases effects of piperacillin. Piperacillin decreases effects of BCG vaccine.

PIPERACILLIN with TAZOBACTAM

Dosage form and strengths: Powder for injection: (2 g/250 mg)/vial: 2.25 g, (3 g/375 mg) vial: 3.375 g, (4 g/500 mg) vial: 4.5 g.

Indications: severe infections, nosocomial pneumonia, community acquired pneumonia, diverticulitis/intra-abdominal abscess/peritonitis complicated intra-abdominal infection, skin and soft tissue infection, malignant otitis externa

Contraindications/Precautions: Allergy to penicillin, cephalosporins, imipenem, beta lactamase inhibitors. Risk of bleeding complications, especially in renal impairment; discontinue if thrombocytopenia; discontinue if thrombocytopenia or bleeding occurs. Serious skin reactions reported, including Stevens-Johnson syndrome and toxic epidermal necrolysis, generalized exanthematous pustulosis; discontinue if reaction occurs.

Dosage schedule:

- *Severe infections:* intravenous: 3.375 g every 6 hr; total of 13.5 g (piperacillin [12 g] per tazobactam [1.5 g]) for 7-10 days; administer over 30 min.
- *Nosocomial pneumonia:* 4.5 g intravenous; add aminoglycoside; total of 18 g (piperacillin 16 g + tazobactam 2 g) for 7-14 days; continue aminoglycoside in *P. aeruginosa* patients.
- *Community acquired pneumonia:* intravenous: 3.375 g every 6 hr for 7-10

days.

- *Diverticulitis/intra-abdominal abscess/peritonitis*: intravenous: 3.375 g every 6 hr for 7-14 days or until clear.
- *Complicated intra-abdominal infection*: intravenous: 3.375 g every 6 hr for 4-7 days.
- *Skin and soft tissue infection*: intravenous: 3.375 g every 6-8 hr for 7-14 days.
- *Malignant otitis externa*: intravenous: 4.5 g every 8 hr then step down to oral ciprofloxacin 500-750 mg every 12 hr for total of 4-6 weeks.

Adverse effects: diarrhea, constipation, headache, insomnia, nausea, fever, oral candidiasis, rash, pruritus.

Drug and food interactions: see under piperacillin.

10.2.2 Protein synthesis inhibitors

10.2.2.1 Aminoglycosides

AMIKACIN

Dosage form and strengths: *Injection*: 50 mg/ml, 125 mg/ml and 250 mg/ml.

Indication: Serious gram-negative infections resistant to gentamicin.

Contraindications/Precautions: Pregnancy (D), hypersensitivity to any aminoglycoside, also see under gentamicin.

Dosage schedule: Adult: Once daily dosing IV infusion initially 15 mg/kg/day (max 1.5 g per dose / day), dose to be adjusted according to serum amikacin concentration: maximum 15 g per course. Child: Inj. 15 mg/kg daily in 2-3 doses, maximum of 1.5 g/day; Neonate: loading dose of 10 mg/kg then 15 mg/kg daily in 2 divided doses.

Adverse effects: See under gentamicin

Drug and food interactions: See under gentamicin.

GENTAMICIN

Dosage and strength: *Injection*: 10 mg/ml and 40 mg/ml; *Ear drops*: (0.3%) 3 mg/ml.

Indications: Urinary tract infections due to *Pseudomonas*, meningitis and other CNS infections, septicaemia and neonatal sepsis, endocarditis (with other antibiotics). Biliary tract disease, adjunct to listerial meningitis, prostatitis, surgical prophylaxis (including joint replacement surgery), medical labyrinthectomy, otitis externa.

Contraindications/Precautions: Hypersensitivity to any aminoglycosides, pregnancy (D). Breast-feeding, neonates, geriatric patients, mild renal disease, hearing deficits, myasthenia gravis, parkinson's disease, infant botulism, pseudomembranous colitis. Monitoring of blood level of gentamicin is advisable when used in high doses particularly in neonates, elderly and in those with renal impairment. To report if loss of hearing, ringing in the ears, feeling of fullness in the head.

Dosage schedule: By intramuscular or by slow intravenous injection over at least 3 minutes or IV infusion: 3-5 mg/kg daily (in divided doses every 8 hours). Child up to 2 weeks: 3 mg/kg every 12 hours; 2 weeks-12 years: 2 mg/kg every 8 hours. By intrathecal injection: 1 mg daily (increased if necessary)

to 5 mg daily)

- *Endocarditis (in combination with other antibiotics)*: adult 1 mg/kg every 8 hours.
- *Gram-positive bacterial endocarditis or HACEK endocarditis (in combination with other anti-bacterials)*: by intramuscular injection or by slow intravenous injection or by intravenous infusion. Adult: 1 mg/kg every 12 hours, intravenous injection to be administered over at least 3 minutes, to be given in a multiple daily dose regimen.
- *Surgical prophylaxis (including joint replacement surgery)*: by slow intravenous injection. Adult: 1.5 mg/kg, intravenous injection to be administered over at least 3 minutes, administer dose up to 30 minutes before the procedure, dose may be repeated every 8 hours for high-risk procedures and joint replacement surgery; up to 3 further doses maybe given by intravenous infusion. Adult: 5 mg/kg for 1 dose, administer dose up to 30 minutes before the procedure.
- *Medical labyrinthectomy*: intra tympanic: 2-3 drops, 3-4 times a day; 2 ml (40 mg/ml), 2 doses/month, left in the ear for 30 min and then attempt is made to clear via eustachian tube by swallowing

Adverse effects: vestibular damage, reversible nephrotoxicity, muscle weakness and respiratory paralysis.

Drug and food interactions: Do not use at the same time or physically mix with penicillins. Increase ototoxicity, neurotoxicity, nephrotoxicity with other aminoglycosides, amphotericin B, polymyxin, vancomycin, ethacrynic acid, furosemide, mannitol, methoxyflurane, cisplatin, cephalosporins, penicillins, cidofovir, acyclovir. Increase effects of non-depolarizing neuromuscular blockers

NEOMYCIN

See under drugs used in skin diseases.

10.2.2.2 CHLORAMPHENICOL

Dosage form and strengths: *Capsule*: 250 mg, 500 mg. *Injection*: 1 g powder for solution for injection vials (it should be protected from light); *Oral suspension*: 125 mg/5 ml (should be protected from light). *Solution*: 5% ear drops

Indication: Life threatening infections those caused by *Hemophilus influenza*, typhoid fever, acute otitis externa.

Contraindications/Precautions: Acute porphyrias. Neonates and G6PD deficiency. Monitor blood counts regularly and discontinue the drug on appearance of leucopenia or anemia. Don't give IM as it is ineffective. Avoid prolonged use of drops. Instruct patient to take the drug on an empty stomach 1 hour before or 2 hours after meal.

Dosage schedule: Adult: 12.5 mg/kg every 6 hours. In severe infections, dose can be doubled in septicemia and meningitis, providing high doses reduced as soon as clinically indicated.

- *Acute otitis externa*: intra-aural: 2-3 drops, twice daily or thrice daily for 7 days

Adverse effects: Erythema multiforme, optic neuritis, grey baby syndrome

10.2.2.3 Lincosamide derivatives

CLINDAMYCIN

Dosage form and strengths: Capsule: 75 mg, 150 mg, 300 mg. Topical lotion: 10 mg/ 1 ml; Gel: 2%

Indication: Staphylococcal bone and joint infections such as osteomyelitis, Peritonitis, Intra-abdominal sepsis, Methicillin-resistant Staphylococcus aureus (MRSA), in bronchiectasis, bone and joint infections, and skin and soft-tissue infections, erysipelas or cellulitis in penicillin-allergic patients, treatment of mild to moderate pneumocystis pneumonia (in combination with primaquine), treatment of falciparum malaria (to be given with or following quinine), acne vulgaris, tonsillitis and pharyngitis (with penicillin allergy)

Contraindications/Precautions: Clostridium difficile associated diarrhea has been reported (mild to fatal colitis), hypersensitivity. Endocarditis prophylaxis: use only for high risk patients. Severe skin reactions including toxic epidermal necrolysis, drug reaction with eosinophilia and systemic symptoms (DRESS) and Steven Johnson Syndrome has been reported.

Dosage schedule:

- *Staphylococcal bone and joint infections such as osteomyelitis, Peritonitis, Intra-abdominal sepsis, Methicillin-resistant Staphylococcus aureus (MRSA), bronchiectasis, bone and joint infections, and skin and soft-tissue infections, erysipelas or cellulitis in penicillin-allergic patients (alternative to macrolides):* oral, Child: 3–6 mg/kg 4 times a day (max. dose 450 mg), Adult: 150–300 mg every 6 hours; increased if necessary up to 450 mg every 6 hours if required, increased dose used in severe infection. Deep intramuscular injection or by intravenous infusion, adult: 0.6–2.7 g daily in 2–4 divided doses; increased if necessary up to 4.8 g daily, increased dose used in life threatening infection, single doses above 600 mg to be administered by intravenous infusion only, single doses by intravenous infusion not to exceed 1.2 g.
- *Pneumocystis pneumonia (mild to moderate form) (in combination with primaquine):* oral, adult: 600 mg every 8 hours.
- *Falciparum malaria (to be given with or following quinine):* oral, Child: 7–13 mg/kg every 8 hours (max. per dose 450 mg) for 7 days. Adult: 450 mg every 8 hours for 7 days.
- *Acne vulgaris:* Adult: Apply 2% gel twice daily, to be applied thinly.
- *Tonsillitis and pharyngitis (with penicillin allergy):* 7 mg/kg/day in 3 divided doses (maximum 1.8 g per day) for 10 days

Adverse effects: Abdominal discomfort, anaphylactoid reactions, antibiotic-associated colitis, diarrhoea (discontinue treatment), eosinophilia, exfoliative dermatitis, jaundice, leucopenia, nausea, oesophageal ulcers, oesophagitis, polyarthrititis, pruritus, rash, Stevens-Johnson syndrome, taste disturbances, thrombocytopenia, toxic epidermal necrolysis, urticarial, vesiculobullous dermatitis, vomiting, antibiotic-associated colitis.

Drug and Food Interaction: Clindamycin increases effects of atracurium by pharmacodynamic synergism. Risk of respiratory depression.

10.2.2.4 Oxazolidinone derivative

LINEZOLID

Dosage form and strengths: *Tablet:* 300 mg; *Oral suspension:* 100 mg/5 ml.

Indications: Pneumonia (when other antibacterials e.g. glycopeptide such as vancomycin cannot be used, initiated under specialist supervision). Complicated skin and soft tissue infection caused by gram positive bacteria when other antibacterials cannot be used (initiated under specialist supervision).

Contraindications/Precautions: Hypersensitivity, lactation, geriatric patients. Acute confusional states, bipolar depression, carcinoid tumors, history of seizures, pheochromocytoma, schizophrenia, thyrotoxicosis, uncontrolled hypertension. Visual function should be monitored regularly if treatment is required for longer than 28 days. Full blood counts are monitored weekly in patients who receive treatment for more than 10-14 days; have preexisting myelosuppression, have severe renal impairment, are receiving drugs that may have adverse effects on hemoglobin, blood counts, or platelet functions. Avoid consuming large amounts of tyramine rich foods like mature cheese, yeasts extracts, undistilled alcoholic beverages and fermented soya bean products. Plasma concentration of linezolid is reduced by rifampin leading to possible therapeutic failure of linezolid.

Dosage schedule: Oral, for adults: 600 mg every 12 hours usually for 10-14 days (maximum duration of treatment 28 days); Child: 10 mg/kg 8 hourly for 10-14 days; preterm infant: 10 mg/kg 12 hourly; by intravenous infusion 600 mg every 12 hours.

Adverse effects: Diarrhea, pruritus, pseudomembranous colitis, vaginal and oral candidiasis, taste disturbance, visual impairment, including blurred vision, visual field defect, color vision, change in visual acuity, pancytopenia

Drug and food interaction: Plasma concentration of linezolid is reduced by rifampicin, linezolid shouldn't be given with another MAOI, SSRIs, TCAs, or within 2 weeks of stopping another MAOI

10.2.2.5 Macrolides

AZITHROMYCIN

Dosage form and strengths: *Tablets:* 250 mg, 500 mg; *Dispersible tablets:* 100 mg; *Syrup:* 100 mg/5 ml, 200 mg/5 ml

Indications: Community-acquired pneumonia, lyme disease, respiratory-tract infections, otitis media, skin and soft tissue infections, non-gonococcal urethritis, multi-drug resistant typhoid tonsillitis and pharyngitis (with penicillin allergy).

Contraindications/Precaution: Contraindicated in impairment of hepatic function; Pregnancy category (B), breast-feeding, geriatric patients, renal/hepatic/cardiac disease; <6 months for otitis media; <2 years for pharyngitis, tonsillitis; QT prolongations, ulcerative colitis, pseudomembranous colitis, sunlight exposure. Use oral suspension 1 hour before or 2 hour after meal.

Dosage schedule:

• *For susceptible infections:* 500 mg once daily for 3 days; Child over 6

months, 10 mg/kg once daily for 3 days.

- *Endocarditis prophylaxis*: 15 mg/kg stat before surgical procedure.
- *Non-gonococcal urethritis*: 1 g as a single dose.
- *Typhoid*: 500 mg once daily for 7 days.
- *Lyme disease*: 500 mg daily for 7-10 days.
- *Acute otitis media*: 500 mg once then 250 mg once daily for 4 days.
- *Tonsillitis and pharyngitis (with penicillin allergy)*, 500 mg oral daily for 5 days

Adverse effects: Headache, drowsiness, constipation, arthralgia, disturbance in taste and vision, pancreatitis.

CLARITHROMYCIN

Dosage form and strengths: *Tablet*: 250 mg, 500 mg

Indications: Respiratory tract infections, mild to moderate skin and soft tissue infections, otitis media, *H. pylori* eradication in combination with proton pump inhibitor and metronidazole and in combination with proton pump inhibitor and amoxicillin, tonsillitis and pharyngitis

Contraindications/Precaution: Hypersensitivity to any macrolide, torsade de pointes, QT prolongation. Pregnancy (C), breast-feeding, geriatric patients, renal/hepatic disease. The drug should be used in pregnancy and breast-feeding if potential benefit outweighs risk.

Dosage schedule:

- *Respiratory tract infections*: Adult, oral: 250 mg every 12 hours for 7 days (severe infection, 500 mg every 12 hours for up to 14 days); Child: 15 mg/kg twice daily for 10 days.
- *H. pylori eradication in combination with a proton pump inhibitor and amoxicillin*: 500 mg twice daily.
- *H. pylori eradication in combination with a proton pump inhibitor and metronidazole*: 250 mg twice daily.
- *Tonsillitis and pharyngitis (with penicillin allergy)*: oral: 250 mg every 12 hrs for 10 days.

Adverse effects: See under erythromycin; also tooth and tongue discoloration, headache, smell and taste disturbances, hyperhidrosis, insomnia.

ERYTHROMYCIN

Dosage form and strengths: *Tablets*: 100 mg, 250 mg, 500 mg; *Drops*: 100 mg/ml; *Oral Suspension*: 100 mg/5 ml

Indication: Lyme disease, chronic prostatitis, pertussis, diphtheria, prevention of recurrence of rheumatic fever, tonsillitis and pharyngitis (with penicillin allergy), acute laryngitis (bacterial).

Contraindications/Precautions: Hypersensitivity to any macrolide, history of cholestatic jaundice. Pregnancy (B), breast-feeding, hepatic disease, GI disease, QT prolongation, seizure disorder, myasthenia gravis. Hepatic function should be closely monitored in patients with a previous history of liver disease.

Dosage schedule:

- *Lyme disease*: 500 mg 4 times a day for 14-21 days.
- *Chronic prostatitis*: 250-500 mg 4 times a day, total daily dose may

alternatively be given in two divided doses. Increased to 4 g daily in divided doses in severe infections. Injection: 6.25 mg/kg every 6 hours for mild infections when oral treatment is not possible. Increased to 12.5 mg/kg every 6 hours in severe infections.

- *Prevention and treatment of diphtheria in non-immune patient*: 500 mg every 6 hours for 7 days, treat for further 10 days if nasopharyngeal swabs positive after 7 days treatment
- *Acne*: 500 mg twice daily for 3 months reduced to 250 mg twice daily for a further 3 months.
- *Early syphilis*: 500 mg 4 times daily for 14 days.
- *Uncomplicated non-gonococcal urethritis*: 500 mg twice daily for 14 days. Child: 20-50 mg/kg/day in divided dose q6hourly. Neonates: 20 mg/kg/day in divided dose q12 hourly.
- *Intestinal amoebiasis*: 30-50 mg/kg/day 4 times a day for 10-14 days.
- *Tonsillitis and pharyngitis (with penicillin allergy)*: adult, oral: 500 mg 4 times a day for 10 days

Adverse effects: Nausea, vomiting, diarrhoea, skin rashes and fever. Cholestatic hepatitis is caused primarily by erythromycin estolate and rarely by erythromycin stearate or ethylsuccinate.

Drug and food interactions: Erythromycin potentiates the effects of carbamazepine, corticosteroids, digoxin, theophylline, tacrolimus and sildenafil.

10.2.2.6 Quinolones and fluoroquinolones

CIPROFLOXACIN

Dosage form and strengths: Tablet: 250 mg, 500 mg, 750 mg; Injection: 200 mg/100 ml. Solution: 0.2%

Indications: Uncomplicated and complicated UTIs, acute and chronic prostatitis, infective chronic airway disease, typhoid fever and gonorrhoea, diffuse otitis externa

Contraindications/Precautions: Lactating mother, hypersensitivity to quinolones, in children. Pregnancy(C), children under 12 years. The drug should be used with caution in patients with epilepsy or history of epilepsy, hepatic or renal impairment, pregnancy and breast-feeding.

Dosage schedule:

- *Oral for respiratory tract infections*: 250-500 mg twice daily;
- *Urinary-tract infections*: 250-500 mg twice daily (100 mg twice daily for 3 days in acute uncomplicated cystitis in women);
- *Gonorrhoea*: 500 mg as a single dose;
- *Chronic prostatitis*: 500 mg twice daily for 28 days;
- *Diffuse otitis externa*: oral 500 mg twice a day for 7 days.
- *Most other infections*: 500-750 mg twice daily;
- *Prophylaxis of meningococcal meningitis*: 500 mg as a single dose.
- *Surgical prophylaxis*: 750 mg 60-90 minutes before procedure; By intravenous infusion (over 30-60 minutes): 200-400 mg twice daily;
- *Urinary-tract infections*: 100 mg twice daily, gonorrhoea: 100 mg as a single dose; Child: not recommended; but when benefit outweighs risk, oral: 10-30

mg/kg daily in 2 divided doses or by intravenous infusion: 8-16 mg/kg daily in 2 divided doses.

• *Ear infection:* 2-3 drops, twice daily for 7 days

Adverse effects: Nausea, vomiting, pancreatitis, tachycardia, hypotension, tinnitus, sweating, joint and cartilage damage, tendinitis and tendon rupture.

Drug and food interaction: Antacids reduce absorption of ciprofloxacin, concomitant use with warfarin prolongs PT.

LEVOFLOXACIN

Dosage form and strengths: *Tablets:* 250 mg, 500 mg. *Infusion:* 500 mg/100 ml.

Indications: Chronic prostatitis, urinary-tract infections, exacerbation of chronic bronchitis, community acquired pneumonia, skin and soft tissue infections, acute bacterial sinusitis, tonsillitis and pharyngitis (with penicillin allergy).

Contraindications/Precautions: Hypersensitivity to quinolones, children less than 18 years. To be used in caution in patients with convulsions and weakness of tendons, hypokalemia, hypomagnesemia, and renal dysfunction, pregnancy, breastfeeding, photosensitivity, acute MI, atrial fibrillation, colitis, dehydration. Monitor blood tests, electrolyte levels, sputum test, urine test and WBC count during treatment periodically. Assess for sign and symptoms of infection allergy and for bowel pattern. Administer 4 hours before or 2 hours after antacids, iron, zinc.

Dosage schedule:

- *Urinary-tract infections:* oral, adult: 250 mg daily for 7-10 days for complicated urinary tract infection. Increased in severe cases, (for 3 days in uncomplicated cases).
- *Exacerbation of chronic bronchitis:* oral, adult: 250-500 mg daily for 7-10 days.
- *Chronic prostatitis:* oral, adult: 500 mg once daily for 28 days.
- *Community-acquired pneumonia:* oral, adult: 500 mg once or twice daily for 7-14 days.
- *Skin and soft tissue infections:* oral, adult: 250 mg daily or 500 mg once or twice daily for 7-14 days.
- *Community acquired pneumonia:* oral, adult: 500 mg once or twice daily by intravenous infusion (over at least 60 minutes for each 500 mg). Child: 10-15 mg/kg single dose (Oral or IV). Tonsillitis and pharyngitis (with penicillin allergy): adult, oral: 500 mg oral once daily for 7days.

Adverse effects: See under ciprofloxacin. It also causes GI disturbance, insomnia, tachycardia, hypotension, hypoglycemia, and pneumonitis.

MOXIFLOXACIN

Dosage form and strengths: *Tablet:* 400 mg

Indication: Sinusitis, community acquired pneumonia, exacerbation of chronic bronchitis, mild to moderate pelvic inflammatory disease, tuberculosis.

Contraindication/Precautions: Hypersensitivity. Pregnancy(C), breastfeeding, hepatic/ cardiac/ renal impairment, epilepsy, uncontrolled

hypokalemia, prolonged QT interval, pseudomembranous colitis, diabetes mellitus. Assess ECG for cardiac status, assess BUN, creatinine, AST, ALT, electrolytes.

Dosage schedule:

- *Sinusitis*: oral dose for adults, 400 mg once daily for 7 days.
- *Community-acquired pneumonia*: oral dose for adults, 400 mg once daily for 7–14 days; by IV infusion for adults: 400 mg once daily for 7–14 days, to be given over 60 minutes.
- *Exacerbations of chronic bronchitis*: oral dose for adults, 400 mg once daily for 5–10 days.
- *Mild to moderate pelvic inflammatory disease*: oral dose for adults, 400 mg once daily for 14 days

Adverse effects: Angina, arrhythmias, constipation, flatulence, gastritis, hyperlipidemia, palpitations, sweating, vasodilation, photosensitivity, xerostomia, headache, dizziness

Food and drug interaction: Increase QT prolongation especially when it is combined with drugs that increase QT interval, probenecid increases serum moxifloxacin level, increase warfarin and cyclosporine effect, increase seizure risk when used with NSAIDs.

NALIDIXIC ACID

Dosage forms and strength: *Oral Suspension*: 300 mg/5 ml; *Tablets*: 500 mg

Indications: Urinary tract infections

Contraindications/Precautions See under Ciprofloxacin, children under 6 months. Renal and hepatic impairment.

Dosage schedule: 900 mg every 6 hours for 7 days, reduced in chronic infection to 600 mg every 6 hours; Child over 3 months maximum 50 mg/kg daily in divided doses; reduced in prolonged therapy to 30 mg/kg daily.

Adverse effects: Nausea, vomiting, abdominal pain, allergic reactions such as pruritus, urticaria, eosinophilia and fever, cranial nerve palsy, increase in intra-cranial pressure, metabolic acidosis, peripheral neuropathy, toxic psychosis

Drug and food interaction: Nitrofurantoin and nalidixic acid should not be used concurrently as antagonism occurs.

NORFLOXACIN

Dosage form and strengths: *Tablets*: 100 mg, 200 mg, 400 mg and 800 mg

Indications: Uncomplicated urinary tract infections, prophylaxis in recurrent urinary-tract infections, chronic prostatitis.

Contraindication/Precautions: Lactation, below 12 years, hypersensitivity to quinolones, tendon rupture. See under ciprofloxacin.

Dosage schedule:

- *Urinary-tract infections*: 400 mg twice daily for 7–10 days (for 3 days in uncomplicated lower urinary-tract infections).
- *Chronic relapsing urinary-tract infections*: 400 mg twice daily for up to 12 weeks; may be reduced to 400 mg once daily if adequate suppression within first 4 weeks.

• *Chronic prostatitis*: 400 mg twice daily for 28 days. Child: 10-15 mg/kg/day in two divided doses.

Adverse effects: Epiphora, see under ciprofloxacin.

Drug interactions: see under ciprofloxacin.

OFLOXACIN

Dosage form and strengths: *Tablets*: 100 mg and 200 mg, *I.V. infusion*: 200 mg/100 ml. *Solution*: 0.3% (3 mg/ml)

Indication: Uncomplicated urinary-tract infections, acute or chronic prostatitis, infective chronic airway disease, multidrug resistant TB, PID, septicemia, skin, and soft tissue infection, acute otitis externa, otitis media.

Contraindications/Indications: See under ciprofloxacin.

Dosage schedule:

- *Skin and soft tissue infections*: 400 mg twice a day for 10 days.
- *PID*: 400 mg twice a day for 14 days.
- *Septicemia*: Inj. adult 200 mg twice a day, increased to 400 mg twice a day for severe complicated infections. Each 200 mg given over at least 30 mins.
- *Urinary-tract infections*: 200-400 mg daily preferably in the morning, increased if necessary in upper urinary-tract infections to 400 mg twice daily.
- *Lower respiratory-tract infections*: 400 mg daily preferably in the morning, increased if necessary to 400 mg twice daily.
- *Uncomplicated gonorrhoea*: 400 mg as a single dose.
- *Non-gonococcal urethritis*: 400 mg daily in single or divided doses for 7 days.
- *By intravenous infusion for complicated urinary-tract infection*: 200 mg daily (over at least 30 minutes for each 200 mg).
- *Lower respiratory-tract infections*: 200 mg twice daily. Child: Oral 15-20 mg/kg/day in two divided doses
- *Acute otitis externa*: 10 drops in affected ear once daily for 7 days;
- *Otitis media*: same as in acute otitis externa for 14 days

10.2.2.7 Sulphonamides

COTRIMOXAZOLE (SULPHAMETHOXAZOLE and TRIMETHOPRIM)

Dosage form and strengths: *Oral suspension*: 40 mg trimethoprim and 200 mg sulphamethoxazole per 5 ml. *Tablets*: 80 mg trimethoprim plus 400 mg sulphamethoxazole, 40 mg trimethoprim plus 200 mg sulphamethoxazole, 160 mg trimethoprim plus 800 mg sulphamethoxazole. *Dispersible tablets*: 20 mg trimethoprim plus 100 mg sulphamethoxazole.

Indication: Uncomplicated lower urinary tract infection, bacterial prostatitis, exacerbation of chronic bronchitis due to *H. influenzae* and *Strep. pneumoniae*, acute otitis media in children and acute maxillary sinusitis in adults due to *H. influenzae* and *Strep. pneumoniae*, *Pneumocystiscarinii* pneumonia.

Contraindication/Precaution: Blood donors, avoid in infants less than 6 weeks, G-6PD deficiency, hypersensitivity, pregnancy, lactation. Monitor for pseudomembranous colitis. Risk of crystalluria can be decreased by maintaining urinary output of at least 1.5 liters daily.

Dosage schedule: Oral: 960 mg every 12 hours, Child: 5-8 mg/kg/day of trimethoprim + 25-50 mg/kg/day of sulfamethoxazole in two divided doses.

- *Pneumocystis jirovecii* infection: (high dose therapy): oral or intravenous infusion 120 mg/kg daily in 2-4 divided doses for 14 days.
- *Prophylaxis of Pneumocystis jirovecii*: oral: 960 mg once daily (may be reduced to 480 mg once daily) or 960 mg twice daily on alternate days; child 6 weeks-5months:120 mg twice daily on 3 consecutive or alternate days per week; 6 months – 5 years: 240 mg, 6-12 years 480 mg.

Adverse effects: Nausea, vomiting, rashes, drug fever, erythema multiform of Stevens-Johnson type, leucopenia, granulocytopenia, glossitis, stomatitis, megaloblastic anaemia and crystalluria.

10.2.2.8 Tetracyclines

DOXYCYCLINE

Dosage forms: Capsules: 100 mg.

Indications: See under tetracyclines, Lyme disease, periodontitis, lymphangioma.

Contraindications/Precautions: See under tetracyclines. Breast-feeding, hepatic impairment, excessive sunlight, sulfite hypersensitivity, ulcerative colitis, avoid in children < 8 years.

Dosage schedule:

- *UTI*: 200 mg on first day, then 100 mg daily; severe infections (including chronic urinary-tract infections) 200 mg daily; increased dose for severe infection including refractory UTI.
- *Acne*: 100 mg daily for 6-12 weeks or longer.
- *Early syphilis*: 100 mg twice daily for 14 days; late latent syphilis 200 mg twice daily for 28 days.
- *Non-gonococcal urethritis*: 100 mg twice daily for 7 days.
- *Anthrax (treatment or post-exposure prophylaxis)*: 100 mg twice daily; child (only if alternative antibacterial cannot be given) 5 mg/kg daily in 2 divided doses (maximum 200 mg daily). Lyme disease: 100 mg twice daily for 10-14 days; for 28 days in lyme arthritis.
- *Periodontitis (As an adjunct to gingival scaling and root planning)*: 20 mg twice for three months. Child: 2-4 mg/kg/day in two divided doses.
- *Lymphangioma*: injected at a concentration of 10-20 mg/ml (after aspiration of contents of lymphangioma)

Adverse effects: See under tetracyclines.

Drug and food interactions: Increases effects of digoxin, anti-coagulants, methotrexate. Effects of doxycycline is decreased by antacids, dairy products, iron, barbiturates, carbamazepine, cholestyramine, cimetidine, sucralfate, colestipol, rifampin, bismuth, magnesium, zinc, decreases effects of penicillin and oral contraceptive pills.

MINOCYCLINE

Dosage form and strengths: Capsules: 50 mg and 100 mg; Syrup: 50 mg/5 ml.

Indications: Acne vulgaris, Gonococcal Infection

Contraindications/Precautions: Hypersensitivity. Pregnancy (C), breast-feeding, children, renal/hepatic impairment, bladder obstruction, dialysis, hypertension.

Dosage schedule:

- Gonococcal infection: uncomplicated infection in male :100 mg twice daily;
- Acne: 50 mg twice daily for minimum course of 6 weeks

Drug and food interaction: Increases effect of warfarin, digoxin, insulin, oral anticoagulants, neuromuscular blockers; Chances of pseudo-tumor cerebri if used concurrently with retinoids.

OXYTETRACYCLINE

Dosage form and strengths: *Capsule:* 250 mg, 500 mg

Indication, adverse effects, precautions and drug and food interaction: See under tetracycline.

Dosage schedule: 250-500 mg every 6 hours

TETRACYCLINE

Dosage forms and strength: tetracycline hydrochloride: *Capsules:* 250 mg, 500 mg.

Indications: Exacerbations of chronic bronchitis, sinusitis, chlamydial infections such as non-gonococcal urethritis, trachoma and lymphogranuloma venereum; acne vulgaris, brucellosis, cholera, syphilis (in patients allergic to Penicillin), diabetic diarrhea in autonomic neuropathy and rosacea.

Contraindications/Precautions: Pregnancy (D), breast-feeding, children <8 years, hypersensitivity. Renal / Hepatic impairment, UV exposure.

Dosage schedule:

- *Susceptible infections:* 250 mg every 6 hours, increased in severe infections to 500 mg every 8 hours.
- *Acne:* Child (12-17 years) and Adults: 500 mg twice daily for 3 months, if there's no improvement after first three months, another anti-bacterial should be used, maximum improvement usually occurs after 4-6 months but in more severe cases treatment needs to be continued for 2 years or longer.
- *Diabetic diarrhoea:* Oral 250 mg for 2 or 3 doses.
- *Rosacea:* 500 mg twice a day for 6-12 weeks.
- *Primary, secondary or latent syphilis:* 500 mg every 6 hours for 15 days.
- *Non- gonococcal urethritis:* 500 mg every 6 hours for 7-14 days (21 days if failure or relapse following the first course).

Adverse effects: Nausea, vomiting, diarrhea, urticaria and glossitis, fungal super infection when used for periodontitis

Drug and food interactions: Fatal nephrotoxicity if used with methoxyflurane. Tetracyclines increase effects of digoxin and warfarin. Decreases effects of iron, antacids, cimetidine and penicillin. Dairy products decrease effects of Tetracycline.

10.2.3 Glycopeptide antibacterials

VANCOMYCIN

Dosage form and strength: *Powder for injection:* 500 mg in vial

Indications Clostridium difficile infection, infections due to Gram-positive bacteria including endocarditis, osteomyelitis, septicaemia and soft-tissue infections, surgical prophylaxis (when high risk of MRSA)

Contraindications/Precautions: Avoid if history of deafness, elderly. Avoid extravasation; necrosis may occur. Monitor plasma vancomycin concentration after 3-4 doses of therapy in normal renal function patients, and earlier if renal impairment. Pre-dose ('trough') concentration: 10-15 mg/litre (15-20 mg/litre for endocarditis/ less sensitive strains of MRSA/ for complicated infections caused by *S. aureus*). Renal impairment: reduce dose. Pregnancy and breast feeding: use with caution.

Dosage schedule:

- *Clostridium difficile* infection: oral, adult: 125 mg 4 times a day for 10-14 days, dose may be increased if infection fails to respond or is life threatening, increased if necessary up to 500 mg 4 times a day.
- *Infections due to Gram-positive bacteria including endocarditis, osteomyelitis, septicaemia and soft-tissue infections:* intravenous infusion, adult: 1-1.5 g every 12 hours. intravenous infusion, elderly: 500 mg every 12 hours, alternatively 1 g once daily
- *Surgical prophylaxis (when high risk of MRSA):* intravenous infusion, adult: 1 g

Adverse effects: Rapid IV administration may result in flushing, pruritus, hypotension, erythema, and urticarial. With intravenous use: Blood disorders, including reversible neutropenia (usually after 1 week or cumulative dose of 25 g), interstitial nephritis, nephrotoxicity, ototoxicity (discontinue if tinnitus occurs), renal failure, Agranulocytosis, thrombocytopenia, anaphylaxis, cardiac arrest on rapid infusion, chills, dyspnea, eosinophilia, exfoliative dermatitis, fever, flushing of the upper body ('red man' syndrome), nausea, pain and muscle spasm of back and chest, phlebitis (irritant to tissue), pruritus, rashes, severe hypotension on rapid infusion, shock on rapid infusion, Stevens-Johnson syndrome, toxic epidermal necrolysis, urticarial, vasculitis, wheezing

Drug and food interaction: Cross sensitivity with teicoplanin. Avoid use with bacitracin, BCG vaccine, typhoid vaccine live.

10.3 Antifungal drugs

AMPHOTERICIN B

Dosage form and strengths: Liposomal 50 mg: 50 mg powder for solution for infusion vials. Intravenous: 50 mg powder for solution for infusion vials. Amphotericin B (as amphotericin B phospholipid complex) 5 mg per ml: 100 mg/20 ml concentrate for suspension for infusion vials

Indications: Intestinal candidiasis, oral and perioral infections, severe systemic or deep mycosis, where toxicity (particularly nephrotoxicity) precludes use of conventional amphotericin; suspected or organ infection in febrile neutropenic patients unresponsive to broad-spectrum antibacterial; aspergillosis, visceral leishmaniasis, systemic fungal infections, severe candidiasis

Contraindications/Precautions: Severe bone marrow depression. Anemia,

breastfeeding, cardiac disease, children, electrolyte imbalance, geriatric, hematological/hepatic/renal disease, hypotension, pregnancy (B), hepatic and renal function tests, and plasma electrolyte monitoring is required. To notify in case of bleeding, bruising, or soft tissue swelling.

Dosage schedule:

- *Severe systemic or deep mycosis where toxicity (particularly nephrotoxicity) precludes use of conventional amphotericin; suspected organ infection in febrile neutropenic patients unresponsive to broad-spectrum antibacterial; Aspergillosis:* Amphotericin B liposomal 50 mg: IV test dose 1 mg, to be given over 10 minutes, then 3 mg/kg once daily; maximum 5 mg/kg per day.
- *Visceral leishmaniasis (unresponsive to the antimonial alone):* Amphotericin B 50 mg: 1-3 mg/kg daily for 10-21 days to a cumulative dose at 21-30 mg/kg, alternatively 3 mg/kg for 5 consecutive days, followed by a single dose of 3 mg/kg after 6 days.
- *Systemic fungal infection:* Amphotericin B 50 mg: IV test dose 1mg to be given over 20-30 minutes then 250 micrograms/kg daily, gradually increased over 2-4 days increased if tolerated to 1 mg/kg daily, maximum (severe infection) 1.5 mg/kg daily or on alternate days. Prolonged treatment usually necessary; if interrupted for longer than 7 days restart at 250 micrograms/kg daily and increase gradually
- *Amphotericin B phospholipid complex 5 mg/1 ml:* severe systemic fungal infections in patients not responding to conventional amphotericin or to other antifungal drugs or where toxicity or renal impairment precludes conventional amphotericin, including, invasive aspergillosis, cryptococcal meningitis and disseminated Cryptococcus in HIV patients: Amphotericin B phospholipid complex 5 mg per 1 ml: test dose 1 mg to be given over 15 minutes, then 5 mg/kg once daily for at least 14 days. Child: for fungal infection: 3-5 mg/kg q 24 hour.
- *Oropharyngeal candidiasis:* 0.1 mg/ml, 5-10 ml oral rinse every 8 hr.

Adverse effects: Chills, fever, vomiting, headache, hypokalemia, neurological disorders including diplopia, convulsions, peripheral neuropathy and anaphylactoid reactions.

Drug and food interaction: Increased hepatotoxicity and/or ototoxicity when used with cidofovir

Increased nephrotoxicity when used with other nephrotoxic antibiotics (aminoglycosides, vancomycin, cyclosporine, polymyxin B), antineoplastics, pentamidine, salicylates, tacrolimus, tenofovir. Increased hypokalemia when used with corticosteroids, digoxin, skeletal muscle relaxants, thiazidies, loop diuretics.

CLOTRIMAZOLE

Dosage form and strengths: Cream 1%, Pessary: 100 mg, Mouth paint: 1% w/v, Ear drops: 1%.

Indications: Candidiasis, Tinea infections, Otomycosis

Contraindications/Precautions: Hypersensitivity, ophthalmic use. Hepatic impairment. Do not use skin products near the eyes, nose or mouth. To wash hands before and after use, wash affected area and gently pat dry. Local application may occasionally cause skin irritation and sensitivity.

Dosage schedule:

- Vaginal Candidiasis: 100 mg for 6 days or 200 mg for 3 days or 500 mg as a single dose in the form of pessary inserted in vagina at bed time.
- Ootomycosis: local application: 3 drops, three times a day, 7-10 days.
- Oropharyngeal candidiasis: 10 mg tablet mix in water 5 times a day.

Adverse effects: Nausea, vomiting, vaginal burning, rash, pruritus.

FLUCONAZOLE

Dosage form and strengths: *Capsule:* 50 mg, 150 mg, 200 mg; *Tablet:* 100 mg; *Oral suspension:* 10 mg/ml, 40 mg/ml; *Infusion:* 2 mg/ml

Indication: Invasive candidal infections, cryptococcal infections, candidial balanitis, dermal candidiasis, oropharyngeal candidiasis.

Contraindications/Precautions: Hypersensitivity, pregnancy, acute porphyria. Breast feeding, renal/hepatic impairment, torsades de pointes. Use alternative method of contraception while taking this product, pregnancy (D), if used for oral candidiasis, don't rinse mouth for 15-30 mins after use.

Adverse effects: Diarrhoea, headache, nausea, rash.

Dosage schedule:

- *Vulvovaginal candidiasis (recurrent):* Initially 150 mg every 12 hours for 3 doses then 150 mg once weekly for 6 months.
- *Mucosal candidiasis (except genital):* 50 mg daily given for 7-14 days in oropharyngeal candidiasis (maximum 14 days except in severely immune compromised patients) for 14 days. Atrophic oral candidiasis associated with dentures for 14-30 days in other mucosal infection (e.g. esophagitis, candidiasis, non-invasive bronchopulmonary infections, increased to 100 mg daily; increased dose usually for difficult infections).
- *Tinea infections (pedis, corporis, cruris, versicolor and dermal candidiasis):* Oral, 50 mg daily for 2-4 weeks (up to 6 weeks in Tinea pedis).
- *Invasive candidal infections (including candidemia and disseminated candidiasis) and cryptococcal infections including meningitis:* Oral or intravenous, child: 6-12 mg/kg daily (max. per dose 800 mg) treatment continued according to response (at least 8 weeks for cryptococcal meningitis). Adult: 400 mg dose to be given on first day, then 200-400 mg daily (max. per dose 800 mg daily) treatment continued according to response (at least 8 weeks for cryptococcal meningitis), maximum dose for use in severe infection.
- *Prevention of fungal infections in immunocompromised patient:* oral or intravenous infusion, Child: 3-12 mg/kg daily (max. per dose 400 mg), commence treatment before anticipated onset of neutropenia and continue for 7 days after neutrophil count is desirable range, dose given according to extent and duration of neutropenia. Adult: 50-400 mg daily, commence treatment before anticipated onset of neutropenia and continue for 7 days after neutrophil count in desirable range, dose adjusted according to risk.
- *Prevention of fungal infections in immunocompromised patients (for patients with high risk of systemic infections e.g. following bone marrow transplantation):* oral or intravenous infusion, adult: 400 mg daily, commence treatment before anticipated onset of neutropenia and continue for 7 days after neutrophil count is desirable range.

- *Prevention of relapse of cryptococcal meningitis in HIV infected patients after completion of primary therapy*: oral or intravenous infusion: oral: 200 mg daily.
- *Oropharyngeal candidiasis*: 100 mg OD for 2 weeks.

Drug and food interaction: Increases hypoglycemia- oral sulphonylureas (glipizide). Increases anticoagulation when used with warfarin, Increases plasma concentration of fluconazole by cyclosporine, phenytoin, theophylline, rifabutin, tacrolimus, sirolimus, zidovudine, zolpidem. Increases effects of zidovudine, methadone, fentanyl, sufentanil, alfentanil, buprenorphine, saquinavir, ergots. Decreases effects of oral contraceptives, calcium channel blockers. Decreases effects of fluconazole by proton pump inhibitors.

GRISEOFULVIN

Dosage form and strengths: *Tablet*: 250 mg, 125 mg

Indication: Dermatophyte infections

Contraindications/Precautions: Acute porphyrias, SLE, pregnancy. Breast-feeding, children, old age. May impair performance of skilled tasks (e.g. driving). To use alternative method of contraception while taking the product.

Dosage schedule:

- *Tinea capitis caused by Trichophyton tonsurans Adult*: 1 g once daily, alternatively 1 g daily in divided doses. Child: 15-20 mg/kg once daily (max. per dose 1 g), alternatively 15-20 mg/kg daily in divided doses.
- *Dermatophyte infection where topical therapy has failed or is inappropriate*: 500 mg daily in divided doses or a single dose, in severe infection dose may be doubled, reducing when response occurs; Child: 10 mg/kg daily in divided doses or as a single dose.

Adverse effects: Nausea, vomiting, headache, heartburn, photosensitivity and skin rashes

Drug and food interaction: Decreases effect of warfarin and oral contraceptives. Phenobarbitone decreases effects of griseofulvin. Enhances the effect of alcohol.

ITRACONAZOLE

Dosage form and strengths: *Oral solution*: 10 mg/ml; *Tablet*: 100 mg

Indications: Systemic candidiasis that has not responded to other antifungal drugs, Onychomycosis, aspergillosis, histoplasmosis, esophageal candidiasis in HIV- positive or other immunocompromised patients, cryptococcal meningitis not responding to other antifungal drugs, oropharyngeal candidiasis.

Contraindication/Precaution: Hypersensitivity, fungal meningitis, onychomycosis or dermatomycosis with cardiac dysfunction in pregnant women. Pregnancy(C), breastfeeding, children, cardiac/renal/hepatic impairment, achlorhydria or hypochlorhydria, dialysis, hearing loss, cystic fibrosis, neuropathy

Dosage schedule:

- *Vulvovaginal candidiasis (recurrent)*: adults, oral: 50-100 mg daily for 6 months.
- *Oral or esophageal candidiasis in HIV positive or other immunocompromised patients*: oral solution, adult: 200 mg daily in 1-2 divided doses for 1 week

(continue for another 1 week if no response).

- *Onychomycosis: oral, adult: 200 mg once daily for 3 months, alternately 200 mg twice daily for 7 days, subsequent courses repeated after 21 days intervals, fingernails 2 courses, toenails 3 courses.*
- *Systemic candidiasis where other antifungal drugs are inappropriate or ineffective: oral, adults: 100-200 mg once daily.*
- *Aspergillosis: oral, adult: 200 mg twice daily.*
- *Histoplasmosis: oral, adults: 200 mg three times a day for 3 days then 200 mg 1-2 times a day*
- *Systemic cryptococcosis including cryptococcal meningitis where other antifungal drugs are inappropriate or ineffective: oral, adult: 200 mg once daily, dose increased in invasive or disseminated disease and in cryptococcal meningitis increased to 200 mg twice daily. Intravenous infusion, adults: 200 mg every 12 hours for 2 days, then 200 mg once daily for max. 12 days.*
- *Maintenance in HIV-infected patients to prevent relapse of underlying fungal infection and prophylaxis in neutropenia when standard therapy inappropriate: oral, adults: 200 mg once daily, then increased only if low plasma itraconazole concentration.*
- *Prophylaxis of deep fungal infections (when standard therapy inappropriate) in patients with hematological malignancy or undergoing bone-marrow transplantation who are expected to become neutropenic: oral solution, adults: 5 mg/kg daily in 2 divided doses, to be started before transplantation or before chemotherapy (taking care to avoid interaction with cytotoxic drugs) and continued until neutrophil count recovers, safety and efficacy not established in elderly patients.*
- *Oropharyngeal candidiasis: adult, oral: 100 mg BD for 2 weeks.*

Adverse effects: Abdominal pain, diarrhea, dyspnea, headache, hepatitis, hypokalemia, nausea, rash, taste disturbances, vomiting, Stevens-Johnson syndrome, tinnitus, toxic epidermal necrolysis, urinary frequency, visual disturbances. With intravenous use hyperglycemia. Potentially life-threatening hepatotoxicity reported very rarely

Drug and food interaction: Increased tinnitus, hearing loss with quinidine. Increased hepatotoxicity with other hepatotoxic products. Increased edema with calcium channel blockers.

Severe hypoglycemia with oral hypoglycemic. Increased sedation with alprazolam, clorazepate, diazepam, estazolam, flurazepam, triazolam, midazolam. Increased levels and toxicity with buspirone, busulfan, clarithromycin, cyclosporine, diazepam, digoxin, felodipine, fentanyl, atorvastatin, carbamazepine, disopyramide, indinavir, isradipine, nicardipine, nifedipine, nimodipine, phenytoin, quinidine, quetiapine, ritonavir, saquinavir, tacrolimus, warfarin.

Decrease action with antacids, H₂-receptor antagonists, rifamycins, didanosine, carbamazepine, isoniazid, proton pump inhibitors

KETOCONAZOLE

Dosage form and strengths: *Topical gel; foam; cream: 2%; shampoo: 1%, 2%; tablet: 200 mg.*

Indications: Candidiasis, coccidioidomycosis, histoplasmosis,

chromoblastomycosis, paracoccidioidomycosis, tinea, seborrheic dermatitis, dandruff, oropharyngeal candidiasis.

Contraindication/Precaution: Hypersensitivity, breastfeeding, fungal meningitis- tablets. Hepatic impairment with tablet, Pregnancy (C), breast-feeding, Children: topical. To perform liver function tests (ALT, AST, bilirubin) if patient is receiving long term therapy. To avoid hazardous activities if dizziness occurs. Inform about the importance of compliance with product regimen, to use alternative method of contraception. Topical- these products are not for intravaginal therapy and are for external use only; do not use skin products near the eyes, nose or mouth, wash hands before and after use; do not wash affected area until 3 hours after application.

Dosage schedule:

- *Systemic candidiasis, chronic mucocandidiasis, oral thrush: adult, oral:* 200-400 mg/day for 1-2 weeks.
- *For other infections-coccidioidomycosis, histoplasmosis, chromomycosis, paracoccidioidomycosis, blastomycosis:* adult 200-400 mg per day for 6 weeks.
- *Seborrheic dermatitis:* topical foam apply to affected area two times a day for 4 weeks, apply gel to the affected area daily for 2 weeks.
- *Tinea corporis, cruris, versicolor:* topical cover area daily for 2 weeks.
- *Dandruff:* shampoo wet to dry hair, lather, and massage for 1minute, rinse, and repeat two times per week spaced by 3 days, for up to 8 weeks, then as needed.
- *Oropharyngeal candidiasis:* 200 mg tab once daily.

Adverse effects: Irritation, stinging, pustules, pruritus.

Drug and food interaction: Decrease effect of ketoconazole- H₂ blockers, proton pump inhibitors, antacids, rifampin, phenobarbitone, carbamazepine and phenytoin. Increase effect of phenytoin, carbamazepine, diazepam, haloperidol, warfarin, sulphonylureas, digoxin, omeprazole, cyclosporine, nifedipine and other dihydropyridines, HIV Protease inhibitors, statins

NYSTATIN

Dosage form and strengths: *Oral liquid:* 50 mg/5 ml, *Mouth paint:* 100000 IU/ml. *Tablet:* 500,000 units, *cream, pessary* 100,000units/ml

Indications: Oral, esophageal, intestinal, vaginal, cutaneous candidiasis, corneal and conjunctival candidiasis.

Contraindications/Precautions: Pregnancy (C). If used for oral candidiasis – Don't rinse mouth for 15-30 mins after use.

Dosage schedule:

- *Vaginal candidiasis:* Pessary 100,000 IU at night.
- *Cutaneous candidiasis:* apply cream to the affected area two times daily.
- *Intestinal candidiasis:* Adult- oral tablet 500,000units every 6 hours, doubled in severe infections, Child: 100,000 units 4 times daily

Adverse effects: nausea, vomiting and diarrhoea at high doses.

10.4 Anthelmintic drugs

ALBENDAZOLE

Dosage form and strengths: *Tablet:* chewable 400 mg, *Suspension:* 400 mg/10 ml

Indications: *Ascaris*, pinworm, hookworm, whipworm, strongyloides, *Echinococcus granulosus*, *E. multilocularis* infections and neurocysticercosis.

Contraindications/Precautions: First trimester of pregnancy, children younger than 1 year of age, known hypersensitivity. Hepatic impairment. Take the medicine with food. Avoid pregnancy for one month as it may cause fetal harm

Dosage schedule: Oral, usually as a single dose, in the treatment of single or mixed intestinal nematode infections. The usual dose for adults and children aged 2 years or over with ascariasis, hook worm infections, or trichuriasis is 400 mg in a single dose.

- *Strongyloidiasis:* 400 mg is given twice daily for 3 consecutive days; this may be repeated after 3 weeks if necessary.
- *Enterobiasis* children aged 2 years or more have been given a single dose of 400 mg repeated after 14 days; the adult dose is 400 mg repeated after 14 days.
- *E. granulosus*, 800 mg daily in divided doses for 1-6 months; Child: 15 mg/kg/day (maximum 800 mg) for 1-6 months.
- *Neurocysticercosis:* adult over 60 kg, 800 mg daily in two divided doses for 8-30 days; adult less than 60 kg, 15 mg/kg daily in two divided doses (maximum 800 mg) for 8-30 days.
- *Ascariasis:* 15 mg/kg/day in divided dose.

Adverse effects: Gastro-intestinal discomfort, headache

Drug and food interaction: Plasma concentration of albendazole reduced by carbamazepine, fosphenytoin, phenobarbital, phenytoin, primidone-consider increasing the dose when given for systemic infections. Plasma concentration of active metabolite of albendazole reduced by ritonavir. Plasma concentration of active metabolite of albendazole increased by corticosteroids

MEBENDAZOLE

Dosage form and strengths: *Suspension:* 100 mg/5 ml, *Tablet:* 100 mg

Indications: Threadworm, roundworm, hookworm, whipworm

Contraindications/ Precaution: Pregnancy (C), children younger than 2 years of age, patients who do have experienced allergic reaction to the drug. Breast-feeding, Crohn's disease, inflammatory bowel disease, ulcerative colitis, hepatic disease.. AST, ALT, ALP, BUN, CBC are monitored during treatment.

Dosage schedule:

- *Whipworm:* oral- adult and child- 100 mg twice daily for 3 days.
- *Thread worm:* adult and child: 2 years: 100 mg as a single dose; if re-infection occurs second dose may be needed after 2 weeks, child under 2 years, not recommended.
- *Roundworm and hookworm:* 100 mg twice daily for 3 days.

Adverse effects: Abdominal pain, diarrhea and rash. In heavily infected children, roundworms may be expelled through the mouth and nose, since mebendazole kills these worms slowly and cause them to migrate.

Drug and food interaction: Decrease mebendazole effect by carbamazepine, hydantoins. Increase absorption by high fat meal.

MILTEFOSINE

Dosage form and strengths: *Capsule:* 50 mg

Indications: Visceral and cutaneous leishmaniasis.

Contraindication/Precaution: Pregnancy (D), breast-feeding (5 months following therapy). Hepatic impairment. Advise females to use additional non-hormonal or alternative methods of effective contraception. Encourage fluid intake to avoid volume depletion.

Dosage schedule: Oral 100 mg daily (patients weighing more than 25 kg) for 28 days; child 2.5 mg/kg daily.

Adverse effects: Vomiting, diarrhoea, rise in hepatic transaminases and serum creatinine (reversible).

Drug and food interaction: Combination therapy with paromomycin or Amphotericin B prevents development of resistance to this drug compared to individual use.

NICLOSAMIDE

Dosage form and strengths: *Tablet:* (chewable) 500 mg.

Indications: Tapeworm infections (*Taenia solium*, *Taenia saginata*, *Hymenolepis nana* and *Diphyllobothrium latum*).

Contraindications/ Precaution: Hypersensitivity, alcohol. Lactation, pregnancy (B), elderly, children. It is inactive against cysticercosis cellulose and danger of cysticercosis must be considered when used in *T. solium* infection. Check patient for the history of allergy before starting treatment. Avoid alcohol intake during treatment with niclosamide.

Dosage schedule:

- *Taenia solium*:- Adult and child over 6 years 2 g as a single dose after a light breakfast or meal followed by a purgative after 2 hours; child under 2 years 500 mg, 2-6 years 1 g.
- *T. saginata* and *Diphyllobothrium latum*: as for *T. solium* but half the dose may be taken after breakfast or meal and the remainder 1 hours later followed by a purgative 2 hours after last dose.
- *Hymenolepis nana*: adult and child over 6 years: 2 g as a single dose on first day then 1 g daily for 6 days; child under 2 years: 500 mg on first day then 250 mg daily for 6 days, 2-6 years: 1 g on first day then 500 mg daily for 6 days.

Adverse effects: Nausea, vomiting, abdominal discomfort, anorexia, diarrhoea and pruritus.

Drug and food interaction: Niclosamide is soluble in alcohol which enhances its absorption raising the possibility of dose related adverse effects.

PENTAMIDINE

Dosage form and strengths: *Injection:* 200 mg and 300 mg vials.

Indications: Visceral leishmaniasis, *Pneumocystis pneumonia*.

Contraindications/Precautions: Hypersensitivity. Pregnancy (C), breastfeeding, children, blood dyscrasias, cardiac/renal/hepatic disease, diabetes mellitus, hypoglycemia, hypocalcemia, hypo/hypertension, anemia.

Dosage schedule:

- *Visceral leishmaniasis*: deep intramuscular injection 3-4 mg per kg of body weight on alternate days to a maximum of 10 injections; course may be repeated if necessary.
- *Pneumococcal pneumonia, Pneumocystis pneumonia*: intravenous infusion, 4 mg per kg of body weight daily for at least 14 days.

Adverse effects: Rash, abnormal liver function tests, hypotension, hyperglycaemia, hypoglycaemia, thrombocytopenia, acute renal failure, hyperkalaemia, megaloblastic anaemia, acute pancreatitis and pain at site of injection. The drug should be used cautiously in the presence of hypertension, hypotension, diabetes, kidney disease.

Drug and food interaction: Increases potential for nephrotoxicity:- aminoglycosides, amphotericin B, cisplatin, NSAIDs, vancomycin. Fetal dysrhythmias:- erythromycin IV. Increase QT prolongation- class III/IA antiarrhythmic, some phenothiazines, β -agonists, local anesthetics, tricyclic antidepressants, haloperidol, chloroquine, CYP3A4 inhibitors (amiodarone, clarithromycin, erythromycin), CYP3A4 substrates (methadone, quetiapine, quinidine, risperidone, ziprasidone). Increase myelosuppression:- anti-neoplastics, radiation.

PIPERAZINE

Dosage form and strengths: Elixir: 750 mg/5 ml. Tablet: 300 mg

Indication: Ascariasis, enterobiasis.

Contraindications/Precautions: Epilepsy, hepatic or renal impairment, in patients who are hypersensitive to this drug. Children, pregnancy (B), breastfeeding, only used if alternative medications are not available. Stool examination may be required before treatment and approximately 2 weeks following treatment with piperazine to determine efficacy or proof of cure. Perianal examination is done 1 week following treatment with piperazine especially in patients with persisting symptoms to determine efficacy or proof of cure. In some patients, pinworms may return after treatment with piperazine, washing all bedding and night clothes after treatment may help to prevent this; because of high probability of transfer of pinworms it is often recommended that all members of household be treated concurrently

Dosage schedule:

- *Ascariasis*: up to 3.5 g per day: Child 75 mg/kg body weight per day for two consecutive days. Treatment may be repeated after one week for heavy infection.
- *Enterobiasis*: up to 2.5 g per day: Child 65 mg/kg body weight per day for seven consecutive days.

Adverse effects: Nausea, vomiting, mild diarrhoea, abdominal pain and urticaria.

Drug and food interaction: Piperazine may enhance the effects of phenothiazines and increase the risk of seizures. Pyrantel pamoate and

piperazine have antagonistic modes of action. These drugs should not be administered concomitantly.

PRAZIQUANTEL

Dosage form and strengths: Tablet: 150 mg, 600 mg.

Indications: Taeniasis (*T. solium*, *T. saginata*), hymenolepiasis (*H. nana*), diphyllorhynchiasis (*D. latum*) and cysticercosis (except ocular), *Schistosoma haematobium*, *Schistosoma japonicum*

Contraindications/ Precaution: Ocular cysticercosis because of danger of inflammatory reactions, hypersensitivity to praziquantel, hepatic impairment. Pregnancy, breast-feeding. Check if infection is accompanied by cerebral cysticercosis, if so then discontinue praziquantel treatment. Advise the patient not to drive or operate machinery during or for 24 hours after treatment

Dosage schedule:

- *Taenia solium*: 10-20 mg/kg a single dose after a light breakfast.
- *Hymenolepis nana*: 25 mg/kg as a single dose.
- *Schistosoma haematobium* worm infection: oral in adults, 20 mg/kg, followed by 20 mg/kg after 4-6 hours.
- *Schistosoma japonicum*: adults oral: 20 mg/kg three times a day for 1 day.

Adverse effects: Nausea, abdominal discomfort, headache, dizziness, drowsiness and rarely urticaria and rectal bleeding.

Drug and food interaction: Plasma concentration of praziquantel is reduced by chloroquine, dexamethasone (continuous use) and increased by grapefruit, cimetidine

PYRANTEL PAMOATE

Dosage form and strengths: Oral suspension 25 mg/ml and 50 mg/ml, tablet 250 mg

Indications: Ascariasis, hookworm and pinworm infections.

Contraindication/Precautions: Allergic reaction, Pregnancy (C), children less than 2 years.

Hepatic impairment, lactation. Pyrantel pamoate may be taken on an empty stomach or with food, milk or juice. May cause dizziness or drowsiness; don't drive operate machinery. Entire household members should be treated with pyrantel pamoate if one individual in household has pinworms. Wear tight underwear both day and night while taking this drug.

Dosage schedule: Adult and child over 2 years, single dose of 10 mg/kg (maximum 1 g). For *Enterobius vermicularis*, the treatment should be repeated after 2 weeks.

Adverse effects: Headache, dizziness, drowsiness and mild gastro-intestinal disturbance.

Drug and food interaction: See under piperazine.

SODIUM STIBOGLUCONATE

Dosage form and strengths: Injection: 100 mg/ml

Indication: Leishmaniasis

Contraindications/Precautions: Severe renal impairment, breastfeeding.

Heart diseases (withdrawn if conduction disturbances occur), mucocutaneous diseases, predisposition to QT interval prolongation. Monitor ECG before and during treatment. Preparation protect from light.

Dosage schedule: 20 mg/kg daily (maximum 850 mg) for at least 20 days by intramuscular or intravenous injection. Skin lesions are treated for 10 days.

Adverse effects: Headache, skin rashes, vomiting and abdominal pain. Rapid intravenous injection can result in severe cough, vomiting and even cardiovascular collapse.

10.5 Antileprotic drugs

CLOFAZIMINE

Dosage form and strengths: Capsule: 50 mg, 100 mg

Indication: Multibacillary leprosy in combination with rifampicin and dapsone (3 drug regimen), Type II lepra reaction.

Contraindications/Precautions: Hepatic and renal impairment. Pregnancy, old age, hepatic and renal impairment. Observe patient for history of allergy to clofazimine, GI problems and diarrhea. Observe patient physically (skin lesions, colour, turgor, texture), ocular examination, bowel sounds, stool color, and culture of the lesion. Antibacterials: increased risk of ventricular arrhythmias when given with bedaquiline. Avoid if persistent abdominal pain and diarrhea, may discolor soft contact lenses, skin discoloration of infants.

Dosage schedule: Oral, adult: 300 mg once a month (supervised administration) and 50 mg daily (self-administered) for 1 year.

Adverse effects: Acne like eruptions, dry eyes, dry skin, phototoxicity, nausea, vomiting, and headache, red discoloration of skin, faeces and urine.

DAPSONE

Dosage form and strengths: Tablets: 50 mg and 100 mg.

Indications: Leprosy, dermatitis herpetiformis, prophylaxis of *Pneumocystis* pneumonia, preventing recurrence of rhinosporidiosis.

Contraindications/Precaution: Cardiac disease, G6PD deficiency, pulmonary disease,

Dosage schedule:

- *Multi-bacillary leprosy:* rifampicin 600 mg and clofazimine 300 mg are both given once a month under supervision together with dapsone 100 mg and clofazimine 50 mg both daily in self-administered doses for 1 year. Doses of all 3 agents are reduced in children and in those aged 10-14 years and adult weighing less than 35 kg, daily dose of dapsone 50 mg or 1-2 mg/kg.
- *Paucibacillary leprosy:* rifampicin 600 mg under supervision once a month and dapsone 100 mg self-administered daily, both agents are given for 6 months. Doses are reduced in children and low body weight patient as for multibacillary leprosy.
- *Prophylaxis and treatment of Pneumocystis pneumonia:* adult 100 mg daily.

Adverse effects: Anorexia, nausea, vomiting, headache, pruritus and haemolytic anaemia (in G6PD deficiency).

Drug and food interaction: Pregnancy- Neonatal hemodialysis and methemoglobinemia reported in third trimester. Folic acid should be given to

mother throughout pregnancy.

RIFAMPICIN: See under anti TB drugs.

10.6 Antimalarials

ARTEMETHER with LUMEFANTRINE

Dosage form and strengths: Artemether oily injection 80 mg/ml in 1 ml ampoule. Artemether with lumefantrine: each tablet containing 20 mg artemether and 120 mg lumefantrine

Indications: Treatment of acute uncomplicated falciparum malaria, treatment of chloroquine resistant non falciparum malaria

Contraindication/Precaution: Patients with history of arrhythmias, breastfeeding. First trimester of pregnancy (C), acute porphyria, electrolyte disturbance. If trouble swallowing, tablet may be crushed before administration. Dizziness may affect performance of skilled tasks.

Dosage schedule: Adult and child over 12 years: 4 tablets followed by 5 further doses of 4 tablets each at 8, 24, 36, 48 and 60 hours (total 24 tablets) with food; Child (5-14 kg): initially 1 tablet followed by 5 further doses of 1 tablet each at 8, 24, 36, 48 and 60 hours; Child (15-24 kg): initially 2 tablets followed by 5 further doses of 2 tablets each at 8, 24, 36, 48 and 60 hours; Child (25-34 kg): initially 3 tablets followed by 5 further doses of 3 tablets each at 8, 24, 36, 48 and 60 hours.

Adverse effects: Diarrhea, anorexia, abdominal pain, headache, dizziness, palpitation, rash.

ARTESUNATE

Dosage form and strengths: Injection, ampoules containing 60 mg anhydrous artesunic acid with a separate ampoule of 5% sodium bicarbonate solution; tablet 50 mg

Indication: *P. falciparum* malaria treatment especially in multidrug-resistance.

Contraindications/Precautions: Hypersensitivity reaction to artesunate; 1st trimester of pregnancy. The powder for injection is difficult to dissolve and care should be taken to ensure that it is completely dissolved before parenteral administration. It should always be used immediately following reconstitution. If the solution is cloudy or precipitate is present, the parenteral preparation should be discarded. Preparation should be protected from light and moisture.

Dosage schedule: A loading dose of 2 mg/kg IV/IM should be followed by 1 mg/kg after 4 hours and 24 hours. Thereafter a dose of 1mg/kg should be given daily until the patient is able to tolerate oral artesunate or for a maximum of 7 days.

Adverse effects: Drug induced fever, neutropenia, cardiotoxicity following administration of high doses, Skin rash, hemolysis around 2 weeks after treatment with artesunate.

CHLOROQUINE

Dosage form and strengths: *Tablets:* Each tablet containing 250 mg of chloroquine phosphate or 200 mg of chloroquine sulphate, both the preparations contain 150 mg chloroquine base. *Suspension:* 40 mg/ml.

Indications: Chemoprophylaxis and treatment of malaria, rheumatoid arthritis, lupus erythematosus.

Contraindication/Precaution: Hypersensitivity, retinal field changes. Pregnancy (C), breastfeeding, children, blood dyscrasia, severe GI disease, neurologic disease, alcoholism, hepatic disease, G6PD deficiency, psoriasis, eczema, seizures, preexisting auditory damage, torsade de pointes. Ophthalmic test if long term treatment or dosage more than 150 mg/day, baseline and periodically.

Dosage schedule:

- *Malaria prophylaxis:* 300 mg base once weekly starting one week before entering malaria area and continued for 4 weeks after leaving.
- Malaria treatment (presumptive and clinically suspected): 600 mg base along with 45 mg primaquine.
- *Malaria treatment (radical cure in relapsing malaria):* 600 mg base followed by 300 mg base after 6 hours, then 300 mg base for 2 days along with 15 mg primaquine for 15 days. Child: 10 mg base/kg for first 2 days, then 5 mg base/kg for third day.
- *Acute rheumatoid arthritis and systemic and lupus erythematosus:* administered on expert advice- 150 mg daily and maximum 2.5 mg/kg/day

Adverse effects: Epigastric discomfort, anorexia, nausea, vomiting, pruritus and headache. Long term daily treatment may cause reversible visual disturbance.

Drug and food interaction: Reduced oral clearance and metabolism of chloroquine by cimetidine. Increase QT prolongation, torsade de pointes-class IA, III antidysrhythmics. Increase effects- 2D6 inhibitor (amiodarone, terbinafine, ticlopidine), CYP3A inhibitors (diltiazem, verapamil, itraconazole, ketoconazole, erythromycin, doxycycline, clarithromycin). Decrease action of chloroquine by magnesium, aluminium compounds, kaolin. Chloroquine decreases effects of ampicillin, rabies vaccine.

Patient information: To report having visual problems, fever, fatigue, bruising, bleeding may indicate blood dyscrasias

MEFLOQUINE

Dosage form and strengths: *Tablet:* 250 mg

Indication: Treatment and prophylaxis of Malaria (*P. falciparum/P. vivax*).

Contraindication/Precautions: History of convulsion, psychiatric disorder, infants less than 3 months, pregnancy. Cardiac conduction disorder, brain injury. Dizziness or disturbed sense of balance may affect performance or skilled tasks (e.g. driving), effects may occur and persist up to several months after stopping mefloquine.

Dosage schedule:

- *Chemoprophylaxis:* 250 mg each week starting 2½ weeks before departure and continued for 4 weeks after leaving malaria area; Child 15-19 kg (2-5 years): quarter adult dose, 20-30 kg (6-8 years): half adult dose, 31-45 kg

(9-11 years): three quarters adult dose.

- *Longer chemoprophylaxis* (more than 3 months) on individual assessment (specialist advice may need to be sought). Young children less than 15 kg not recommended. Child: 15 mg/kg single dose.

Adverse effects: Nausea, vomiting, diarrhoea, epigastric pain, headache, dizziness, vertigo, tinnitus, bradycardia, disturbances in liver function tests and extrasystoles.

Drug and food interaction: Concurrent administration of mefloquine with beta-blocking agent or calcium channel blocking agents should be avoided as it may result into bradycardia.

PRIMAQUINE

Dosage form and strengths: *Tablet:* 7.5 mg

Indications: Adjunct in the treatment of malaria caused by *P.vivax* and *P. ovale*.

Contraindication/Precautions: Children under one year of age, lupus erythematosus, rheumatoid arthritis, hypersensitivity. Pregnancy (C), breastfeeding, methemoglobin reductase deficiency, bone marrow suppression, hemolytic anemia, G6PD deficiency.

Dosage schedule:

- *Presumptive cases:* 45 mg single dose.
- *For radical cure:* 15 mg daily for 5 days; child: 250 micrograms/kg daily.

Adverse effects: Abdominal cramps, epigastric distress, anorexia, vomiting, leucocytosis and haemolytic anaemia in patients with glucose-6-phosphate dehydrogenase deficiency.

Drug and food interactions: Drug should always be given in conjunction with full dose of chloroquine in order to reduce the possibility of developing drug resistant strains. Drug should not be administered concurrently with other drugs liable to induce hemolysis or bone marrow depression. Decrease primaquine effect: grapefruit effect

QUININE

Dosage form and strengths: *Tablet:* 300 mg and 600 mg; *Injection:* 300 mg/ml

Indication: Treatment of uncomplicated malaria

Contraindication/Precautions: Hypersensitivity, Pregnancy, idiosyncratic reaction, digoxin toxicity, blood dyscrasia, myasthenia gravis, optic neuritis. Breast-feeding, children, geriatric patients, potassium imbalance, renal/hepatic impairment, CHF, respiratory depression, depression, bradycardia, hypotension, syncope. With intravenous use monitor blood glucose and electrolyte concentration during parental treatment.

Dosage schedule: Oral; Adult- 300 to 600 mg every 8 hour in divided doses for 5 to 7 days. Child- 25 mg/kg body weight every 8 hour in divided doses for 5 to 7 days. Intravenous infusion for patients unable to swallow tablets Loading dose 900 mg to 1.4 g infused over 4 hour, then 300 to 600 mg every 8 hour infused over 4 hour.

Adverse effects: Cinchonism (tinnitus, blurred vision, temporary blindness, hot flushed skin), hemolytic anaemia (in G6PD deficiency), hypersensitivity,

hypoglycemia, nephrotoxicity.

Drug and food interaction: Additive vagolytic effect with anticholinergic. Increase cardiac depression with other anti-dysrhythmic, phenothiazines, reserpine. Increase effects of neuromuscular blockers, digoxin, warfarin, tricyclics, and propranolol. Increase QT prolongation by macrolides, quinolones, tricyclics, procainamide, antipsychotic

SULFADOXINE and PYRIMETHAMINE

Dosage form and strengths: *Tablet:* each containing 500 mg of sulfadoxine and 25 mg of pyrimethamine.

Indications: Combination with other antimalarials in malaria caused by *P. Falciparum* only.

Contraindications/Precautions: Acute porphyrias, sulfonamide allergy, pregnancy, breastfeeding. Asthma, avoid in blood disorders, avoid in infants under 6 weeks, elderly, G6PD deficiency, predisposition to folate deficiency, predisposition to hyperkalemia in adults. : Monitor blood counts on prolonged treatment.

Dosage schedule: *Treatment:* adult 3 tablets as single dose; child: 1.25 mg/kg body weight of pyrimethamine and 25 mg/kg body weight of sulphadoxine.

Adverse effects: Diarrhoea, headache, hyperkalemia, nausea and rash.

Drug and food interaction: Folic acid + (sulfadoxine and pyrimethamine): decrease effects of each other. Sulfadoxine and pyrimethamine increases levels of chlorpromazine by decreasing metabolism.

Patient information: To maintain adequate fluid intake to avert crystalluria or stone formation.

10.7 Anti-tubercular drugs

10.7.1 First line drugs

ETHAMBUTOL

Dosage form and strengths: *Tablet:* 100 mg, 400 mg, 600 mg, 800 mg

Indications: Tuberculosis in combination with other drugs.

Contraindication/Precautions: Children less than 5 years, hypersensitivity, optic neuritis, severe renal impairment. Pregnancy B, breast-feeding, renal disease, diabetic retinopathy, cataracts, ocular defects, hepatic and hematopoietic disorders, severe renal impairment. Renal function should be checked before treatment. Visual acuity should be tested by Snellen chart before treatment with ethambutol. In children routine ophthalmological monitoring is recommended.

Dosage schedule: 15-25 mg/kg daily.

Adverse effects: Optic neuritis (reversible) resulting in decrease in visual acuity and loss of ability to differentiate red from green. The effect is dose dependent and occurs rarely on dose of 15 mg/kg given daily. The other adverse effects are skin rash, drug fever, pruritus, hyperuricemia, joint pain and gastro-intestinal upset.

Drug and food interaction: Ethambutol decreases effects of live BCG vaccine by pharmacodynamic antagonism Aluminium hydroxide :increases levels of

ethambutol by cation binding in GI tract. Ethambutol decreases effects of allopurinol- hyperuricemia reported with ethambutol and precipitation of gout reported. Neurotoxicity- increases by other neurotoxic drugs. Patient information: To report any visual changes, rash, hot swollen and painful joints, numbness, tingling of extremities.

ISONIAZID

Dosage form and strengths: *Tablets:* 100 mg and 300 mg.

Indications: Tuberculosis in combination with other drugs, TB prophylaxis.

Contraindications/Precautions: Hypersensitivity, acute hepatic disease, drug induced hepatic disease. Pregnancy (C), renal impairment, diabetic retinopathy, cataracts, ocular defects, IV drug users, > 35 years, postpartum, HIV, neuropathy, alcoholism, acute porphyria, excessive alcohol intake and history of liver disease should be assessed monthly for hepatic-damage. Pyridoxine (25-100 mg) per day should be given for the prevention of peripheral neuropathy. The drug should be used with caution in patients with impaired liver and kidney function. Hepatic and renal functions should be checked before treatment. Those with alcohol dependence should have frequent checks for hepatic function, particularly in the first two months.

Dosage schedule: 300 mg daily; Child: 10 mg/kg daily (maximum 300 mg daily)

Adverse effects: Peripheral neuritis is the most common adverse effect, higher when high doses are used; skin rash, ataxia, dizziness, optic neuritis and hepatic damage.

Drug and food interaction: Increased toxicity when given with tyramine containing foods, alcohol, cycloserine, ethionamide, rifampin, carbamazepine, phenytoin, benzodiazepines, meperidine. Increased risk of serotonin syndrome when given with SSRIs, SNRIs. Aluminium antacids decreases its absorption. Decreases effectiveness of BCG vaccine and ketoconazole.

Patient information: To avoid alcohol while taking the drug as it may increase the risk of hepatic disease.

PYRAZINAMIDE

Dosage form and strengths: *Tablet:* 400 mg/500 mg/750 mg/1 g.

Indications: Tuberculosis

Contraindications/Precautions: Acute attack of gout, pregnancy (C), lactation. Diabetes, gout, old age. RFT and LFT needs to be assessed at onset of treatment. Monitor for presence of gout.

Dosage schedule: Adult <50 kg: 1.5 g/day, adult > 50 kg: 2 g/day, Child: 25-35 mg/kg daily.

Adverse effects: Hepatotoxicity is the serious adverse effect. Anorexia, nausea, vomiting and arthralgia are less common. Rise in serum transaminase concentrations are common during the early phase of treatment and return to normal despite continuation of treatment, in most of cases. Hyperuricemia, sideroblastic anaemia, thrombocytopenia.

Drug and food Interactions: Rifampin+Pyrazinamide: either increases toxicity of the other by pharmacodynamic synergism. Additive hepatotoxicity.

RIFAMPIN

Dosage form and strengths: Capsules: 150 mg, 300 mg and 450 mg. Tablets: 150 mg, 300 mg

Oral Suspension: 100 mg/ 5 ml,

Indications: Short course chemotherapy of tuberculosis and leprosy, prevention of meningococcal meningitis and *H. influenzae*, atrophic rhinitis.

Contraindication/Precautions: Hypersensitivity to this product and rifamycin, active *Nisseria meningitis* infection, acute porphyrias. Pregnancy (C), breastfeeding, children less than 5 years, hepatic disease, blood dyscrasias.

Dosage schedule:

- *Brucellosis, legionnaire's disease and serious staphylococcal infections:* in combination with other drugs, oral or by i.v infusion: 0.6-1.2 g daily in 2-4 divided doses.
- *Tuberculosis, in combination with other drugs:* adult (more than 50 kg) 600 mg daily for 6 months in category-I and for 8 months in category-II; child: 15 mg/kg daily for 6 months in category-I and for 8 months in category-II.
- *Leprosy, multibacillary leprosy:* (3 drugs regimen), 600 mg once monthly, supervised (450 mg for those weighing less than 35 kg.)
- *Paucibacillary leprosy:* (2 drugs regimen) 600 mg once monthly supervised (450 mg for those weighing less than 35 kg).
- *Prophylaxis of meningococcal meningitis:* 600 mg every 12 hours for 2 days; child 3 months - 1 year 5 mg/kg, over 1 year 10 mg/kg every 12 hours for 2 days.
- *Prophylaxis of H. influenza type B:* 600 mg once daily for 4 days; child 1-3 months 10 mg/kg once daily for 4 days, over 3 months 20 mg/kg once daily for 4 days (maximum 600 mg daily).
- *Atrophic rhinitis: oral:* 600 mg once daily for 12 weeks.

Adverse effects: Anorexia, nausea, vomiting, diarrhoea, "flu" like syndrome characterized by fever, malaise, headache, chills, skin rashes, transient rise in serum bilirubin and transaminases, respiratory symptoms, thrombocytopenic purpura and orange/red body secretions.

Adverse effect are more likely to occur during intermittent therapy, however the monthly schedules in leprosy appears to be devoid of this risk.

Drug and food interactions: Drug induces hepatic enzymes which accelerate the metabolism of several drugs including corticosteroids, digitalis glycosides, estrogens and oral hypoglycemic. Increase hepatotoxicity with isoniazid. Do not use with protease inhibitors.

Patient information: To avoid alcohol because hepatotoxicity may occur. Urine, saliva, faeces, sputum, sweat, tears may be colored red-orange. Soft contact lenses may be permanently stained

STREPTOMYCIN

Dosage form and strengths: Injection: 1 g and 0.75 g streptomycin sulphate.

Indications: Tuberculosis resistant to other treatment in combination with other drugs, brucellosis and bacterial endocarditis.

Contraindications/Precautions: Pregnancy and over 40 years. Should be avoided during pregnancy and in patient over 40 years whenever possible.

Drug and food interaction: See under gentamicin.

Dosage schedule: Adult: 0.75 g daily; child 15-20 mg/kg/day IM

Adverse effects: Vestibular damage is the main adverse effect, the risk increases with dose and age (above 40 years), skin rashes, drug fever, nephrotoxicity, hypersensitivity antibiotic associated colitis.

10.7.2 Second line drugs

BEDAQUILINE

Dosage form and strengths: Tablet: 100 mg

Indications: combination regimen to treat pulmonary MDR-TB infection when other effective treatment regimens are not available.

Contraindications/Precautions: Alcoholism, bradycardia, breastfeeding, arrhythmias, cardiac impairment, children, coronary artery disease, diabetes mellitus, females, geriatric, heart failure, hepatic impairment, hypertension, hypocalcemia, hypokalemia, hypomagnesemia, malnutrition, MI, pregnancy (B), syncope, thyroid disease. Obtain ECG before starting treatment and then at least monthly during treatment or more frequently if concomitant use with other drugs known to prolong QT interval.

Dosage schedule: MDR-Pulmonary TB, in combination with other drugs. Adult: Initially 400 mg once daily for 2 weeks, then 200 mg 3 times a week for 22 weeks, intervals of at least 48 hours between each dose, continue appropriate combination therapy after bedaquiline

Adverse effects: Arthralgia, diarrhea, dizziness, headache, myalgia, nausea, QT interval prolongation, vomiting.

Drug and food interactions: Increase QT prolongation: other drugs that prolong QT (class IA/III antidysrhythmics, some phenothiazines, beta agonists, local anesthetics, tricyclics, haloperidol, chloroquine, droperidol; CYP3A4 inhibitors (amiodarone, clarithromycin, erythromycin); CYP3A4 substrates (methadone, pimozone, quetiapine, quinidine, risperidone, ziprasidone)

Increase adverse reactions: lopinavir/ritonavir. Increase bedaquiline effect: strong CYP3A4 inhibitors, avoid use over 14 days. Decrease bedaquiline effect: strong CYP3A4 inducers, avoid concurrent use.

CAPREOMYCIN

Dosage form and strengths: Powder for injection, 1 g in vial.

Indications: TB resistant to 1st line drugs in combination with other drugs

Contraindications/Precautions: Hypersensitivity, anxiety, epilepsy, psychotic reactions, porphyria. Auditory impairment, hepatic and renal impairment, breast feeding, children, pregnancy, old age. Monitor renal, hepatic, auditory and vestibular function and electrolytes.

Dosage schedule: TB resistant to first line drugs in combination with other drugs: By deep IM injection Adult: 1 g daily (max. per dose 20 mg/kg) for 2-4 months, then reduced to 1 g 2-3 times a week.

Adverse effects: Induration at injection site, changes in liver function tests, electrolyte disturbances, hearing loss with tinnitus and vertigo, hypersensitivity reactions, leucocytosis, leucopenia, nephrotoxicity,

neuromuscular, block after large doses, pain at injection site, rashes, thrombocytopenia, urticaria.

Drug and food interactions: Antibacterials: increased risk of nephrotoxicity when given with colistin or polymyxins; increased risk of nephrotoxicity and ototoxicity when given with aminoglycosides or vancomycin.

Cytotoxics: increased risk of nephrotoxicity and ototoxicity when given with platinum compounds.

CYCLOSERINE

Dosage form and strengths: Capsule 250 mg

Indications: TB resistant to 1st line drugs in combination with other drugs.

Contraindications/Precautions: Alcohol dependence, depression, epilepsy, psychotic states, severe anxiety. Blood concentration monitoring required especially in renal impairment or if dose exceeds 500 mg daily or if signs of toxicity; Blood concentration should not exceed 30 mg/litre. Monitor hematological, renal and hepatic function.

Dosage schedule: *TB resistant to first line drugs in combination with other drugs:* Initially 250 mg every 12 hours for 2 weeks, then increased if necessary up to 500 mg every 12 hours, dose to be increased according to blood concentration and response. Child: 10 mg/kg/day in 2 divided doses.

Adverse effects: Allergic dermatitis, changes in liver function tests, confusion, convulsions, depression, dizziness, megaloblastic anemia, psychosis, rashes, tremor, vertigo.

Drug and food interactions: Alcohol: increased risk of convulsions when cycloserine given with alcohol. Increased risk of CNS toxicity when cycloserine given with isoniazid.

ETHIONAMIDE

Dosage form and strengths: *Tablet:* 125 mg, 250 mg

Indications: Second line drug for TB

Contraindications/Precautions: Hypersensitivity, hepatic impairment, porphyria. Pregnancy, lactation, psychiatric cases or patient with psychosis.

Dosage schedule: Initiate dose at 250 mg/day for 1-2 days then increase to 250 mg twice daily for 1-2 days with gradual increase to highest tolerated dose; 750 mg/day average dose; not to exceed 100 mg/day in 3-4 divided dose.

Adverse effects: Nausea, vomiting, diarrhea, anorexia, postural hypotension, depression, dizziness, drowsiness, headache, peripheral neuropathy, psychosis, photosensitivity, rash, excessive salivation, gynaecomastia, hypoglycemia, impotence, thrombocytopenia, hepatitis, optic neuritis, visual changes.

Drug and food interactions: Ethionamide and cycloserine increase the toxicity of each other. Increases level of isoniazid. Decreases the effect of magnesium oxide, sodium picosulfate.

KANAMYCIN

Dosage form and strengths: *Powder/ solution:* for injection 1 g in vial/ ampoule

Indications: 2nd line drug in TB

Contraindications/Precautions: Pregnancy (D). Renal impairment, Myasthenia Gravis, breast feeding, vestibular/cochlear implant.

Dosage schedule: IM injection: 250 mg every 6 hours, 500 mg every 12 hours; IV infusion: 15-30 mg/kg every 8-12 hours.

Adverse effects: See under gentamicin

Drug and food interactions: See under gentamicin

P-AMINOSALICYLIC ACID (PAS)

Dosage form and strengths: *Granules* 4 g, 9.2 g sachet; *Tablet*: 500 mg

Indications: 2nd line drugs in TB

Contraindications/Precautions: Hypersensitivity, pregnancy, lactation. Hepatic impairment, old age, children, peptic ulcer. To be taken with meals to decrease epigastric pain and burning.

Adverse effects: Nausea, diarrhoea, anorexia, epigastric pain and burning rarely skin rash, fever, malaise, goiter and blood dyscrasias.

10.8 Anti-virals

10.8.1 Anti-hepatitis agents

ENTECAVIR

Dosage forms and strength: *Tablet*: 0.5 mg, 1 mg

Indication: Chronic hepatitis B (HBV)

Contraindications/Precautions: Reduce dose if eGFR less than 50 ml/min/1.73m². Monitor liver function test every 3 months and viral marker for hepatitis B every 3-6 months during treatment (continue monitoring for at least 1 year after discontinuation- recurrent hepatitis may occur on discontinuation).

Dosage schedule:

- *Chronic hepatitis B in patients with compensated liver disease (with evidence of viral replication, and histologically documented active liver inflammation or fibrosis) not previously treated with nucleoside analogues:* Oral, Adult: 0.5 mg once daily.
- *Chronic hepatitis B in patients with compensated liver disease (with evidence of viral replication, and histologically documented active liver inflammation or fibrosis) and lamivudine-resistance:* Oral, Adult: 1 mg once daily, consider other treatment if inadequate response after 6 months.
- *Chronic hepatitis B in patients with decompensated liver disease.* Oral, Adult: 1 mg once daily.

Adverse effects: Diarrhoea, dizziness, dyspepsia, fatigue, headache, nausea, raised serum amylase, raised serum lipase, sleep disturbances, vomiting, alopecia, rash, thrombocytopenia

Drug and food interactions: High fat meal decreases absorption of entecavir.

PEGINTERFERON ALFA (POLYETHYLENE GLYCOL-CONJUGATED DERIVATIVES OF INTERFERON ALFA)

Dosage form and strength: *Prefilled vial*: 50 mcg, 80 mcg

Indications: Combined with ribavirin for chronic hepatitis C, monotherapy for chronic hepatitis C if ribavirin not tolerated or contraindicated, Monotherapy for chronic hepatitis B

Contraindications/Precautions: Monitor: lipid concentration. Renal impairment: reduce dose in moderate to severe impairment. Hepatic impairment: avoid in severe impairment. Monitoring closely in mild to moderate hepatic impairment Pregnancy: avoid unless benefit outweighs risk

Dosage schedule: *Combined with ribavirin for chronic hepatitis C/ monotherapy for chronic hepatitis C if ribavirin not tolerated or contraindicated/Monotherapy for chronic hepatitis B:* subcutaneous injection, adult: 1.5 mcg/kg/week, not to exceed 150 mcg/week, Treat for 12 weeks (treatment-naïve or relapsed); for non-responders, may extend treatment of PEG/RBV to 24 weeks

Adverse effects: Anorexia, diarrhea, influenza like symptoms, lethargy, nausea, alopecia, arrhythmias, cardiovascular problems, coma (usually with high doses in the elderly), confusion, depression, hepatotoxicity, hyperglycaemia, hypersensitivity reactions, hypertension, hypertriglyceridaemia (sometimes severe), hypotension, myelosuppression (particularly affecting granulocyte counts), nephrotoxicity, ocular side-effects, palpitation, psoriasiform rash, seizures (usually with high doses in the elderly), suicidal behavior, thyroid abnormalities

SOFOSBUVIR

Dosage forms and strength: *Tablet:* 400 mg

Indication: Chronic hepatitis C

Contraindications/Precautions: Hypersensitivity and pregnancy (X). Breast-feeding, children, hepatic/renal impairment. Use two forms of reliable contraceptives, avoid breast-feeding.

Dosage schedule: Oral, 40 mg once daily.

Adverse effects: Headache, chills, fatigue, fever, insomnia, diarrhoea, hyperbilirubinemia, rash, pruritus, anaemia.

Drug and food interactions: Decrease sofosbuvir with P-glycoprotein inducers carbamazepine, phenobarbital, phenytoin, and rifampin. Bradycardia with amiodarone. Increase sofosbuvir level with carvedilol.

10.8.2 Anti-herpes virus agents

ACYCLOVIR

Dosage form and strengths: *Injection:* powder 250 mg; *Tablets:* 200 mg

Indications: Herpes infections, mucocutaneous HSV, infectious mononucleosis.

Contraindications/Precaution: Hypersensitivity. Pregnancy (B), breastfeeding, renal/hepatic/neurological impairment, electrolyte imbalance, dehydration, hypersensitivity, obesity, old age. The drug should be used with caution in renal impairment. Do not give concurrently with live vaccines. Immunization should be brought up to date before the treatment. Inform patient that pain, swelling and redness usually occur after 2 hours of injection- use cold compress to relieve pain and swelling.

Dosage schedule:

- *Herpes simplex treatment: oral, adult/child >2yrs:* 200 mg (if absorption is impaired) 5 times daily, usually for 5 days; child, < 2 years: half adult dose.
- *Herpes simplex prevention of recurrence:* 200 mg 4 times daily or 400 mg twice daily possibly reduced to 200 mg 2 or 3 times daily and interrupted every 6-12 months.
- *Herpes simplex prophylaxis in the immunocompromised:* oral, adult/ child >2yrs: 200-400 mg 4 times daily; child < 2 years: half adult dose.
- *Varicella and Herpes zoster treatment:* oral, adult: 800 mg 5 times daily for 7 days; Child: Varicella, 20 mg/kg (max. 800 mg) 4 times daily for 5 days or < 2 years 200 mg 4 times daily, 2-5 years 400 mg 4 times daily, >6 years 800 mg 4 times daily.
- *Herpes simplex:* topical application (cream or eye ointment) every 4 hours (5 times daily) for at least 3 days after complete healing.
- *Mucocutaneous HSV:* 400 mg 5 times a day for 7 days; (immune-compromised) 5 mg/kg 3 times a day for 7 days.
- *Infectious mononucleosis, infectious mononucleosis:* oral, adult: 600-800 mg oral 5 times a day for 7-10 days or 10 mg/kg IV 3 times a day for 7 days.

Adverse effects: Gastrointestinal disturbances, photosensitivity, rashes, urticaria, increase in blood urea and creatinine, headache and fatigue.

Drug and food interaction: Increase serious infections when used with other TNF- α blockers

10.8.3 Anti-influenza agents**OSELTAMIVIR**

Dosage form and strengths: Capsule: 30 mg, 45 mg, 75 mg as phosphate; Oral powder: 6 mg/ml.

Indications: Prevention and treatment of influenza A or B

Contraindications/Precautions: Hypersensitivity. Pregnancy (C), neonates, breastfeeding, infants, children, geriatric patients, renal/hepatic/pulmonary/cardiac disease, psychosis, viral infection. Avoid use with H1N1 virus vaccine, intranasal influenza vaccine.

Dosage schedule:

- *Influenza:* 75 mg twice daily for 5 days.
- *Prevention of influenza:* 75 mg once daily for 10 days.
- *Post-exposure prophylaxis:* up to 6 weeks during an epidemic.

Adverse effects: Headache, dizziness, insomnia, seizures, toxic epidermolysis necrolysis, Steven-Johnson syndrome.

10.8.4 Anti-retroviral agents**DIDANOSINE**

Dosage form and strengths: Capsules: 250 mg, 400 mg (enteric coated)

Indications: HIV infection

Contraindications/Precaution: Hypersensitivity, lactic acidosis, pancreatitis, phenylketonuria. Pregnancy (B), breastfeeding, children, renal disease, sodium restricted diets, elevated amylase, pre-existing peripheral

neuropathy, hyperuricemia, gout, congestive heart failure, non-cirrhotic portal hypertension. Ophthalmological examination (including visual acuity, color vision, and dilated fundus examination) recommended annually or if visual changes occur. Capsules should be swallowed whole and taken at least 2 hour before or 2 hour after food.

Dosage schedule: Oral, adult 60 kg: 250 mg daily in 1-2 divided doses, more than 60 kg: 400 mg daily in 1-2 divided doses.

Adverse effects: Common acute renal failure, alopecia, anaphylactic reactions, diabetes mellitus, dry eyes, dry mouth, hyperuricemia, hypoglycemia, liver failure, non-cirrhotic portal hypertension, optic nerve changes, pancreatitis (less in children), parotid gland enlargement, renal changes: peripheral neuropathy (dose-related), vomiting, diarrhoea, chest pain, headache, gynaecomastia, elevated liver enzymes and serum amylase.

Drugs and food interactions: Increase didanosine level: allopurinol, tenofovir, increase side effects from magnesium, aluminium antacids, increase pancreatitis risk: stavudine, decrease absorption: ketoconazole, dapson, fluoroquinolones.

EFAVIRENZ

Dosage form and strengths: *Capsule:* 200 mg; *Tablet:* 500 mg

Indication: HIV infections

Contraindications/Precaution: Acute porphyrias, pregnancy (D), breastfeeding, hypersensitivity, moderate severe hepatic impairment, seizures. Breast-feeding, children less than 3 years, renal/hepatic impairment, depression, seizures; co infection with hepatitis B or C. Monitor liver function if other hepatotoxic drugs are administered concurrently. If dose is missed, take as soon as remembered, not to double the dose.

Dosage schedule: 600 mg once daily (adult and child over 40 kg)

Adverse effects: Rash including Stevens-Johnson syndrome, diarrhoea, vomiting, depression, anxiety, ataxia, alopecia and cognitive impairment.

Drug and food interaction: Increase CNS depression when used with alcohol, antidepressants, antihistaminics, opioids. Increase level of both products: ritonavir, estrogens, anti-convulsants. Increase level of warfarin, statins. Decrease levels of indinavir, amprenavir, lopinavir, oral contraceptives, ketoconazole, itraconazole, voriconazole, saquinavir, cyclosporine, tacrolimus, bupropion, sertraline.

INDINAVIR

Dosage form and strengths: *Capsule:* 400 mg

Indications: See under saquinavir.

Contraindications/Precautions: Hypersensitivity, breastfeeding. Pregnancy (C), lactation, children, renal/hepatic impairment, history of renal disease, diabetes mellitus, hypercholesterolemia, hemophilia, chronic hepatitis B or C. Ensure adequate hydrations (risk of nephrolithiasis). If dose is missed, take as soon as remembered, do not double the dose.

Dosage schedule: 800 mg every 8 hours; child 500 mg/ m² every 8 hours (maximum 800 mg every 8 hours).

Adverse effects: Dry mouth, taste disturbances, headache, hyperglycemia,

dizziness, pancreatitis, paraesthesia, alopecia.

Drug and food interaction: Life-threatening dysrhythmias: ergots, midazolam, rifampin, triazolam, amiodarone, pimozide, alfuzosin, increase myopathy: statins (atorvastatin, lovastatin, simvastatin). Increase indinavir levels: CYP3A4 inhibitors (aprepitant, protease inhibitors, azole antifungals, nefazodone, verapamil); phosphodiesterase-5 inhibitors (sildenafil, tadalafil, vardenafil), increase levels of clarithromycin, zidovudine, isoniazid, oral contraceptives. Decrease indinavir levels: CYP3A4 inducers (barbiturates, carbamazepine, nonnucleoside reverse transcriptase inhibitors, phenytoins, rifamycins, modafinil), St. John's wort, grapefruit juice; high-fat, high-protein foods. Decrease effect of both products: anticonvulsants. Decrease effect: CYP3A4 substrates (calcium channel blockers, immunosuppressants, benzodiazepines, azole antifungals, macrolides, SSRIs, statins).

LAMIVUDINE

Dosage form and strengths: *Tablet:* 150 mg, *Oral liquid:* 50 mg/ml.

Indication: HIV infection in combination with anti-retroviral drugs

Contraindication/Precautions: Hypersensitivity. Pregnancy (C), breastfeeding, children, geriatric patients, hepatic/renal impairment, granulocyte count less than 1000/mm³, Hb less than 9.5 g/dl, renal disease, pancreatitis, peripheral neuropathy.

Dosage schedule: Adult 150 mg twice daily or 300 mg once daily; Infant under 1 month, 2 mg/kg twice daily; Child 1 month or over 4 mg/kg twice daily (maximum 300 mg).

Adverse effects: Vomiting, diarrhea, cough, headache, fatigue, insomnia, fever, rash, alopecia, peripheral neuropathy, anaemia. To be used with caution in renal impairment, chronic hepatitis B or C, liver impairment, pregnancy and breast-feeding.

Drug and food interaction: Lamivudine decrease the effect of each other. Increases the effects of lamivudine: cotrimoxazole, amiloride, entecavir, metformin, procainamide. Interferons decrease the effects of lamivudine.

LOPINAVIR + RITONAVIR

Dosage form and strengths: *Capsule:* 200 mg Lopinavir + 50 mg Ritonavir

Indications: HIV infection

Contraindications/Precautions: Hypersensitivity to this product or polyoxyethylated castor oil (oral solution). Pregnancy (C), breastfeeding, children, HBV/HCV co-infections, hepatic impairment, pancreatitis, diabetes, hemophilia, AV block, hypercholesterolemia, immune reconstitution syndrome, neonates, cardiomyopathy, hypokalemia, elderly patients, Grave's disease, polymyositis, Guillain-Barre syndrome. Monitor LFT before and during treatment. Assess HIV viral load, CD4 at baseline, throughout therapy. Assess blood glucose, serum cholesterol/lipid profile, signs of infections, anemia, skin eruptions and rash. Teach patient/family that others can continue to contract HIV from patient. Product isn't a cure for HIV; that opportunistic infections can continue to be acquired.

Dosage schedule: In adults oral using tablets 400/100 mg twice daily,

alternatively (oral) 800/200 mg once daily in adults with a HIV strain that has less than 3 mutations to protease inhibitors.

Adverse effects: Amenorrhoea, anxiety, arthralgia, colitis, hypertension, menorrhagia, neuropathy, night sweats, sexual dysfunction, weight changes, anaphylaxis, myalgias.

Drug and food interactions: Increase toxicity: amiodarone, astemizole, azole antifungals, benzodiazepines, bupropion, cisapride, clozapine, desipramine, dihydroergotamine, encainide, ergotamine, flecainide, HMG-CoA reductase inhibitors, interleukins, meperidine, midazolam, pimozide, piroxicam, propafenone, propoxyphene, quinidine, ranolazine, saquinavir, terfenadine, triazolam, zolpidem. Increase QT prolongation: class IA/III antidysrhythmics, some phenothiazines, local anesthetics, tricyclics, haloperidol, chloroquine, droperidol, pentamidine, CYP3A4 inhibitors (amiodarone, clarithromycin, erythromycin, telithromycin), arsenic trioxide, CYP3A4 substrates (methadone, pimozide, quetiapine, quinidine, risperidone, ziprasidone). Increase ritonavir levels: fluconazole, increase level of both products: clarithromycin, didanosine. Decrease ritonavir levels: rifamycins, nevirapine, barbiturates, phenytoin. Decrease levels of anticoagulants, atovaquone, divalproex, ethinyl estradiol, lamotrigine, phenytoin, sulfamethoxazole, theophylline, voriconazole, zidovudine

NELFINAVIR

Dosage form and strengths: *Oral suspension:* 500 mg/1 g scoopful; *Tablet:* 250 mg/625 mg

Indication: HIV infection

Contraindications/Precautions: Hypersensitivity to protease inhibitor. Pregnancy (B), breast feeding, renal/hepatic disease, hemophilia, diabetes, pancreatitis. Serum lipids, blood glucose should be obtained baseline and during treatment. Loperamide could be used to stop the diarrhea due to nelfinavir.

Dosage schedule: HIV infection: 750 mg 3 times a day OR 1250 mg twice a day.

Adverse effects: Headache, anemia, leucopenia, suicidal ideation, hepatitis, diarrhoea, nausea, flatulence, anaphylaxis, hyperglycemia, hypoglycemia, hyperlipidemia

Drug and food interactions: Severe dysrhythmias with amiodarone, ergots, lovastatin, midazolam, salmeterol, quinidine. Increases effects of: Atorvastatin, azithromycin, rifabutin, indinavir, tacrolimus. Nelfinavir level increased by: ketoconazole, indinavir, protease inhibitor. Nelfinavir level decreased by: Rifampicin, phenobarbital, nevirapine, phenytoin, carbamazepine. Decrease effects of: Didanosine, Methadone, OCP, phenytoin.

NEVIRAPINE

Dosage form and strengths: *Tablet:* 200 mg, *Oral liquid:* 50 mg/5 ml

Indication: HIV infection, Prevention of mother-to-child transmission (PMTCT) of HIV

Contraindication/Precautions: Severe hepatic impairment (use efavirenz),

acute porphyrias, hypersensitivity. Pregnancy (B), breastfeeding, children, renal impairment, female (at greater risk of hepatic side effects). Monitor liver functions before treatment then every 2 weeks for 2 months then after 1 month and then regularly. Monitor skin reactions closely during first 18 weeks

Dosage schedule: 200 mg once daily for first 14 days, then 200 mg twice daily; child (1 month-13 years): 120 mg/m² once daily for 14 days, then 200 mg/m² twice daily.

Adverse effects: Rash including Stevens-Johnson syndrome, hepatitis, headache, fever, anaemia, arthralgia

Drug and food interaction: Increase: nevirapine levels- cimetidine, macrolide, anti-infectives.

Decreases effects of protease inhibitors, oral contraceptives, ketoconazole, methadone, itraconazole. Decrease nevirapine levels: rifamycins, anticonvulsants, clonazepam, diazepam, warfarin

RITONAVIR

Dosage form and strengths: *Tablet:* 100 mg

Indications: HIV infections.

Contraindications/Precautions: Pregnancy (B), breastfeeding, hepatic impairment, pancreatitis, diabetes, hemophilia, AV block, hypercholesterolemia, immune reconstitution syndrome, neonates, cardiomyopathy, infants 1-6 months (overdose). Monitor AST/ALT every 3 months in those with hepatic impairment.

Dosage schedule: HIV infection in combination with other antiretroviral drugs (high-dose ritonavir): oral: Initially 300 mg every 12 hours for 3 days, increased in steps of 100 mg every 12 hours over no longer than 14 days; increased to 600 mg every 12 hours. Low-dose booster to increase effect of other protease inhibitors oral: adult: 100-200 mg 1-2 times a day

Adverse effects:- Acne, anxiety, arthralgia, blood pressure changes, blurred vision, confusion, cough, decreased blood thyroxine concentration, fever, flushing, gastrointestinal hemorrhage, menorrhagia, mouth ulcers, edema, peripheral neuropathy, pharyngitis, renal impairment, seizures, syncope.

Drug and food Interactions: Increase ritonavir levels: fluconazole. Decrease ritonavir levels: rifamycins, nevirapine, barbiturates, phenytoin. Decrease levels of anticoagulants, atovaquone, divalproex, ethinyl estradiol, lamotrigine, phenytoin, sulfamethoxazole, theophylline, voriconazole, zidovudine.

SAQUINAVIR

Dosage form and strengths: *Tablet:* 500 mg

Indications: HIV infection in combination with other drugs.

Contraindications/Precautions: Bradycardia, congenital QT prolongation, electrolyte disturbance, heart failure with reduced left ventricular function, history of symptomatic arrhythmias, severe hepatic impairment, child: safety and efficacy in children under 16 years is not established. Chronic hepatitis B or C, renal impairment, diabetes mellitus, pregnancy (B), and breastfeeding. Monitor ECG before starting treatment (do not initiate treatment if QT interval

over 450 milliseconds). If treatment is started, monitor ECG regularly. Patient should be told how to recognize signs of arrhythmias and advised to seek medical attentions if symptoms such as palpitations or syncope develop.

Dosage schedule: HIV infection other anti-retroviral in patients previously treated with ART with low dose ritonavir. HIV infection in combination with other antiretrovirals in patients previously treated with ART with low dose ritonavir. Adult 1 gram every 12 hours. HIV infection in combination with other antiretrovirals in patients not previously treated with ART with low dose ritonavir. Adult 500 mg every 12 hours for 7 days, then increased to 1 gram every 12 hours.

Adverse effects: Buccal and mucosal ulceration, diarrhoea, taste disturbances, vomiting, chest pain, peripheral neuropathy, fever, changes in libido.

STAVUDINE

Dosage for and strength: *Capsule:* 15 mg, 20 mg, 30 mg; *Powder for oral liquid:* 5 mg/5 ml

Indications: HIV infection in combination with other drugs.

Contraindications/Precautions: Hypersensitivity to stavudine or didanosine or zidovudine or zalcitabine. Severe peripheral neuropathy, lactic acidosis. Breast-feeding, advanced HIV infections, bone marrow suppression, peripheral neuropathy, renal impairment, osteoporosis, obesity, pregnancy (C), hepatic disease, pancreatitis. Stavudine is associated with a higher risk of lipotrophy especially in combination with didanosine.

Dosage schedule: Adult (60kg): 30 mg every 12 hours; 40 mg every 12 hours for more than 60kg

Adverse effects: Peripheral neuropathy (dose-related), pancreatitis, vomiting, diarrhoea, chest pain, headache, gynaecomastia, elevated liver enzymes and serum amylase

Drug and food interaction: Decrease level of stavudine: probenecid. Decrease level of stavudine: methadone, zidovudine. Increase peripheral neuropathy: lithium, dapsone, chloramphenicol, didanosine, ethambutol, hydralazine, phenytoin, zalcitabine, isoniazid.

TENOFOVIR DISOPROXIL

Dosage form and strengths: *Tablet:* 245 mg.

Indications: HIV infection

Contraindications/ Precaution: Hypersensitivity, lactic acidosis, breastfeeding. Pregnancy B, children, geriatric patients, renal impairment, creatinine clearance less than 60 ml/min, osteoporosis, immune reconstitution syndrome. The renal function test and serum phosphate should be estimated before treatment, then every 4 weeks for 1 year and then every 3 months, interrupt treatment if renal function deteriorate or serum phosphate decreases. Not to breastfeed while taking this product.

Dosage schedule: *HIV infection in combination with other antiretroviral drugs, oral: adult:* 245 mg once daily.

Adverse effects: Gastro-intestinal disturbances including diarrhoea, vomiting, abdominal pain, anorexia, pancreatitis, headache, anorexia,

neutropenia, hypophosphataemia, polyuria, renal failure.

Drug and food interaction: Increase tenofovir level: acyclovir, valacyclovir. Increase level of didanosine when given with tenofovir. Increase tenofovir level: any product that decrease renal function.

ZIDOVUDINE

Dosage form and strengths: *Solution for infusion:* 10 mg/ml, *Capsule:* 100 mg and 250 mg

Indications: Prevention of maternal-fetal HIV transmission, HIV infections in combination with other antiretroviral drugs.

Contraindications/Precaution: Hypersensitivity, acute porphyria. Pregnancy (C), breastfeeding, children, granulocytes count < 1000 mm³ or Hb 9.5 g/dl, severe renal disease, obesity. Monitor full blood count after 4 week of treatment, then every 3 months

Dosage schedule:

- *HIV infections in combination with other antiretroviral drugs, oral:* adult, 250-300 mg twice daily.
- *In patients who are temporarily unable to take zidovudine oral:* IV infusion 0.8-1 mg/kg every 4 hours usually for not more than 2 weeks, dose approximately 1.2-1.5 mg/kg every 4 hours oral. Child Oral, 500-600 mg daily in 2-3 divided doses. Over 3 months initially 360-480 mg/m² every 6-8 hours.
- *Prevention of maternal-fetal transmission:* For mother- zidovudine 300 mg + lamivudine 150 mg twice daily + nevirapine 200 mg once daily for 1 days (if CD4 <250). Start as soon as possible in pregnancy and continue throughout pregnancy, labour, delivery and postpartum and for life. If no reaction continue zidovudine + lamivudine and increase nevirapine to 200 mg twice daily after 14 days. For neonates and infants: zidovudine 4 mg/kg twice daily for 7 days. If the mother has received less than 4 weeks for HAART, infant zidovudine should be continued for 4 weeks

Adverse effects: Diarrhea, liver disorders, abdominal pain, pancreatitis, bone marrow depression with severe anaemia, granulocytopenia, and thrombocytopenia, gynaecomastia, myopathy, neuropathy, influenza-like symptoms.

Drug and food interaction: Concomitant use of drug with nephrotoxic and myelosuppressive drugs increases risk of toxicity. Increase bone marrow depression when used with anti-neoplastics, clotrimazole. Increase zidovudine level: by methadone, fluconazole, probenecid, trimethoprim, valproic acid. Decrease zidovudine level: by interferons, NRTIs, doxorubicin, stavudine.

Section II - Chapter 11

Drugs used in Endocrine Disorders

11.1 Adrenal hormones and synthetic substituents

Beclomethasone
Betamethasone
Cortisone acetate
Dexamethasone
Fludrocortisone acetate
Hydrocortisone
Methyl prednisolone
Prednisolone
Triamcinolone acetonide

11.2 Drugs used in diabetes mellitus

11.2.1 Insulin analogues

Insulin aspart
Insulin glargine
Insulin isophane (NPH)
Insulin lispro
Insulin protamine zinc
Insulin soluble
Insulin zinc (semi-lente, lente, ultra-lente)

11.2.2 Oral anti-diabetic drug

11.2.2.1 α -glucosidase inhibitors

Acarbose

11.2.2.2 Biguanides

Metformin

11.2.2.3 Dipeptidyl peptidase-4 inhibitors

Sitagliptin

11.2.2.4 Glucagon like peptide-1 agonists

Liraglutide

11.2.2.5 Meglitinide/Phenylalanine analogues

Repaglinide

11.2.2.6 Sulfonylureas

Chlorpropamide

Glibenclamide

Gliclazide

Glipizide

11.2.2.7 Thiazolidinediones

Pioglitazone

Rosiglitazone

11.3 Treatment of hypoglycaemia

Glucagon

11.4 Thyroid hormones

Levothyroxine

11.5 Anti-thyroid drugs

Carbimazole
Iodine
Lugol's iodine
Propranolol
Propylthiouracil

11.6 Somatostatin analogue

Octreotide
Somatotropin

11.7 Drugs used in osteoporosis

Calcitonin
Teriparatide

11.8 Anti-obesity drug

Orlistat

11.1 Adrenal hormones and synthetic substitutes

The adrenal cortex normally secretes hydrocortisone, which has glucocorticoid activity and weak mineralcorticoid activity.

Glucocorticoids

Indications: Replacement therapy in adrenocortical insufficiency states, diagnosis of Cushing's syndrome, Suppressing the manifestations of disease in a wide variety of inflammatory and allergic conditions and in reducing antibody production in a number of auto-immune diseases, allergic disorders, rheumatic disease, neoplastic diseases.

Contraindications/Precautions: Avoid in case of untreated serious infections (except tubercular meningitis or septic shock), ITP, premature infants or baby on live vaccine. Use with caution in cirrhosis, hypertension, diabetes mellitus, ocular herpes simplex, peptic ulcer etc.

Adverse effects: Hypertension, sodium retention, potassium loss, muscle weakness, diabetes, osteoporosis, dyspepsia, increased susceptibility to and severity of infection, mental disturbance (euphoria, psychosis, depression, aggravation of epilepsy), peptic ulceration, haemorrhage, perforation, suppression of growth in children

Drug and food interactions: Barbiturates, phenytoin, rifampicin which induce hepatic enzymes may increase glucocorticoid metabolism, concomitant use with alpha-blockers, angiotensin-II receptor antagonists, beta-blockers and calcium channel blockers antagonise hypotensive effect.

Relative potencies and duration of action of corticosteroids:

Compounds	Relative anti-inflammatory potency	Relative sodium retaining potency	Duration of action (hours)
1. Hydrocortisone	1	1	8-12
2. Betamethasone	25	0	36-72
3. Dexamethasone	25	0	36-72
4. Methyl prednisolone	5	0.5	12-36
5. Prednisolone	4	1	12-36
6. Prednisone	4	1	12-36
7. Triamcinolone	5	0	12-36

BECLOMETHASONE

Dosage form and strength: *Aerosol inhaler:* 50 µg, 100 µg and 200 µg per metered dose

Indications: Prophylaxis of bronchial asthma, prophylaxis and treatment of allergic rhinitis

Contraindications/Precautions: It may cause oral candidiasis. *Also see under respiratory system*

Dosage schedule: *See under respiratory system (chapter 7)*

Adverse effects: Bronchospasm and wheezing, rash, *Candida* infections in mouth or throat

Patient's information: Gargle mouth after each use.

BETAMETHASONE

Dosage form and strength: Drops: 0.5 mg/ml; Injection: 4 mg/ml; Tablets: 0.5 mg

Indications: See under section 12.1

Contraindications/Precautions: See under section 12.1

Dosage schedule: Oral: 0.5-5 mg daily; IM injection or slow IV injection or infusion: 4 -20 mg, repeated up to 4 times in 24 hours; child: by slow IV injection, up to 1 year 1 mg, 1-5 years 2 mg, 6-12 years 4 mg

Adverse effects: See under section 12.1

CORTISONE ACETATE

Dosage form and strength: Tablet: 5 mg and 25 mg

Indications: See under section 12.1

Contraindications/Precautions: See under section 12.1

Adverse effects: See under section 12.1

Dosage schedule: Oral, for replacement therapy, 25-37.5 mg in divided dose.

DEXAMETHASONE

Dosage form and strength: Tablet: 0.5 mg; Injection: 4 mg/ml

Indications: See section 12.1

Contraindications/Precautions: Should be protected from light. See section 12.1

Dosage schedule:

- *Physiological replacement (oral):* Adult: 0.03-0.15 mg/kg/day in 2-4 divided doses; (parenteral)- 0.03-0.15 mg/kg/day IV or IM in 2-4 divided doses;
- *As anti-inflammatory (oral):* adult: 0.75-9mg/day in 2-4 divided doses, children: 0.8-0.3 mg/ day in 2-4 divided doses; (parenteral)- adult: 0.75-9 mg IM/IV in 2-4 divided doses, children: 0.8-0.3 mg/ day IM/IV in 2-4 divided doses;
- *Adrenal crisis:* 4-10 mg/day as single dose, repeat if required;
- *Bacterial meningitis:* children (>2 months): 0.6 mg/kg/day in 4 divided doses on the first 4 days of treatment;
- *Cerebral edema:* 10 mg IV followed by 4 mg 6 hourly till condition improves

Adverse effects: See section 12.1

FLUDROCORTISONE ACETATE

Dosage form and strength: Tablet: 100 µg

Indications: Mineralocorticoid replacement in adrenocortical insufficiency

Contraindications/Precautions: See under section 12.1

Dosage schedule: Adrenocortical insufficiency: adult 50-300 µg daily; child 5 micrograms/kg daily

Adverse effects: See under section 12.1

HYDROCORTISONE

Dosage form and strength: Injection: 100 mg (hydrocortisone sodium succinate), 25 mg/ml (hydrocortisone acetate)

Indications: See under section 12.1

Contraindications/Precautions: Hydrocortisone acetate injection should be protected from light; container should be gently shaken before dose is

withdrawn. Also see under section 12.1

Dosage schedule: Adult: by IM injection or slow IV injection or infusion, 100-500 mg, 3-4 times in 24 hours or as required; Child by slow IV injection up to 1 year 25 mg, 1-5 year 50 mg, 6-12 years 100 mg

Adverse effects: See under section 12.1

METHYLPREDNISOLONE

Dosage form and strength: Tablet: 4 mg, 8 mg and 16 mg; Injection: 250 mg/vial

Indications: See under prednisolone

Dosage schedule: Oral: 2-40 mg daily; IM injection or slow IV injection or infusion: initially 100-500 mg

Adverse effects: See under prednisolone

PREDNISOLONE

Dosage form and strength: Tablet: 5 mg, 10 mg and 20 mg

Indications: See section 12.1

Contraindications/Precautions: Cushingoid side effects more likely with doses above 7.5 mg daily; should be protected from light. Also see section 12.1

Dosage schedule: Oral, adult- 5-60 mg/day; children: 0.14-2 mg/kg/day in 3-4 divided doses; IV: 10-40 mg, 1-2 times weekly; IM 100 mg, 1-2 times weekly

Adverse effects: See section 12.1

Patient's information: Preferably taken in the morning after breakfast or food; can often be reduced within a few days but may need to be continued for several weeks or months.

TRIAMCINOLONE ACETONIDE

Dosage form and strength: Injection: 40 mg/ml

Indications: See section 12.1

Contraindications/Precautions: See section 12.1

Dosage schedule: By deep IM injection, 40 mg of triamcinolone acetonide for depot effect, repeated at intervals according to the patient's response, maximum single dose 100 mg

Adverse effects: See section 12.1

11.2 Drugs used in diabetes mellitus

11.2.1 Insulin

Insulin preparations are of mainly three types.

1. Short duration with relatively rapid action. E.g. regular insulin injection (soluble), insulin lispro and insulin aspart.
2. Intermediate duration of action. E.g. isophane insulin (NPH) injection and insulin zinc suspension (lente).
3. Long duration of action. E.g. protamine zinc insulin (PZI) and insulin zinc suspension (ultralente).

INSULIN ASPART

Dosage form and strength: *Injectable solution:* 100 units/ml

Indications: Diabetes mellitus

Contraindications/Precautions: Can be given during pregnancy and breastfeeding. Should be taken before meal or immediately after meal

Dosage schedule: By SC injection, immediately before meals or when necessary shortly after meals, according to requirements; By IV injection or infusion according to requirements

Adverse effects: *See under soluble insulin*

INSULIN GLARGINE

Dosage form and strength: *Injectable solution:* 100 units/ml, 300 units/ml (prefilled syringe)

Indications: Diabetes mellitus

Contraindications/Precautions: High morbidity due to hypoglycemia. Should be injected with evening meal

Dosage schedule: By subcutaneous injections, start Insulin glargine as 1/3rd of total daily insulin dose; use remaining 2/3 of daily insulin dose on short-acting, premeal insulin. Usual initial dose range: 0.2-0.4 units/kg; optimal glucose lowering effect may take 5 days to fully manifest

Adverse effects: *See under soluble insulin*

INSULIN ISOPHANE (NPH)

Dosage form and strength: *Injection:* 40 units/ml

Indications: Diabetes mellitus

Dosage schedule: By subcutaneous injection, according to patient's requirements

Adverse effects: *See under soluble insulin*

INSULIN LISPRO

Dosage form and strength: *Injectable solution:* 100 units/ml

Indications: Diabetes mellitus

Dosage schedule: Start with 0.2-0.6 unit/kg/day subcutaneously in divided doses. Recommended to start with lower dose to reduce risk of hypoglycemia Total maintenance daily insulin requirement may vary; it is usually between 0.5 and 1 unit/kg/day

Adverse effects: *See under soluble insulin*

INSULIN PROTAMINE ZINC (PZI)

Dosage form and strength: *Injection:* 100 units/ml

Indications: Diabetes mellitus

Contraindications/Precautions: *See under soluble insulin*

Dosage schedule: By subcutaneous injection: according to patient's requirement as described under insulin glargine

Adverse effects: *See under soluble insulin*

INSULIN SOLUBLE

Dosage form and strength: *Injection:* 40 units/ml and 100 units/ml

Indications: Diabetic ketoacidosis, diabetes mellitus

Dosage schedule: By SC, IM or IV injection, according to patient's requirements

Adverse effects: Hypoglycaemia localised allergic reactions, fat hypertrophy at injection sites

INSULIN ZINC SUSPENSION

(INSULIN SEMILENTE, INSULIN LENTE, INSULIN ULTRALENTE)

Dosage form and strength: *Injectable:* 40 units/ml; sterile, neutral suspension of porcine insulin or of human insulin in the form of a complex obtained by the addition of a suitable zinc salt

Indications: Diabetes mellitus

Dosage schedule: By subcutaneous injection, according to patient's requirements

Adverse effects: *See under soluble insulin*

11.2.2 Oral Antidiabetic drugs

11.2.2.1 α -Glucosidase inhibitors

ACARBOSE

Dosage form and strength: *Tablet:* 50 mg

Indications: Type 2 diabetes mellitus

Contraindications/Precautions: <18 years age, pregnancy, breast-feeding, hepatic impairment and severe renal impairment.

Dosage schedule: Initially 50 mg/day, increased to 50 mg 3 times daily then increased if necessary after 6-8 weeks to 100 mg 3 times daily; maximum 200 mg 3 times daily

Adverse effects: Abdominal pain, flatulence, diarrhoea, jaundice

Drug and food interaction: Used with caution with insulin and sulphonylureas (enhance hypoglycaemia)

11.2.2.2 Biguanides

METFORMIN

Dosage form and strength: *Tablet:* 500 mg, 850 mg, 1000 mg

Indications: Type 2 diabetes mellitus, gestational diabetes, polycystic ovarian syndrome

Contraindications/Precautions: Renal impairment, hepatic impairment, recent myocardial infarction, pregnancy, chronic alcoholics, ketoacidosis, general anaesthesia. Suspend metformin on the morning of surgery and restart when baseline returns to normal

Dosage schedule: Adult and child over 10 years, initially 500 mg with breakfast for at least 1 week then 500 mg every 12 hours with or after food for at least 1 week, maximum 2 g daily in divided doses

Adverse effects: Anorexia, nausea, vomiting, diarrhoea, metallic taste, abdominal discomfort, vitamin B₁₂ deficiency, and hepatitis and lactic acidosis (rarely)

11.2.2.3 Dipeptidyl peptidase-4 inhibitors

SITAGLIPTIN

Dosage form and strength: Tablets: 25 mg, 50 mg and 100 mg

Indications: Type 2 diabetes mellitus

Contraindications/Precautions: Hypersensitivity. Pregnancy Category B

Dosage schedule: Oral: 100 mg/day

Adverse effects: Hypoglycemia, acute pancreatitis, acute kidney injury, bundle branch block, exfoliative dermatitis. May develop arthralgia, bullous pemphigoid, pancreatitis, hypersensitivity reactions.

11.2.2.4 Glucagon-like peptide receptor agonists

LIRAGLUTIDE

Dosage form and strength: SC injection, 6 mg/ml (3 ml Pen-injector)

Indications: Type 2 diabetes mellitus, chronic weight management

Contraindications/Precautions: Pregnancy (Category C/X), multiple endocrine neoplasia type 2 (MEN-2), personal or family history of medullary thyroid carcinoma (MTC), Pregnancy, breast feeding.

Dosage schedule:

- *Chronic weight management:* SC injection 0.6 mg once daily for one week; increase by 0.6 mg daily at weekly intervals to a target dose of 3 mg once daily; Delay dose escalation if patient cannot tolerate increased dose, if 3 mg dose is not tolerated for chronic weight management, discontinue drug.
- *Diabetes mellitus, type 2:* SC injection 0.6 mg once daily for 1 week then increase to 1.2 mg once daily may increase further to 1.8 mg once daily if optimal glycemic response not achieved with 1.2 mg daily.

Adverse effects: Hypoglycemia, tachycardia, headache, nausea, vomiting, diarrhoea, constipation

11.2.2.5 Meglitinide/Phenylalanine analogues

REPAGLINIDE

Dosage form and strength: Tablet: 500 µg, 1 mg and 2 mg

Indications: Type 2 diabetes mellitus

Contraindications/Precautions: Avoid during ketoacidosis, pregnancy, breast-feeding, severe hepatic impairment. Myocardial infarction, infection, coma, during surgery, renal impairment; child and adolescent under 18 years not recommended. Substitute by insulin during peri-operative period and during intercurrent illness such as MI, coma, infection; use cautiously in renal impairment and liver impairment;

Dosage schedule: Initially 500 µg within 30 minutes before main meals, adjusted according to response at intervals of 1-2 weeks

Adverse effects: Hypoglycaemia, diarrhoea, constipation, abdominal pain, nausea, vomiting, pruritus, urticaria, vasculitis, visual disturbances

11.2.2.6 Sulfonylureas

CHLORPROPAMIDE

Dosage form and strength: *Tablet:* 250 mg

Indications: Type 2 diabetes mellitus

Contraindications/Precautions: Patients with ketoacidosis, diabetic coma, severe infection, severe impairment of kidney or liver function. Safety of drug during pregnancy and breast-feeding has not been established

Dosage schedule: Initially 250 mg/day, adjusted according to response, maximum 500 mg daily taken with breakfast or meal

Adverse effects: Hypoglycaemia, nausea, vomiting, diarrhoea and disulfiram like reaction with alcohol. The antidiuretic action may result in the symptoms and signs of water intoxication (mental confusion, decreased sodium concentration, dizziness etc.)

GLIBENCLAMIDE

Dosage form and strength: *Tablet:* 2.5 mg and 5 mg

Indications: Type 2 diabetes mellitus

Contraindications/Precautions: *See under chlorpropamide*

Dosage schedule: Initially 5 mg/day (elderly patient 2.5 mg), adjusted according to response; maximum 15 mg daily; taken with breakfast or meal

Adverse effects: Hypoglycaemia, nausea, vomiting, photosensitivity, hyponatremia, diarrhoea, constipation, weight gain. Neonatal hypoglycaemia when used by pregnant mother during first trimester.

Drug and food interaction: Warning signs of hypoglycaemia (such as tremor) with antidiabetic may be masked when given with beta-blockers. Flushing if taken with alcohol (disulfiram like reaction)

GLICLAZIDE

Dosage form and strength: *Tablet:* 80 mg

Indications: Type 2 diabetes mellitus

Contraindications/Precautions: Acute porphyria

Dosage schedule: Initially 40-80 mg daily, adjusted according to response; up to 160 mg as a single dose with breakfast or meal; higher doses divided; maximum 320 mg daily.

Adverse effects: *See under glibenclamide*

GLIMEPERIDE

Dosage form and strength: *Tablet:* 1 mg, 2 mg, 3 mg and 4 mg

Indications: Type 2 diabetes mellitus.

Contraindications/Precautions: Porphyria (but comparatively safer than other sulphonylureas); hepatic impairment; ketoacidosis

Dosage schedule: Initially 1 mg daily, max up to 4 mg daily.

Adverse effects: Hyponatremia. *Also see under glibenclamide*

GLIPIZIDE

Dosage form and strength: *Tablet:* 5 mg

Indications: *See under glibenclamide*

Contraindications/Precautions: Acute porphyrias.

Dosage schedule: Initially 2.5-5 mg daily, adjusted according to response; maximum 20 mg daily, up to 15 mg may be given as a single dose before breakfast or meal; higher doses divided. To be ingested 30 min before breakfast because food decreases its absorption.

Adverse effects: Dizziness, drowsiness, hyponatremia, hepatic impairment, renal impairment

11.2.2.7 Thiazolidinediones

PIOGLITAZONE

Dosage form and strength: *Tablet:* 15 mg and 30 mg

Indications: Type 2 diabetes mellitus.

Contraindications/Precautions: Avoid during ketoacidosis, pregnancy, breast-feeding, hepatic impairment, cardiac failure, previous or active bladder cancer, uninvestigated macroscopic hematuria. Substitute insulin during peri-operative period; Risk of bladder cancer so patient should be asked to immediately report if hematuria or any urinary symptoms occur

Dosage schedule: Initially 15-30 mg/day, increased to 45 mg/day according to response

Adverse effects: Anemia, arthralgia, dizziness, gastro-intestinal disturbances, hematuria, headache, peripheral edema, weight gain, impotence, hypoaesthesia

11.3 Treatment of hypoglycaemia

Initially glucose 10-20 g is given by mouth. If necessary, this may be repeated in 10-15 minutes. Hypoglycaemia which causes unconsciousness is an emergency. It should be treated with glucagon or 50 ml of glucose IV infusion 20% into large vein.

GLUCAGON (GLUCAGON HYDROCHLORIDE)

Dosage form and strength: *Injection:* 1 mg/vial

Indications: Acute hypoglycaemia, insulin induced hypoglycemia, β -blocker poisoning (cardiogenic shock unresponsive to atropine)

Contraindications/Precautions: Avoid in pheochromocytoma, history of insulinoma, starvation. Should be used immediately after preparation; if it shows any signs of gel formation or insoluble matter it should be discarded. Protect from light and stored at a temperature not exceeding 25°C

Dosage schedule: SC, IM, or IV injection: adult/child over 8 years 1 mg, if no response after 15 minutes IV glucose should be given

Adverse effects: Nausea, vomiting, diarrhoea hypotension, hypokalaemia, hypersensitivity.

11.4 Thyroid hormones

LEVOTHYROXINE (L-THYROXINE)

Dosage form and strength: *Tablet:* 100 μ g

Indications: Cretinism, adult hypothyroidism, myxoedema coma, non toxic goitre, papillary carcinoma of thyroid after surgery

Contraindications/Precautions: Angina pectoris and other cardiovascular disorders, diabetes mellitus, hypertension; pregnancy, breast-feeding. Should be protected from light.

Dosage schedule: Initially up to 50-100 µg/day (preferably before morning meal or breakfast), 25-50 µg in elderly patients or those with cardiac disease, increased by 50 µg at intervals of at least 3-4 weeks; neonate (up to 1 month)- 5-10 µg/kg/day; child (over 1 month)- initially 5 µg/kg, adjusted in steps of 25 µg every 2-4 weeks until mild toxic symptoms appear then reduce dose slightly

Adverse effects: Palpitation, tachycardia, diarrhoea, cardiac arrhythmias, tremor, weight loss, sweating, insomnia, angina pain and increased appetite.

11.5 Anti-thyroid drugs

CARBIMAZOLE

Dosage form and strength: *Tablet:* 5 mg

Indications: Hyperthyroidism, first episode in patient <40 years, control thyrotoxicosis in both Grave's disease and toxic nodular goitre, pre-operatively to make euthyroid state, along with radioactive iodine (given after 5 to 7 days and withdrawn till response develops), thyroid storm

Contraindications/Precautions: Hypersensitivity, pregnancy, breast-feeding, liver disorders

Dosage schedule: 15-40 mg daily in divided doses, until patient becomes euthyroid (usually 4-8 weeks), then reduced to a maintenance dose of 5-15 mg for 12-18 months

Adverse effects: Major side effects- hepatitis, SLE like syndrome. Most serious-agranulocytosis but reversible; hypothyroidism and goitre may occur due to over treatment but is reversible once stopped. GI Intolerance, skin rashes, urticaria, joint pain, loss of hair, loss of taste, fever

IODINE

Dosage form and strength: *Injection:* 480 mg/ml

Indications: Prevention and treatment of iodine deficiency

Contraindications/Precautions: Breast-feeding. Pregnancy, nodular goitre, over 45 years of age

Dosage schedule: Iodine deficiency, IM- infant 190 mg; child/adult 380 mg (aged over 45 years or with nodular goitre 76 mg). It provides protection up to 3 years; (oral)- infant under 1 year 100 mg single dose; child (1-5 years), 200 mg yearly; adult/child (>6 years) 400 mg yearly, pregnancy 200 mg single dose; endemic moderate to severe iodine deficiency, IM- adult woman of child-bearing age, including any stage of pregnancy, 480 mg yearly

Adverse effects: Hypothyroidism, goitre, hypersensitivity, inflammation of mucous membrane, headache, flaring of acne in adolescents

LUGOL'S IODINE

Dosage form and strength: *Oral solution (Lugol's solution):* 5% w/v of iodine and 10% w/v of potassium iodide

Indications: Thyrotoxicosis (pre-operative)

Contraindications/Precautions: Breast-feeding, pregnancy, children.

Should be kept in well closed container, the material of which is resistant to iodine

Dosage schedule: 0.1-0.3 ml 3 times daily well diluted with water or milk

Adverse effects: Hypersensitivity reactions manifested by angioedema, fever, arthralgia, urticaria, metallic taste, headache, swelling and tenderness of the salivary glands

PROPRANOLOL

Dosage form and strength: *Tablet:* 10 mg, 20 mg

Dosage schedule: *See under section 2.1.2, beta-blockers*

Adverse effects: *See under section 2.1.2, beta-blockers*

PROPYLTHIOURACIL

Dosage form and strength: *Tablet:* 50mg

Indications: *See under carbimazole*

Dosage schedule: 200-400 mg daily and maintained on this dose until the patient becomes euthyroid, the dose may then be gradually reduced to maintenance of 50 to 150 mg daily

Adverse effects: May cause thrombocytopenia, aplastic anaemia, hypoprolthrombinaemia and bleeding. *Also see under carbimazole.*

11.6 Somatostatin analogue

OCTREOTIDE

Dosage form and strength: *Injection:* 0.05 mg/ml, 0.1 mg/ml, 0.2 mg/ml, 0.5 mg/ml, 1 mg/ml; *Depot injection:* 10 mg/kit, 20 mg/kit, 30 mg/kit

Indications: Acromegaly, carcinoid tumor, VIPoma, esophageal variceal bleeding

Contraindications/Precautions: Can inhibit gallbladder contractility, predisposed to gallstone formation, ascending cholangitis, acute cholecystitis, biliary obstruction, cholestatic hepatitis, or pancreatitis. Use caution in renal impairment, hepatic impairment, pregnancy category B

Dosage schedule:

- *Acromegaly:* 50 µg sub-cutaneous q8-12hr initially, titrate up to 500 µg SC every 8 hours if necessary; after successful treatment with solution for 2 weeks, followed by suspension (depot injection)- 20 mg IM (gluteal) every 4 weeks for 3 months; titrate up or down to 10-30 mg IM every 4 weeks, depending on response, not to exceed 40 mg
- *Esophageal variceal bleeding (off-label):* 50 µg IV bolus, then 25-50 µg/hr for 1-5 days

Adverse effects: Gallstones, cholecystitis, cholestatic hepatitis, dysglycemia, hypothyroidism, bradycardia

SOMATROPIN

Dosage form and strength: *Injection* (powder for reconstitution, solution): 0.2 ng, 0.4 ng, 0.6 ng, 1 ng, 2 ng, 5 ng, 10 ng

Indications: Pituitary dwarfism, Turner's syndrome, renal failure, adult GH deficient patients, AIDS related wasting

Contraindications/Precautions: May increase intracranial tension

Dosage schedule: Pituitary dwarfism, 0.03-0.06 mg/kg daily in the evening or on alternate days, up to age of 20 years or more; adult GH deficient patients, 150-300 µg/day SC adjusted accordingly

Adverse effects: Pain at injection site, lipodystrophy, glucose intolerance, hypothyroidism, salt and water retention, hand stiffness, myalgia, headache

11.7 Drug used in bone metabolism disorder

CALCITONIN

Dosage form and strength: *Nasal spray:* 2200 USP Calcitonin Salmon units per mL (2mL, 3.7mL), dispensing 200 USP Calcitonin Salmon units (0.09ml) per actuation

Indications: Postmenopausal osteoporosis in women greater than 5 years post menopause

Contraindications/Precautions: Known hypersensitivity. Hypocalcaemia, nasal changes, malignancy

Dosage schedule: Postmenopausal osteoporosis, 1 spray per day intranasally, alternating nostrils daily

Adverse effects: Hypersensitivity, facial or peripheral edema, hypertension, vasodilation, syncope, chest pain, dizziness, seizure, visual or hearing impairment, tinnitus, cough, bronchospasm, dyspnoea, loss of taste/smell, alopecia, increased sweating, diarrhoea, tremor, nasal adverse reactions (rhinitis, epistaxis, nasal mucosal alterations)

SODIUM ALDRONATE

Dosage form and strength: *Tablet:* 5 mg, 10 mg, 35 mg and 70 mg

Indications: Prevention and treatment of post-menopausal osteoporosis, osteoporosis in men, prevention and treatment of corticosteroid-induced osteoporosis

Contraindications/Precautions: Avoid in pregnancy, breast-feeding, stricture or achalasia of oesophagus. Use caution in patients with history of ulcers, active gastro-intestinal bleeding, renal impairment, gastritis

Dosage schedule:

- *Prevention of post-menopausal osteoporosis:* 5 mg daily; Treatment of post-menopausal osteoporosis and osteoporosis in men, 10 mg daily or (in post-menopausal osteoporosis) 70 mg once weekly
- *Prevention and treatment of corticosteroid-induced osteoporosis:* 5 mg daily (post-menopausal woman not receiving hormone replacement therapy, 10 mg daily)

Adverse effects: Oesophageal reactions (oesophagitis, oesophageal ulcers, oesophageal stricture and oesophageal erosions), dyspepsia, abdominal pain and distension, regurgitation, diarrhoea or constipation, melaena, headache, peptic ulceration, severe skin reactions including Stevens-Johnson syndrome

TERIPARATIDE

Dosage form and strength: *Injection (Prefilled injectable pen):* 600 µg/ml (2.4 ml)

Indications: Osteoporosis (severe, with already suffered episodes of osteoporotic fractures, having multiple risk factors for fracture),

hypoparathyroidism

Contraindications/Precautions: Paget's disease, hypercalcemia

Dosage schedule: 20 µg SC daily into thigh or abdominal wall

Adverse effects: Arthralgia, rhinitis, nausea, dizziness, leg cramps

11.8 Anti-obesity drugs

ORLISTAT

Dosage form and strength: *Capsule:* 120 mg

Indications: Obesity management (Body mass index >30 kg/m² or >27 kg/m² in the presence of other risk factors- hypertension, diabetes, dyslipidaemia)

Contraindications/Precautions: Avoid during pregnancy (category X), chronic malabsorption syndrome, cholestasis, hepatotoxicity, renal impairment, dysglycaemia. Fat soluble vitamin supplementation ≥2hrs before or after administering orlistat

Dosage schedule: Obesity management: 120 mg 3 times daily with each main meal containing fat (during or up to 1 hour after the meal), omit dose if meal is occasionally missed or contains no fat.

Adverse effects: Oily rectal leakage, abdominal distress/pain, flatulence with discharge, bowel urgency, steatorrhea, oily evacuation, frequent bowel movements, nausea, faecal incontinence, infectious diarrhoea, rectal pain, gingival disease, cholelithiasis, pancreatitis, acute renal failure, calcium oxalate nephrolithiasis

Patient's information: Avoid high fat diet, distribute daily fat intake over 3 main meals

Section II - Chapter 12

Drugs used in Reproductive Disorders

12.1 *Androgens*

Mesterolone
Methyl testosterone
Testosterone

12.2 *Anabolic steroids*

Nandrolone
Oxymetholone
Stanozolol

12.3 *Antiandrogens*

Bicalutamide
Danazol

12.4 *5 α reductase inhibitors*

Finasteride

12.5 *Estrogens*

Conjugated estrogen
Estradiol
Ethinylestradiol
Mestranol

12.6 *Antiestrogens/Selective estrogen receptor modulators (SERMs)*

Chorionic gonadotrophin
Clomiphene
Tamoxifen

12.7 *Progesterone*

Dydrogesterone
Hydroxyprogesterone
Medroxyprogesterone
Norethisterone

12.8 *Contraceptives*

Combined oral contraceptive pills
Medroxyprogesterone
Levonorgestrel (Levonorgestrel implant)

12.9 *Oxytocics*

Ergot alkaloids (Ergometrine, Methyl ergometrine)
Mifepristone
Oxytocin
Prostaglandin analogues (Misoprostol, Dinoprostone, Carboprost/
Dinoprost)

12.10 Tocolytics**12.10.1 Calcium channel blockers**

Nifedipine

12.10.2 Uterine sympathomimetics

Isoxsuprine

Salbutamol

Terbutaline

12.1 Androgens

MESTEROLONE

Dosage form and strength: *Tablets:* 25 mg

Indications: Androgen deficiency, male infertility associated with hypogonadism.

Contraindications/Precautions: Breast cancer in men, prostate cancer, pregnancy, breast-feeding, hypercalcaemia, history of primary liver tumours, ischaemic heart disease, hypertension, elderly, cardiac, renal or hepatic impairment, diabetes mellitus, pre-pubertal boys. Not recommended in children

Dosage schedule: Orally, 25 mg 3-4 times daily for several months, reduced to 50-75 mg daily in divided doses for maintenance

Adverse effects: prostate abnormalities and prostate cancer, gynaecomastia, excessive frequency and duration of penile erection, increased bone growth, early closure of epiphysis, headache, depression, gastro-intestinal bleeding, hypertension, male-pattern baldness, weight gain

Patient information: Advise patient to swallow the tablet whole with a drink of water. Instruct patient to avoid taking double dose if the drug is missed.

METHYL-TESTOSTERONE

Dosage form and strength: *Capsule:* 10 mg

Indications: *See under testosterone*

Contraindications/Precautions: Carcinoma of prostate, male breast, liver and kidney disease, pregnancy. *Also see under testosterone.*

Dosage schedule: *Hypogonadism:* orally 10-50 mg per day. Breast cancer, 50 mg one to four times a day

Adverse effects: More likely to cause jaundice. frequent/persistent erection (male), changes in menstrual periods (female). *Also see under testosterone.*

Drug and food interactions: *See under testosterone*

TESTOSTERONE

Dosage form and strength: *Injection:* 100 mg (as enanthate), 25 mg (propionate)

Indications: Hypogonadism, breast cancer in females

Contraindications/Precautions: Males with carcinoma of the breast or prostate; pregnancy and breast-feeding. Patients with cardiac, renal or hepatic impairment, ischaemic heart disease, diabetes mellitus and hypertension; used with extreme caution in children

Dosage schedule:

- *Hypogonadism:* testosterone propionate, by intramuscular injection 50 mg twice or thrice weekly. Testosterone enanthate, by slow intramuscular injection 250 mg every 2-3 weeks.
- *Breast cancer in women:* testosterone propionate, 100 mg 2-3 times weekly; testosterone enanthate, 250 mg every 2-3 weeks

Adverse effects: Virilization, excessive body hair and menstrual irregularity

in female, headache, nausea, prostate abnormalities and prostate cancer, changes in libido, gynaecomastia, oedema, priapism, nausea, hypercalcaemia, precocious sexual development and premature closure of epiphyses in pre-pubertal males

Patient information: Report the following sign and symptoms promptly: in male, priapism, gynaecomastia; in female, virilism. Emphasize the importance of regular follow-up, physical exam, lab tests, and x-ray exams to monitor progress.

12.2 Anabolic steroids

NANDROLONE

Dosage form and strength: *Injection:* 25 mg/ml and 50 mg/ml (nandrolone decanoate); 25 mg/ml (nandrolone phenylpropionate)

Indications: Aplastic anaemia, antineoplastic

Contraindications/Precautions: Pregnancy, breast-feeding and prostate cancer, cardiac, hepatic and renal impairment. Possible premature closure of epiphysis in children and adolescents, precocious sexual development in males and virilisation in females

Dosage schedule: Deep intramuscular injection, 50 mg every 3 weeks

Adverse effects: Virilism, oedema, acne, amenorrhoea, inhibition of spermatogenesis, liver tumour with prolonged treatment

Patient information: Administer intramuscularly only. Advise the patient to protect the drug from light.

OXYMETHOLONE

Dosage form and strength: *Tablets:* 50 mg

Indications: Aplastic anaemia

Contraindications/Precautions: *See under nandrolone.* Protect from sunlight

Dosage schedule: 1-5 mg/kg daily in divided doses; child 0.175 mg/kg daily as a single dose

Adverse effects: *See under nandrolone*

STANOZOLOL

Dosage form and strength: *Tablets:* 2 mg

Indications: Hereditary angioedema

Dosage schedule: *Hereditary angioedema:* oral, initially 2-4 mg daily

Adverse effects: *See under nandrolone*

12.3 Antiandrogens

BICALUTAMIDE

Antiandrogens act by inhibiting binding of androgens to their receptors in target tissues

Dosage form and strength: *Tablet:* 50 mg

Indications: Prostate cancer (advanced stage-for palliation, locally advanced disease at high-risk of disease progression, post-surgical castration)

Contraindications/Precautions: Cardiovascular effects (angina, heart failure, arrhythmias, ECG changes); interstitial pneumonitis, pulmonary fibrosis, hepatitis, impaired glucose tolerance, monitor serum prostate specific antigen levels

Dosage schedule: *Advanced prostatic cancer (palliative treatment), along with gonadorelin analogue:* 50 mg daily

Adverse effects: Pruritus, asthenia, alopecia, hair regrowth, and dry skin; hypersensitivity reaction (angioedema, urticaria)

Drug and food interactions: CYP3A4 inhibitor, displaces warfarin from its protein binding site

Patient information: Instruct patient that tablets be taken at the same time each day. If a dose is missed, take the next dose at the scheduled time.

DANAZOL

Synthetic derivative of ethisterone, possesses weak androgenic and anabolic properties resulting in suppression of gonadotropin secretion from pituitary resulting in inhibition of testicular/ovarian function

Dosage form and strength: *Capsules:* 50 mg, 100 mg and 200 mg

Indications: Endometriosis, palliative treatment of fibrocystic breast disease

Contraindications/Precautions: Abnormal genital bleeding of unknown aetiology, pregnancy. Migraine, seizure disorder, cardiac or renal dysfunction (aggravates fluid retention). In women, all doses should start during menstruation, preferably on the first day, unsuitable for those desiring conception.

Dosage schedule:

- *Endometriosis:* initially 400 mg daily in up to 4 divided doses, adjusted according to response, usually for six months;
- *Menorrhagia:* 200 mg daily, usually for 3 months; benign breast cyst, 300 mg daily usually for 3 months;
- *Gynaecomastia:* 400 mg daily in divided doses for 6 months (adolescents 200 mg daily, increased to 400 mg daily if no response after 2 months)

Adverse effects: Hirsutism, decreased breast size, acne, weight gain, oedema, cholestatic jaundice, dizziness, headache, fatigue and tremor

Patient information: Encourage patient about use of adequate methods of non-hormonal contraception.

12.4 5 α -reductase inhibitors

FINASTERIDE

5 α -reductase antagonist (especially type II)

Dosage form and strength: *Tablets:* 5 mg

Indications: Benign prostatic hyperplasia, male-pattern baldness

Contraindications/Precautions: Children, adolescents, women

Dosage schedule:

- *Benign prostate hyperplasia*: 5 mg daily; review treatment after 6 months;
- *Male pattern baldness*: 1 mg/day

Adverse effects: Impotence, decreased libido, breast tenderness and enlargement, rash, decrease volume of ejaculate, gynaecomastia

Patient information: Instruct patient to take finasteride as directed, even if symptoms improve or are unchanged. At least 6-12 months of therapy may be necessary. Emphasize the importance of periodic follow-up exams.

12.5 Estrogens

CONJUGATED ESTROGEN

Similar to those of endogenous oestrogens

Dosage form and strength: *Tablets*: 625 µg

Indications: *See under ethinyl estradiol*

Contraindications/Precautions: *See under ethinyl estradiol*. Breast cancer and thromboembolism. Long term use without incombination of progesterone could increase the risk of endometrial cancer.

Dosage schedule: menopausal symptoms, 0.625-1.25 mg daily

Adverse effects: *See under ethinyl estradiol*

ESTRADIOL

Principal and most active endogenous oestrogen; activity differs following oral or parenteral administration

Dosage form and strength: *Tablets*: 0.5 mg, 1 mg, 2 mg; *Transdermal patch*: 0.05 mg, 0.06 mg, 0.075 mg, 0.1 mg, 0.025 mg, 0.0375 mg; *Injectable*: 2.5 mg

Indications: *See under ethinyl estradiol*

Contraindications/Precautions: *See under ethinyl estradiol*

Dosage schedule: Menopausal symptoms, 1-2 mg daily

Patient information: Assess BP before and periodically during therapy. Explain dose schedule and maintenance routine.

Adverse effects: *See under ethinyl estradiol*

ETHINYL ESTRADIOL

Representative estrogen, preparation in widespread use, about twenty times more active than oestradiol following oral administration

Dosage form and strength: *Tablets*: 10 µg, 50 µg

Indications: Female hypogonadism, post-menopausal hormonal replacement therapy, primary ovarian failure, contraception, dysmenorrhea, dysfunctional uterine bleeding, prostate cancer and breast cancer (palliative), acne

Contraindications/Precautions: Avoid in women having estrogen dependent neoplasm, undiagnosed vaginal bleedings, history of the thromboembolic disorder and liver disease, pregnancy, in heavy smokers, active porphyria. Active trophoblastic disease. Maintain caution if history of breast nodules or fibrocystic disease, history of endometrial hyperplasia, family history of breast cancer, obesity (BMI \geq 30 kg/m²), risk of thromboembolism in presence of anti-phospholipid antibodies, cardiovascular disease (especially

with risk of pulmonary hypertension and thromboembolism).

Dosage schedule:

- *Estrogen deficiency*: 10-50 µg daily for 21 days, repeated after 7 days tablet free period, can be followed with combined oestrogen and progesterone therapy;
- *Palliation in prostate cancer*: 0.15 to 1.5 mg daily

Adverse effects: Nausea, vomiting, headache, bloating, breast tenderness, swelling of the ankles/feet, missed/irregular periods, spotting, thromboembolic disorder, photosensitivity.

Drug and food interactions: Risk of endometrial hyperplasia/cancer, breast cancer and thromboembolism could be reduced when combined with progesterone.

Patient information: Advise patient to report signs and symptoms of fluid retention (swelling of ankles and feet), thromboembolic disorders (pain, swelling, tenderness in extremities, headache). Instruct patient to stop taking medication and notify health care professional if pregnancy is suspected.

MESTRANOL

3-methyl ester of ethinyl estradiol, slightly less active than ethinyl estradiol

Dosage form and strength: *Tablets*: 35 µg, 50 µg

Indications: *See under ethinyl estradiol*

Dosage schedule: *Menopausal symptoms*: if uterus intact, 1 tablet daily

Adverse effects: *See under ethinyl estradiol*

12.6 Antiestrogens/Selective estrogen receptor modulators (SERMs)**CHORIONIC GONADOTROPHIN****(Human Chorionic Gonadotrophin; hCG)**

Mimics the action of luteinizing hormone (LH)

Dosage form and strength: *Injection*: 1500 unit and 5000 unit, as powder for reconstitution

Indications: Treatment of infertility in women

Contraindications/Precautions: Androgen dependant tumors. Use cautiously in cardiac or renal impairment, epilepsy, asthma, migraine

Dosage schedule: 5000-10000 units intramuscular injection once 1 day following the last dose of menotropins

Adverse effects: Headache, tiredness, mood changes, multiple pregnancy, gynaecomastia

Patient information: Inform patient that this medication can increase chances of having multiple pregnancy. Instruct patient to report signs and symptoms of ovarian hyperstimulation syndrome: severe pelvic pain, swelling of extremities, dyspnoea.

CLOMIPHENE

Nonsteroidal compound with estrogenic and anti-estrogenic properties. Mechanism in stimulating ovulation-unknown, acts by occupying estrogen

receptors in hypothalamus, interfering with feedback mechanism and increased secretion of LH and FSH resulting into maturation of ovarian follicles and development of corpus luteum

Dosage form and strength: *Tablets:* 25 mg and 50 mg

Indications: Anovulatory infertility in females

Contraindications/Precautions: Ovarian cysts, liver disease or abnormal uterine bleeding, pregnancy. Uterine fibroids, ectopic pregnancy, may cause visual disturbances (avoid performing tasks requiring mental alertness)

Dosage schedule: 50 mg daily for 5 days, starting within about 5 days of onset of menstruation (preferably on 2nd day) or at any time if cycles have ceased; second course of 100 mg daily for 5 days may be given in absence of ovulation; most patients who are going to respond will do so to first course; 3 courses should constitute adequate therapeutic trial, long term cyclical therapy not recommended.

Adverse effects: Ovarian enlargement or cyst formation, vasomotor symptoms such as hot flushes, transient blurring of vision, diplopia, abdominal or pelvic discomfort, nausea, vomiting, heavier menses, breast discomfort, weight gain, endometriosis and headache

Patient information: Instruct patient to take clomiphene exactly as directed at the same time each day. Missed doses should be taken as soon as remembered. Advise patient that conception should be attempted with intercourse every other day starting 48 hr prior to ovulation. Prior to therapy, inform of the potential for multiple pregnancy and even ectopic pregnancy. Instruct to protect from light and to store at a temperature not exceeding 40°.

TAMOXIFEN

See under section 11.3.3, hormone antagonist.

12.7 Progesterone

Derivatives of testosterone or progesterone; modify effects of estrogens and act on tissues sensitised by estrogens, causes further thickening and development of the secretory phase in the endometrium

DYDROGESTERONE

Naturally occurring progesterone analogue

Dosage form and strength: *Tablets:* 5 mg

Indications: See under norethisterone

Contraindications/Precautions: See under norethisterone

Dosage schedule:

- *Endometriosis:* 10 mg 2-3 times daily from 5th to 25th day of cycle or continuously;
- *Dysfunctional uterine bleeding:* 10 mg twice daily (together with an estrogen) for 5-7 days to arrest bleeding, 10 mg twice daily (together with an estrogen) from 11th to 25th day of cycle to prevent bleeding;

- *Dysmenorrhoea*: 10 mg twice daily from 5th to 25th day of cycle;
- *Amenorrhoea*: 10 mg twice daily from 11th to 25th day of cycle with estrogen therapy from 1st to 25th day of cycle;
- *Hormone replacement therapy, with continuous estrogen therapy*: 10 mg daily from 15-28 days of each 28-day hormone replacement therapy (HRT) cycle.

Adverse effects: See under norethisterone

HYDROXYPROGESTERONE

Derivative of progesterone, more potent than progesterone, longer duration of action (7-14 days)

Dosage form and strength: *Injection*: 250 mg and 500 mg

Indications: Secondary amenorrhoea, dysfunctional uterine bleeding, induction of menses.

Contraindications/Precautions: See under norethisterone

Dosage schedule:

- *Amenorrhoea or dysfunctional uterine bleeding*: by intramuscular injection, 375 mg;
- *Induction of menses*: intramuscular injection, 125-250 mg on day 10 of the menstrual cycle

Adverse effects: See under norethisterone

Patient information: Administer intramuscularly only. Advise the patient to protect the drug from light. Inform patient that injection site reactions (pain, swelling, bruising, nodule formation) may occur.

MEDROXYPROGESTERONE

Derivative of progesterone, has less androgenic activity

Dosage form and strength: *Injection*: 150 mg/mL; *Tablet*: 10mg

Indications: Contraceptive (long acting), secondary amenorrhoea, dysfunctional uterine bleeding, mild to moderate endometriosis

Contraindications/Precautions: See under norethisterone

Dosage schedule:

- *For contraception*: deep intramuscular injection 150 mg within first 5 days of cycle or within first 5 days after parturition (delay until 6 weeks after parturition if breast-feeding), for long-term contraception, repeated every 3 months;
- *Dysfunctional uterine bleeding and secondary amenorrhoea*: by mouth, 2.5-10 mg daily for 5-10 days beginning on 16-21 day of cycle, repeated for 2 cycles in dysfunctional uterine bleeding and 3 cycles in secondary amenorrhoea;
- *Mild to moderate endometriosis*: 10 mg 3 times daily for 90 consecutive days, beginning on day 1 of cycle

Adverse effects: See under norethisterone

Patient information: Explain the dose schedule. Instruct the patient to take medication at the same time each day.

NORETHISTERONE

Testosterone derivative, has some androgenic activity, potent oral progestin

Dosage form and strength: *Tablets:* 5 mg

Indications: Dysfunctional uterine bleeding (DUB), contraceptive (in combination with estrogen), endometriosis, premenstrual syndrome, postponement of menstruation or resumption of menstruation in secondary amenorrhoea.

Contraindications/Precautions: Pregnancy, patients with genital or breast cancer, patients with conditions that might be aggravated by fluid retention (cardiac or renal dysfunction, or epilepsy or hypertension), diabetes, impaired liver function. Protect from light

Dosage schedule:

- *Endometriosis:* 10-15 mg daily starting 5th day of cycle for 4-6 months (increased if spotting occurs to 20-25 mg daily, reduced once bleeding has stopped);
- *Postponement of menstruation:* 5 mg 3 times daily starting 3 days before anticipated onset (menstruation occurs 2-3 days after stopping)

Adverse effects: More virilising effects and the greater possibility of liver disturbances and jaundice, urticaria, gastrointestinal disturbances, oedema, weight gain, breast discomfort and irregular menstrual cycles.

12.8 Contraceptives

A method or system which allows intercourse and yet prevents conception is called contraceptive method

COMBINED ORAL CONTRACEPTIVE PILLS (OCs)

(Estrogen and Progestin)

Acts by inhibiting FSH/LH, has anovulatory effect, renders endometrium hypersecretory and makes cervical mucus thick

Dosage form and strength: *Tablets:* Phasic tablets with 21 hormonal pills containing ethinyl estradiol and levonorgestrel (30 µg + 150 µg, 20 µg + 1 mg) or ethinyl estradiol and norethisterone (35 µg + 1 mg) and 7 dummy pills containing iron.

Indications: Temporary contraception

Contraindications/Precautions: Contraindicated in: < 6 weeks postpartum, smoker over the age of 35 (≥15 cigarettes/day), hypertension (systolic ≤160mm Hg or diastolic ≤ 100mmHg), current or past history of venous thromboembolism, ischemic heart disease, history of cerebrovascular accident, complicated valvular heart disease, migraine headache with focal neurological symptoms, breast cancer (current), diabetes with retinopathy/nephropathy/ neuropathy. Use precaution: smoker over the age of 35 (< 15 cigarettes per day), adequately controlled hypertension, hypertension (systolic 140–159mm Hg, diastolic 90–99mm Hg), migraine headache over the age of 35, currently symptomatic gallbladder disease, mild cirrhosis

Dosage schedule: *Temporary contraception:* one tablet daily starting within

0-5 day of menstruation

Adverse effects: Spotting/bleeding (if taken irregularly), nausea, weight gain, mood changes, breast tenderness, headache, increased risk of venous thromboembolism, myocardial infarction, stroke, gallbladder disease, cervical cancer (if taken continuously for > 5yr)

Patient information: Explain the dose schedule. Instruct the patient to take medication at the same time each day. Advise that she may experience minor side effects, most commonly during the first 3 cycles. Cervical and breast screening for long term users.

Missed pill instruction:

- Single missed: to be taken as soon as remembered & to continue that day's dose on usual time.
- If >2 doses are missed, additional contraceptive protection (barrier method) is recommended and begin the new cycle.

MEDROXYPROGESTERONE

Dosage form and strength: *Injection:* vial (2.5 mL), medroxyprogesterone 150 mg/mL

Indications: Temporary contraception, endometriosis, endometrial cancer.

Contraindications/Precautions: *See under medroxyprogesterone*

Dosage schedule: *Injectable:* 150 mg IM progestin every 3 months, start within 5 days of parturition (give injection deep IM in gluteus or deltoid muscle).

LEVONORGESTREL IMPLANT

Dosage form and strength: *Subcutaneous implant capsule:* 216 mg, *Implant:* 75 mg/rod

Indications: Temporary contraception

Contraindications/Precautions: *See under levonorgestrel*

Dosage schedule:

- *Implant subcutaneous:* in the inner side of upper arm on day 5 of menstruation, that lasts for 7 years
- *Temporary contraception:* IUD inserted within day 5-7 of menstrual period, needs to be removed after 3-5 days depending on the formulation

Adverse effects: *See under levonorgestrel*

Patient information: Instruct the patient that it can be used anytime. Instruct the patient that bleeding may be irregular, lighter or heavier or may completely stop.

LEVONORGESTREL

Inhibits LH secretion, can inhibit ovulation in some cases, renders endometrium hostile for implantation, increased uterine/tubal contraction, may dislodge a just implanted blastocyst, may interfere with fertilization/implantation

Dosage form and strength: *Tablets:* 750 mg

Indications: Emergency contraceptive

Contraindications/Precautions: Known or suspected pregnancy, menstrual irregularities

Dosage schedule:

- *Emergency contraceptive:* 1.5 g as a single dose as soon as possible after sex (preferably within 12 hours but not later than after 72 hours), effective if dose is taken within 72 hours of unprotected sex. Hormonal emergency contraception is less effective than insertion of an intra-uterine device

Adverse effects: Nausea, low abdominal pain, headache, dizziness, menstrual irregularities

Patient information: Instruct to report immediately to health care personal if severe abdomen pain for investigation of possibility of ectopic pregnancy.

12.9 Oxytocics

ERGOT ALKALOIDS (Ergometrine, Methyl ergometrine)

Causes non-physiological uterine contraction. Onset of action is within 45-60 sec with ergometrine and 1.5 min with methyl ergometrine. Duration of action is about 3 hrs for both ergometrine and methyl ergometrine.

Dosage form and strength: Ergotmetrine: *Ampoule:* 0.23 and 0.5 mg/ml; *Tablets:* 0.5 mg, 1 mg. Methyl ergometrine: *Ampoule:* 0.2 mg/ml; *Tablets:* 0.5 mg and 1 mg

Indications: Postpartum haemorrhage, post abortion haemorrhage

Contraindications/Precautions: Induction of labour, cardiac disease, eclampsia, multiple pregnancy, Rh-negative mother, pregnancy induced hypertension. Given only after foetal delivery, may decrease milk secretion.

Dosage schedule: *Postpartum haemorrhage:* Methyl ergometrine 0.2 mg or Ergometrine 0.25 mg is given IM or IV, can be repeated every 15 min if required with total 5 doses

Adverse effects: Nausea, vomiting, headache, dizziness, rise in blood pressure, gangrene of toes and bowel infarction in high dose

Patient information: Requires transportation by cold chain & requires refrigeration storage 2-8°C. Needs protection from sunlight.

MIFEPRISTONE

Antagonizes action of progesterone (affects ovulation, renders endometrium hostile, stimulates uterine contractions), causes abortion by dislodging the conceptus; softens cervix to assist surgical abortion

Dosage form and strength: *Tablet:* 200 mg, available in combi-pack of one tablet mifepristone (200 mg) and 4 tablets of misoprostol (200 µg)

Indications: Medical termination of intra-uterine pregnancy up to 63 days gestation.

Contraindications/Precautions: Suspected ectopic pregnancy, uncontrolled severe asthma. Caution in renal impairment, hepatic impairment, breastfeeding, asthma, age over 35 years

Dosage schedule: *Medical termination of intra-uterine pregnancy of up to 63 days gestation:* by mouth mifepristone 200 mg as a single dose, followed

24-48 hours later (unless abortion already complete) by misoprostol 800 µg by per vagina, buccal mucosa or orally and individual observed for at least 6 hours (or until bleeding or pain at acceptable level) with follow-up visit 10-15 days later to verify complete expulsion (if treatment fails, it is essential that pregnancy be terminated by another method).

Adverse effects: Prolongs/disrupts next menstrual cycle, vaginal bleeding (sometimes severe), nausea, vomiting, rash, dizziness, headache

MIFEPRISTONE with MISOPROSTOL

Dosage form and strength: *Tablets (combi-pack):* mifepristone 200 mg (1 tablet) and misoprostol 200 µg (4 tablets)

Indications: Medical termination of pregnancy (up to 9 weeks)

Contraindications/Precautions: *Also see individual drugs.* To be used only after confirming intrauterine pregnancy with approved indication for abortion

Dosage schedule: *Medical termination of intra-uterine pregnancy of up to 63 days gestation:* oral mifepristone 200 mg as a single dose, followed 24-48 hours later (unless abortion already complete) by misoprostol 800 µg by per vagina, buccal mucosa or orally and individual observed for at least 6 hours (or until bleeding or pain at acceptable level) with follow-up visit 10-15 days later to verify complete expulsion (if treatment fails, it is essential that pregnancy be terminated by another method).

Adverse effects: Nausea, vomiting, diarrhoea, abdominal pain, fever more than 24 hr after taking mifepristone may indicate life threatening sepsis.

Patient information: Inform patient of the treatment and its effects. Advise patient that if the treatment fails, there is a risk of fetal malformation; medical abortion failures are managed by surgical termination.

OXYTOCIN

Simulates physiological uterine contraction; has ADH-like actions. Half-life is about 4-5 minutes. Onset of action is 3-5 min for IM and about 1 min for IV. Duration of action lasts about 30-60 min with IM and about 20 min with IV administration.

Dosage form and strength: *Ampoule:* 5 U/ml (synthetic oxytocin)

Indications: Induction of labour, augmentation of labour, active management of third stage of labour, postpartum haemorrhage, uterine inertia

Contraindications/Precautions: Absolute contraindication- Cephalo-pelvic disproportion, malpresentation, placenta previa, obstructed labour. Foetal distress; Uterine hypertonia. Use cautious in grand multipara, heart disease patients, water intoxication and hyponatremia, previous caesarean delivery. Better to avoid IV bolus injection.

Dosage schedule:

• *Induction and augmentation of labour:* 2.5 units in 500ml of Dextrose or N.S. at 10 drops per minute i.e. 2.5mIU/min. Increase the rate by 10 drops per min every 30 min until adequate contraction (≥ 3 contractions each lasting >40 seconds in 10 minutes) is established. Maximum up to 60 drops per minute. Use oxytocin only if cervix has ripened.

• *Active management of third stage of labour:* 10 IU oxytocin IM. Post-partum haemorrhage: IV infusion of 20 units in 1 litre of IV fluids at 40 drops per min as a continuing dose not more than 3ml of IV fluid.

Adverse effects: Uterine hyperstimulation leading to foetal distress and foetal asphyxia, uterine rupture, water intoxication, hypotension, antidiuresis.

Patient information: Advise patient to expect contractions similar or more as menstrual cramps after administration has started.

PROSTAGLANDIN ANALOGUE

(MISOPROSTOL, DINOPROSTONE, DINOPROST/CARBOPROST)

Contracts uterus (pregnant as well as non-pregnant), sensitivity increases near term, increases basal tone as well as amplitude of uterine contractions

Dosage form and strength: Misoprostol: vaginal tablets- 25 µg, oral-200µg; Dinoprostone: gel- 1 mg, 2 mg in 2.5 ml, vaginal tablet- 3 mg, Dinoprost: injection- 5 mg/ml in 4 ml

Indications: Termination of pregnancy; induction of labour (PGE₂ & PGE₁ both) and cervical ripening; active management of third stage of labour; postpartum haemorrhage

Contraindications/Precautions: Hypersensitivity; previous uterine scar; bronchial asthma; active cardiac, pulmonary and renal disease.

Dosage schedule:

- *Induction of labour:* Misoprostol 25-50 µg every 4-6 hourly max 200 µg given per-vaginally, buccal mucosa or orally; Dinoprostone 0.5 mg gel intracervically 2 doses 6 hour apart max 3 doses
- *Postpartum haemorrhage:* Carboprost 0.25 mg IM and can be repeated every 15 min for total 8 doses max up to 2 mg
- *Active management of third stage of labour:* Misoprostol 600 µg oral (only when no access to injectable oxytocin or proper storage facilities e.g. home delivery)

Adverse effects: Nausea, vomiting, fall in blood pressure, tachycardia, chest pain, uterine cramps, fever, rigor, chills, diarrhoea.

12.10 Tocolytics

12.10.1 Calcium channel blockers

NIFEDIPINE

Calcium channel blocker, less effective than uterine sympathomimetics, equally effective to magnesium sulfate

Dosage form and strength: Tablets: 10 mg, 20 mg, 30 mg, 60 mg, 90 mg

Indications: Inhibit uncomplicated premature labour 24-33 weeks gestation

Contraindications/Precautions: Within 1 month of myocardial infarction, cardiogenic shock, unstable or acute attacks of angina. Severe hypotension, diabetes mellitus, breast feeding, heart failure. Sublingual dose/route is not practiced now. Pregnancy category C, lactation information not available

Dosage schedule: Sublingually (immediate-release tablets) 10 mg every 15 minutes if necessary, maximum 40 mg in the first hour then oral (sustained release tablets) 60-160 mg daily in 3-4 divided doses adjusted to uterine activity.

Adverse effects: Tachycardia, flushing, headache, oedema, constipation or diarrhoea, tremor, urticaria.

Patient information: Instruct patient on technique for monitoring pulse; to contact health care professionals if heart rate is <50 bpm. Caution patient to change positions slowly to minimize orthostatic hypotension.

12.10.2 Uterine sympathomimetics

ISOXSUPRINE

β_2 receptor agonist, direct relaxation of vascular and uterine smooth muscle

Dosage form and strength: *Injection:* 5 mg/mL; *Tablets:* 10 mg, 20 mg and 40 mg

Indications: Premature labour

Contraindications/Precautions: Recent arterial haemorrhage, premature detachment of placenta, abruptio placenta. Parenteral administration to patients with heart disease or severe anaemia

Dosage schedule:

- *To arrest premature labour:* by intravenous infusion, 200-300 $\mu\text{g}/\text{minute}$, adjust according to patient's response, until control is achieved.
- *Prophylaxis:* by mouth, 40-80 mg daily.

Monitor BP, pulse; may cause hypotension, tachycardia, tremor.

Adverse effects: Transient flushing, hypotension, tachycardia, rashes, gastro-intestinal disturbances, maternal pulmonary oedema and foetal tachycardia

SALBUTAMOL

Selective β_2 receptor agonist

Dosage form and strength: *Injection:* 50 $\mu\text{g}/\text{ml}$, 500 $\mu\text{g}/\text{ml}$, *Tablet:* 2 mg, 4 mg, 8 mg

Indications: Arrest uncomplicated premature labour 24-33 weeks gestation

Contraindications/Precautions: Avoid prolong therapy, Pregnancy Category (C)

Dosage schedule: *To arrest premature labour (24-33 weeks of gestation):* 10 $\mu\text{g}/\text{min}$ intravenous infusion (20 $\mu\text{g}/\text{ml}$ solution in glucose 5%), increased gradually at 10-minute intervals response is seen, then increase slowly until contractions cease, to maximum of 45 $\mu\text{g}/\text{minute}$. Maintain rate for 1 hour after contractions have stopped, then gradually reduce by 50% every 6 hours, then by mouth 4 mg every 6-8 hours.

TERBUTALINE

Selective β_2 receptor agonist, longer half-life, fewer side effects

Dosage form and strength: *Injection:* 500 $\mu\text{g}/\text{ml}$, *Tablet:* 2.5 mg, 5 mg

Indications: Premature labour

Contraindications/Precautions: Renal disorders, liver diseases, heart diseases, diabetes, epilepsy, hyperthyroidism and hypertension, myocardial insufficiency, history of seizures, heart disease. Pregnancy category B, caution in lactation

Dosage schedule: Continuous intravenous infusion: 10 to 25 µg/min. Therapy should be continued until labour has been arrested. Maximum dose 80 µg/min; then 2.5 to 7.5 mg orally every 6 hours. Therapy should be continued until 36 to 37 weeks gestation.

Adverse effects: Chest pain, arrhythmia, allergic reactions, headache, dry mouth, tremor, insomnia, dizziness, sweating and GI disturbances.

Patient information: Advise patient to notify health care professional immediately if labor resumes or if significant side effects occur.

Section II - Chapter 13

Drugs used as Antidotes & other substances used in Poisoning

13.1 Introduction

13.2 Clues to poisoning

13.3 Risk assessment based approach to poisoning

13.4 Decontamination/Prevention of absorption and active elimination of drugs

13.4.1 Skin decontamination

13.4.2 Gastrointestinal decontamination

13.4.3 Other techniques for enhancing poison elimination

13.5 Symptomatic and supportive treatment

13.6 Common poisons and their management including antidotes

Aluminium phosphide poisoning

Aspirin (salicylate) poisoning

Atropine and belladonna poisoning

Barbiturate poisoning

Benzodiazepine poisoning

Carbamate poisoning

Carbon monoxide poisoning

Chlorinated hydrocarbon insecticide poisoning

Corrosives

Ethylene glycol poisoning

Insect stings

Kerosene poisoning

Methanol poisoning

Morphine and other opioids poisoning

Mushroom poisoning

Organophosphorus insecticides poisoning

Paracetamol poisoning

Tricyclic antidepressants poisoning

Zinc phosphide poisoning

13.1 Introduction

Hospital admission is generally necessary for all patients with features of poisoning.

In most cases the identity of the poison and the consumed dose is often difficult to establish with certainty. However, this might only be of importance in cases of poisoning with a poison that have a specific antidote. Treatment is usually symptomatic and only a few patients require active removal of the drug. However, knowledge of type and timing of poisoning may help anticipate the course of events and hence may direct therapy.

All relevant information should be retrieved from the patients and their guardians, however, these should not be fully relied upon. Patients' reports are generally of little help for they are usually confused and those from parents may also be exaggerative due to anxiety or guilt. So, patient should be assessed carefully and interpretation should be made reasonably.

Risk assessment is pivotal in developing a management plan tailored to the individual patient, however, is secondary only to resuscitation in the management of acute poisoning.

13.2 Clues to poisoning

Pupils:

- *Fixed dilated pupils:* may be a sign of death, but it could also be due to atropine, tricyclic antidepressants, antihistamines, etc. Therefore, even in the presence of acute respiratory or cardiac arrest, resuscitation should be attempted.
- *Pinpoint pupils:* may be a sign of pontine hemorrhage, but consider opioid poisoning, mushroom, organophosphorus insecticide or other cholinergic poisoning.

Respiration: Often impaired in unconscious patients.

Blood pressure: Hypotension is common in severe poisoning with CNS depressants. Hypertension occurs less frequently than hypotension and might be associated with sympathomimetics or CNS stimulating agents.

Heart: Cardiac conduction defects and arrhythmias may occur with acute poisonings with drugs like tricyclic antidepressants, some antipsychotics, some antihistaminics, etc.

Convulsions: A dazed look and oculogyric spasms. Think of phenothiazine overdose (iatrogenic).

Body temperature : Hypothermia may develop in unconscious patients especially with overdose of barbiturates or phenothiazines. Hyperthermia occurs with CNS stimulants.

Patient looks drunk: may be hypoglycemic, but consider all hypnotics, sedatives and antipsychotics.

Metabolic acidosis: may be diabetic or due to severe gastro-enteritis, but do not forget salicylate poisoning.

13.3 Risk assessment based approach to poisoning

• Resuscitation (ABCDE)

- Airway
- Breathing
- Circulation
- Detect and correct
 - Hypoglycemia
 - Check for blood glucose level in patients with altered mental status
 - Treat if level <4.0 mmol/L: 50 ml 50% dextrose IV.
 - Seizures
 - Usually generalized
 - IV benzodiazepines are first-line
 - Barbiturates are second-line therapy
 - Pyridoxine in case of seizures secondary to isoniazid
 - Hyper/hypothermia
- Emergency antidote administration

• Risk assessment

- Agent
- Dose
- Time since ingestion
- Clinical features and course
- Patient factors
 - Weight
 - Co-morbidities

• Supportive care and monitoring

- Initial period of close observation and monitoring in emergency
- Maintain ABC; correct metabolic, fluid and electrolyte imbalances

• Investigations

- Screening-12-lead ECG
- Drug levels in body fluids
- Other selective investigations that will assist risk assessment or management

• Decontamination and enhanced elimination

• Antidotes

• Disposition

13.4 Decontamination/Prevention of absorption and active elimination of drugs

13.4.1 Skin decontamination

Indications:

Poisons that are absorbed via the intact skin, e.g. organophosphorus insecticides. Patient should be stripped of his/her clothes and skin should be washed thoroughly with warm water and soap. Attendants should wear latex gloves.

13.4.2 Gastrointestinal decontamination

GASTRIC LAVAGE

Not a routine practice.

Indications:

- Ingestion of a life-threatening amount of a substance
- Ingestion of a poison within the previous hour
- No other effective means of removal, no availability of specific antidote

Technique:

- Position the patient in left decubitus position
- Use large bore 36-40 G lubricated lavage tube
- Confirm tube position by aspirating gastric contents and auscultating for insufflated air at the stomach
- Administer 200ml aliquot of warm tap water or NS into the stomach and drain it
- Repeat the procedure until effluent is clear
- Once complete, activated charcoal may be administered via the tube.

Contraindications:

- Initial resuscitation incomplete
- Risk assessment indicates good outcome with supportive care and antidote therapy alone
- Unprotected airway
- Decreased level of consciousness; drowsy or comatose patient
- Corrosive or hydrocarbon ingestion

ACTIVATED CHARCOAL

Adsorbs toxic substances or irritants, in gut lumen, thus inhibiting GI absorption

Not a routine practice, however, is usually the preferred method of decontamination. It is indicated when the potential benefits outweigh the risks. The sooner it is given, the better will be the outcome.

Indication:

- Any drug known to absorb it or after unknown ingestions by patients with protected airways
- Dose: 50 g (adults) or 1 g/kg (children)

Cautions:

- Vomiting and aspiration; treat with an anti-emetic
- Used with caution in drowsy or comatose patients and those with reduced gastro-intestinal motility.

Contraindications:

- Initial resuscitation incomplete
- Risk assessment indicates good outcome with supportive care and antidote therapy alone
- Poisoning with corrosives, alcohols, petroleum distillates, malathion, iron and lithium salts, etc.

MULTI-DOSE ACTIVATED CHARCOAL

Indications:

- Ingestion of large doses

- Substances that form bezoars
- Slow release toxins, sustained-release products
- Toxins that slow gut function
- Toxins with enterohepatic circulation
- Useful to enhance the elimination of certain drugs (e.g. theophylline, phenobarbital, carbamazepine, aspirin)
- Repeat dose: 0.25-0.5 g/kg

13.4.3 Other techniques for enhancing poison elimination

Hemodialysis:

For ethylene glycol, lithium, methanol, phenobarbital, salicylates, sodium valproate, etc.

Alkalinization of urine:

For salicylates, barbiturates and other acidic drug toxicity

13.5 Symptomatic and supportive treatment

When the nature of the poison is not known, the treatment is essentially symptomatic as follows:

Respiration

- Airway should be cleared and opened with simple measures like chin lift or jaw thrust.
- If necessary, respiration should be assisted.
- Analeptics should not be used.

Blood pressure

- Hypotension should be corrected by raising the foot of the bed and administration of intravenous fluids.
- Central venous pressure should be carefully monitored when necessary.
- Urine output should be monitored (urinary catheterization done if necessary).
- Vasopressors might be required.

Convulsions

- Convulsions may be controlled by intravenous diazepam or lorazepam.

Pain

- In corrosive poisoning or for burns, pethidine or other analgesic should be given.

Cardiac conduction defects and arrhythmias

- Arrhythmias often respond to correction of underlying hypoxia, acidosis or other biochemical abnormalities.
- Ventricular arrhythmias causing serious hypotension needs prompt treatment with cardioversion.

Fluid and electrolyte balance

- An intravenous drip is always useful, especially if an open route for drug administration is required.
- Hypotonic electrolyte solutions such as half-strength Lactated Ringer's, half-strength Darrow's Solution or Pediatric Electrolyte Mixture are safe.
- Care should be taken not to overload the circulation.

Body temperature

- A low-reading thermometer is essential for detecting hypothermia.
- Hypothermia should be managed by preventing further heat loss and appropriate re-warming as with wrapping, using electric blankets, etc. Hot water bottles have caused burns too often and should be used cautiously.
- Hyperthermia is initially managed by removing unnecessary clothing, using a fan or sponging with tepid water.

13.6 Common poisons and their management including antidotes

ALUMINIUM PHOSPHIDE POISONING

Mechanism of toxicity :

Phosphine gas is released from tablets of aluminium phosphide in presence of atmospheric moisture.

Toxic effects :

- Severe pulmonary irritation and pulmonary edema.
- Hepatic and myocardial injury.
- Breathlessness and cyanosis may develop up to 36 hours after exposure.
- Death may occur.

Management :

Management is usually supportive.

- Oxygen should be given to those who develop pulmonary edema.
- Assisted ventilation may be necessary in the most serious cases.
- Patients should be kept under observation.

ASPIRIN (SALICYLATE) POISONING

Dose related risk assessment :

- <150 mg/kg: Minimal symptoms
- 150-300 mg/kg: Mild to moderate intoxication. Salicylism with tachypnoea, tinnitus, vomiting
- 300-500 mg/kg: Severe intoxication. Metabolic acidosis, altered mental state, seizures
- >500 mg/kg: Potentially lethal

Investigations :

- 12-lead ECG
- Serum electrolytes, blood glucose level
- Arterial blood gas analysis: metabolic acidosis

Management :

- Resuscitation, general supportive care and monitoring
 - Adequate ventilation
 - Control seizures
 - Fluid and electrolyte balance
- Decontamination
 - Activated charcoal in repeated doses (50 g 4 hourly) for overdose of >150 mg/kg.
 - Intravenous sodium bicarbonate may be given to enhance urinary salicylate excretion (optimum urinary pH 7.5 to 8.5).
 - Hemodialysis remains the treatment of choice for severe salicylate poisoning.

- No specific antidote available.

ATROPINE AND BELLADONNA POISONING

Toxic dose :

- The fatal adult dose of Atropine is not known; 200 mg doses have been used and doses as high as 1000 mg have been given so far
- Excitement, hallucinations, delirium and coma with a dose of 10 mg or more
- In children, 10 mg or less may be fatal.

Features :

- Antimuscarinic
 - Dry and flushed skin, dry mucous membrane, dilated pupils, hyperthermia, tachycardia, decreased bowel sounds, ileus, urinary retention, drowsiness, stupor, convulsions, coma

Specific antidote :

- Physostigmine, an anticholinesterase agent. It crosses the blood-brain barrier and therefore, reverses both the central and peripheral action of anticholinergic drugs such as atropine, belladonna, certain antihistaminics and tricyclic antidepressants notably amitriptyline.
- Dose:
 - Adult dose 2 mg I.M. or I.V. or S.C., followed by 1 mg every 20 to 30 minutes until the desired effect is obtained (up to 4 mg).
 - Effect lasts less than an hour; so the dose should be repeated.

BARBITURATE POISONING

Risk assessment

- Ingestion of >8 mg/kg is expected to produce toxic neurological symptoms
- Multiples of this dose is expected to produce profound coma.

Investigations

- Screening 12-lead ECG, blood glucose level
- Serum barbiturate levels
- CNS depression correlates with serum phenobarbitone levels
 - 15-25 mg/L (65-108 micromol/L: usual therapeutic range
 - 30-80 mg/L (108-350 micromol/L: causes increasing sedation
 - >80-100 mg/L (>350 micromol/L: coma requiring intubation
 - >100 mg/L (>430 micromol/L): prompts consideration of hemodialysis

Management

- There are no specific antidotes and hence the management is usually supportive.
- Resuscitation, supportive care and monitoring
 - If the patient is in coma, an intratracheal tube should be inserted to prevent aspiration and to assist ventilation.
 - Blood gases and serum electrolytes should be closely monitored.
- Decontamination
 - Gastric lavage can be done.
 - Multiple dose activated charcoal (MDAC) significantly increases elimination.
 - Hemodialysis is the treatment of choice in severe cases.

BENZODIAZEPINE POISONING

Risk assessment

- Benzodiazepines have a large therapeutic index. Isolated benzodiazepine overdose usually causes only mild sedation, irrespective of dose ingested. Management consists of simple supportive treatment in most cases.
- Co-ingestion of other CNS depressants (e.g. alcohol, opioids) increases the risk of complications, prolonged hospital stay and death.

Management

- Resuscitation, supportive care and monitoring
- Activated charcoal is usually not indicated.
- The specific antidote is flumazenil
 - Dose:
 - Initial dose of 0.1-0.2 mg IV, repeat every minute until reversal of sedation, maximum 2 mg.
 - Resedation normally occurs at around 90 minutes, repeat the dose if required.
 - Contraindications
 - Known seizure disorder, co-ingestion of pro-convulsant drugs, known benzodiazepine dependence, QRS prolongation on ECG.

CARBAMATE POISONING

- Reversible acetylcholinesterase inhibitors used predominately as insecticides and pesticides.
- The carbamate insecticides propoxur (Baygon), aldicarb produce symptoms closely resembling those of organophosphates.

Management

- Skin decontamination
- Gastric lavage if ingestion has occurred within the past hour.
- Antidote: Atropine (see organophosphates)
- Pralidoxime is not recommended for the treatment.

CARBON MONOXIDE POISONING

Risk assessment

- Attempts should be made to identify those at increased risk of long-term neuropsychological sequelae.
- Acute exposure to high concentration CO for short duration: low risk of long-term sequelae
- Exposure to lower concentration CO for longer duration: high risk of long-term sequelae

Investigations

- Screening 12-lead ECG, blood glucose levels
- Carboxyhemoglobin levels: confirms the diagnosis
- Arterial blood gas analysis, serum lactate
- Cranial CT or MRI to demonstrate cerebral pathologies in severe cases

Management

- Immediate treatment is essential.
- Remove from exposure and administer high-flow oxygen 100%.
- Correct acidosis and maintain blood pressure.
- Patient should be admitted because neurological complications may arise

after a delay of hours or days.

- Cerebral edema in severe cases may require IV infusion of mannitol.

CHLORINATED HYDROCARBON INSECTICIDES POISONING

- Includes DDT, BHC (benzene hexachloride), chlordane, aldrin, dieldrin, gamma BHC, heptachlor and many others.

Clinical features

- Features of central nervous system depression, cardiac dysrhythmias or sudden death, features of hepatic or renal damage, aspiration with chemical pneumonitis

Management

- Decontamination
- Remove from exposure, remove clothing, wash skin.
- Gastrointestinal decontamination contraindicated.
- Activated charcoal has no role.
- Avoid milk and oils as these facilitate absorption.
- For convulsions, IV infusion of diazepam.
- Monitor renal and liver functions.

CORROSIVES

Acids (hydrochloric, sulfuric and nitric acid) and Alkalis (ammonia, caustic soda, caustic potash)

Management

- Prehospital management: dilution with water or milk
- Emesis and gastric lavage are contraindicated.
- Maintain airway, assist ventilation if required.
- Analgesics may be given as required.
- Corticosteroids has been suggested to prevent stricture, along with prophylactic antibiotics.
- Oesophagoscopy can be done shortly after admission to determine if burn is present.
- If strictures develop, perform endoscopically guided dilation beginning after week 2.

ETHYLENE GLYCOL POISONING

Risk assessment

- Ingestion of >1ml/kg is potentially lethal
- All deliberate self-poisoning are assumed to be potentially lethal

Clinical features

- Initial clinical features: within first 1-2 hrs
 - Euphoria, nystagmus, drowsiness, nausea, vomiting
- Progressively severe features develop over subsequent 4-12 hrs
 - Dyspnea, tachypnea, tachycardia, hypertension, decreased consciousness progressing to shock, coma, seizures and death
- Flank pain and oliguria suggests acute renal failure
- Late cranial neuropathies may occur up to 5-20 days later.

Investigations

- Serum electrolytes, urea, creatinine, serum lactate, serum osmolality, arterial blood gas analysis

- Anion gap acidosis, hyperlactatemia are markers
- Serum ethylene glycol level

Management

- Resuscitation
 - Supportive management; includes respiratory and circulatory support
 - Correct metabolic acidosis with IV bicarbonate
 - Bolus IV bicarbonate 1-2 mmol/kg
 - Treat seizures with IV benzodiazepines.
 - Detect and correct hypoglycemia, hyperkalemia.
 - Monitor fluid input and output.
 - Hemodialysis is the definitive management
 - Thiamine and pyridoxine
 - Antidotes
1. Ethanol
 - Competitively inhibits metabolism of methanol to its toxic metabolite formic acid.
 - Administered by oral, nasogastric or intravenous route to maintain a blood ethanol concentration of 100-150 mg/dL (22-33 mmol/L)
 - Oral or nasogastric administration
 - Loading dose: 1.8 ml/kg of 43% ethanol, or 4 x 30mL shots of vodka in a 70 kg adult
 - Maintenance: 0.2-0.4 mL/kg/hour of 43% ethanol, or 40 mL shot each hour
 - Intravenous administration
 - Loading dose: 8 mL/kg of 10% ethanol
 - Maintenance infusion rate: 1-2 mL/kg/hour of 10% ethanol
 - The required maintenance dose is extremely variable.
 - The doses outlined above act as a guide only and must be adjusted to maintain blood alcohol concentrations in the desired range
 - Continue maintenance ethanol therapy until the toxic alcohol poisoning has been definitively treated with haemodialysis.
 2. Fomepizole
 - Loading dose: 15 mg/kg in 100 mL of NS or 5% dextrose IV over 30 minutes
 - Maintenance dose: 10 mg/kg in 100 mL of NS or 5% dextrose IV over 30 minutes every 12 hours for 48 hours
 - Note: If administration for >48 hours is required, dosing may need to be adjusted according to ethylene glycol concentrations.
 - Monitoring of fomepizole concentrations is not necessary
 - If haemodialysis is undertaken, fomepizole should be given as a continuous infusion at 1 mg/kg/hour for the entire duration of haemodialysis.

INSECT STINGS

- Stings from ants, bees and wasps
- Seldom cause severe toxicity

Features

- Local pain and swelling.

Management

- Cleansing the area with antiseptics.
- Bee stings should be removed as soon as possible.
- Topical corticosteroids and oral antihistaminics may help alleviate inflammation and the associated symptoms.
- Anaphylactic reactions require treatment with adrenaline.

KEROSENE POISONING

- Gastric lavage is contraindicated.
- Treatment is usually supportive. There is no specific antidote.
- Chest X-ray
- Pulmonary edema if occurs, should be treated with furosemide (25-100 mg IV) and may require ventilatory support.
- Aspiration pneumonia requires antibiotic treatment.

METHANOL POISONING**Risk assessment**

- Ingestion of >0.5 ml/kg is potentially lethal.
- Ingestion of >0.25 ml/kg is potentially toxic requiring specific management.

Clinical features

- Mild CNS depression, nausea, vomiting and abdominal pain within 1 hour of ingestion.
- Following a latent period of 12-24 hours, headache, dizziness, vertigo, dyspnea, blurred vision and photophobia develop.
- Severe intoxication: tachypnoea, drowsiness, and blindness. Progressive obtundation leading to coma and seizures herald the onset of cerebral oedema. Papilloedema is characteristic with progressive demyelination and up to one third of patients suffer irreversible visual complications
- Those who recover from serious CNS toxicity frequently display extrapyramidal movement disorders.

Investigations

- As for ethylene glycol poisoning.
- Serum methanol levels.

Management

- As for ethylene glycol poisoning.
- Antidotes: ethanol and fomepizole (as ethylene glycol)
- If pH <7.30 administer bicarbonate in 50 mmol aliquots to raise the pH above this level.
- Dialysis is recommended if more than 30 ml of pure methanol is ingested.

MORPHINE AND OTHER OPIOIDS POISONING**Risk assessment**

- Life-threatening CNS and respiratory depression frequently occur just above the analgesic dose
- Severe CNS depression with likelihood of fatal outcome without supportive care can occur with:
 - Opioid use by naive patients (no tolerance)
 - Co-ingestion of other CNS depressants (ethanol, benzodiazepines, antidepressants)

- Certain agents have specific risk assessments based on particular toxicities
 - Dextropropoxyphene
 - 10 mg/kg likely to cause symptoms like delirium and seizures
 - 20 mg/kg may cause CNS depression, seizures and cardiac dysrhythmias
 - Tramadol
 - Doses >500 mg may cause seizures in adults. The risk of seizures increases in a dose-dependent fashion and deaths have occurred following ingestion of 3-5 g
 - Implicated in serotonin syndrome
 - Pethidine
 - Repeated therapeutic doses are associated with seizures
 - Implicated in serotonin syndrome

Clinical features

The classical opioid toxidrome consists of triad of CNS depression, respiratory depression and miosis.

Management

- Initial resuscitation and supportive care.
 - Monitor in a facility with full resuscitative care. Carefully monitor respiratory rate, GCS and oxygen saturation.
 - In the rare event of ventricular dysrhythmias in dextropropoxyphene intoxication, resuscitation includes serum alkalinization by the administration of IV bolus sodium bicarbonate.
- Specific antidote: Naloxone, an opioid receptor antagonist
 - Treatment dose is extremely variable and depends on the amount and type of agonist present.
 - Give an initial bolus dose of 100 microgram IV or 400 microgram IM or SC if IV access cannot be established. Larger initial doses may safely be used where the patient is not opioid-dependent.
 - Repeated doses of 100 microgram IV every 30-60 seconds may be given until adequate spontaneous respiration is re-established
 - Duration of treatment is extremely variable and dependent on the absorption and elimination kinetics of the ingested competing agonist. Clinically significant re-sedation is extremely unusual following heroin overdose. However, following overdose with controlled-release morphine tablets or methadone, re-sedation is expected and a naloxone infusion may be necessary.
 - Commence the naloxone infusion rate at 2/3rd of the initial dose required/hour.
 - Monitor the patient for evidence of opioid withdrawal and titrate the infusion according to clinical response.

MUSHROOM POISONING

Mushroom poisonings occur in four settings:

- Inadvertent ingestion of mushrooms by children;
- Foragers looking for a free meal or a delicacy;
- An attempted homicide or suicide;
- Persons seeking hallucinatory effects.

Clinical presentations

- Mushrooms that cause early gastrointestinal symptoms

- Abdominal pain, cramping, diarrhea, and vomiting
- Before 2 hours and most within the first hour after ingestion.
- Management
 - Adequate fluid and electrolyte replacement.
 - Antiemetics e.g. promethazine.
- Mushrooms that cause delayed gastrointestinal symptoms
 - Gastrointestinal symptoms usually begin 5–12 hours after ingestion.
 - Initial: intractable vomiting, watery diarrhea; hypoglycemia
 - Delayed: hepatotoxicity, fulminant hepatic failure and death
 - Management
 - Emesis or gastric lavage if presents early
 - Repeated dose activated charcoal may be beneficial
 - Replace fluid and electrolyte losses
 - Promptly treat hypoglycemia
 - Continued monitoring for hypoglycemia is important as hypoglycemia is a frequent cause of death
 - Monitor liver function
- Mushrooms that cause neurological symptoms
 - Hallucinations: last 2–6 hours, flashbacks
 - Loss of co-ordination, seizures
 - Management
 - Supportive
 - IV benzodiazepines for seizures

ORGANOPHOSPHORUS INSECTICIDE POISONING

Risk assessment

- Deliberate self-poisoning produces life-threatening toxicity
- Onset of clinical manifestation of poisoning may be delayed up to 12 hours with some agents
- Occupational dermal or inhalation exposure can cause toxicity but is rarely life-threatening
- Children: Any ingestion is potentially lethal.

Clinical features

All inhibit cholinesterase and decrease degradation of acetylcholine resulting in symptoms of parasympathetic overactivity. Timing of onset of symptoms depends on the agent, dose and route of exposure.

- *Acute intoxication*
 - Muscarinic effects
 - Diarrhoea, urination, miosis, bronchorrhea, bronchospasm, emesis, lacrimation, salivation - “DUMBBELS”
 - Bradycardia and hypotension
 - Nicotinic effects
 - Fasciculation, tremor, weakness, respiratory muscle paralysis
 - Tachycardia and hypertension
 - Central nervous system
 - Agitation, coma, seizures
 - Respiratory
 - Chemical pneumonitis if hydrocarbon solvent aspirated
- *Intermediate syndrome*

- Delayed paralysis (2-4 days) associated with particular agents (e.g. fenthion, diazinon, malathion).
- *Delayed syndrome*
 - Organophosphate-induced delayed neuropathy (OPIDN) is rare ascending sensorimotor polyneuropathy that occurs 1-5 weeks post-acute exposure to particular agents (e.g. fenthion, chlorpyrifos, parathion).
- *Chronic organophosphate-induced neuropsychiatric disorder*
 - May occur following acute intoxication or chronic low-level exposure.

Specific investigations

- Red cell and plasma cholinesterase levels
 - Red-cell cholinesterase levels correlate better with severity. They return to normal following successful oxime therapy and are used to monitor progress when oximes are withdrawn.

Management

- Resuscitation, supportive care and monitoring.
- Skin decontamination is helpful.
- Activated charcoal usually not beneficial.
- Antidotes:
 1. Atropine
 - 1.8 mg IV and double the dose every 5 minutes until adequate atropinization is achieved (characterized by dry armpit, dilated pupil and clear chest on auscultation, SBP>80 mm Hg and HR>80 bpm)
 - Followed by maintenance dose: 10-20% of dose required for adequate atropinization per hour to be given
 2. Pralidoxime
 - Indicated in all patients with objective evidence of organophosphate intoxication.
 - Not necessary in carbamate intoxication.
 - Administer initial 2 g in 100 ml NS IV over 20 minutes.
 - Then continue an infusion of 0.5 g/hour (6 g in 500 ml NS at 42 ml/hour) for at least 24 hours.
 - If clinical evidence of OP poisoning recurs, infusion is recommended for further 24 hrs.

PARACETAMOL POISONING

Toxic dose:

- Single dose as low as 7.5 g in adults or 150 mg/kg in a child can cause severe hepatocellular necrosis and less frequently renal tubular necrosis.
- Risk of hepatotoxicity is predicted by plotting a serum PCM level in Rumack-Matthew nomogram. Serum paracetamol levels in excess of 200 mg/liter at 4 hours and 25 mg/L at 16 hours post ingestion often results in hepatotoxicity.

Investigations

- Serum paracetamol: not before 4 hours.
- Hepatic transaminases (>1000 IU/L indicates liver damage)
- Coagulation studies
- Renal function and acid-base status
- Urinalysis for hematuria and proteinuria

Management

- Resuscitation, supportive care and monitoring
- Decontamination
 - Activated charcoal may be given if patient presents within the first hour of overdose.
- Antidotes
 - Intravenous N-acetylcysteine (NAC)
 - Decision to administer NAC depends upon the plot of serum PCM level on the nomogram.
 - Dose: IV 150 mg/kg in 200 ml of 5% dextrose over 15 minutes, then 50 mg/kg in 500 ml of 5% dextrose over 4 hours, then 100 mg/kg in 1 liter of 5% dextrose over 16 hours.
 - Adverse effects: rashes and anaphylaxis.

TRICYCLIC ANTIDEPRESSANT POISONING (Amitriptyline, Nortriptyline, Desipramine)

Ingestion of >10 mg/kg is potentially life-threatening. Onset of severe toxicity usually occurs within 2 hours of ingestion. Assessment in hospital is strongly advised.

Dose related risk assessment

- <5 mg/kg: Minimal symptoms
- 5-10 mg/kg: Drowsiness, mild anticholinergic effects
- 10-30 mg/kg: Potential for all major effects within 2-4 hours of ingestion (coma, hypotension, seizures, cardiac dysrhythmias). Anticholinergic effects likely but may be masked by coma
- >30 mg/kg: Severe toxicity with pH dependent cardiotoxicity and coma expected to last >24 hours

Clinical features

- Central nervous system
 - Sedation, delirium, coma, seizures
- Cardiovascular
 - Sinus tachycardia and mild elevation of blood pressure, hypotension due to alpha blocking effects and impaired contractility, broad complex tachyarrhythmias, broad complex bradycardia occurs pre-arrest
- Anticholinergic effects
 - Agitation, restlessness, delirium, myoclonic jerks, mydriasis, tachycardia, urinary retention, ileus
 - Dry, warm, flushed skin

Investigations

- Serial ECGs
 - Vital tool in the management of TCA intoxication
 - Diagnostic features include:
 - Prolongation of PR and QRS intervals
 - Large terminal R wave in aVR
 - Increased R/S ratio (>0.7) in aVR
 - QT prolongation secondary to potassium channel blockade
 - QRS widening reflects degree of fast sodium channel blockade
 - QRS >100 ms is predictive of seizures
 - QRS >160 ms is predictive of ventricular tachycardia

Management

- Close monitoring is mandatory for at least 6 hours. Cardiac monitoring is continued until reversal of toxicity.
- Ventilator support may be required for severe CNS depression.
- Decontamination
 - Activated charcoal not indicated for ingestions <10 mg/kg as a good outcome is expected with supportive care
 - In patients with significant ingestions, activated charcoal is indicated (after securing airway)
- For ventricular dysrhythmias
 - Sodium bicarbonate 100 mEq (2 mEq/kg) IV, repeated every 1-2 minutes until restoration of normal rhythm
 - Maintain a serum pH 7.50-7.55
 - Lignocaine (1.5 mg/kg) IV is second-line therapy when pH is established at >7.5
- Type Ia antiarrhythmic agents (e.g. procainamide), amiodarone and beta-blockers are contraindicated
- Seizures are managed with IV benzodiazepines.
- Hypotension is treated with crystalloid (10-20 ml/kg), sodium bicarbonate 100 mEq (2mEq/kg) and adrenaline or noradrenaline infusion.

ZINC PHOSPHIDE POISONING

- Typical garlic odor
- One of common components of rodenticides
- It reacts with water and hydrochloric acid in the stomach to produce phosphine gas, which produces severe gastro-intestinal irritations, coughing.
- Hepatic necrosis may develop after initial phase.
- Patients should be kept under observation.
- No specific antidotes. Decontamination may help.
- Management is usually supportive.

Section II - Chapter 14

Drugs used in Malignant Diseases

14.1 Cytotoxic drugs

Actinomycin D
Arsenic trioxide
Azathioprine
Calcium folinate (calcium leucovorin)
Capecitabine
Carboplatin
Chlorambucil
Cisplatin
Cyclophosphamide
Cytarabine
Daunorubicin
Docetaxel
Doxorubicin
Epirubicin
Etoposide
Fludarabine
Fluorouracil
Hydroxyurea
Irinotecan
Interferon beta
Interferon gamma-1b
Lomustine
Melphalan
Mercaptopurine (6-mercaptopurine)
Methotrexate
Mitomycin
Mitoxantrone
Oxaliplatin
Paclitaxel
Pemetrexed
Procarbazine
Tacrolimus
Temozolomide
Topotecan
Tretinoin
Vincristine
Vinblastine
Vinorelbine

14.2 Targeted drugs

Bevacizumab
Bortezomib
Cetuximab
Erlotinib

Geftinib
Imatinib
Nilotinib
Osimertinib
Rituximab
Sunitinib
Trastuzumab

14.3 *Hormonal drugs*

Anastrozole
Exemestane
Fulvestrant
Tamoxifen

14.1 Cytotoxic drugs

ACTINOMYCIN D (Dactinomycin)

Dosage form and strength: *Injection:* 0.5 mg

Indications: Wilm's tumor, trophoblastic neoplasms, testicular cancer.

Contraindications/Precautions: Hypersensitivity, active chickenpox or herpes zoster. Vesicant administer slowly by IV push to avoid extravasation, caution in hepatic/renal impairment, elderly, may cause hepatic sinusoidal obstruction syndrome, toxic effects may take 1-2 weeks to reach maximum severity following treatment; discontinue treatment if severe diarrhoea, myelosuppression, or stomatitis occur. Avoid use within 2 weeks of radiation treatment for right-sided tumor (may increase risk of hepatotoxicity). Avoid use of concomitant live virus vaccines. Increased risk of radiation recall skin reaction. If extravasation occurs, it may cause severe soft tissue damage. Contracture of the arms may occur (rare).

Dosage schedule: *Wilm's tumor/Ewing sarcoma:* 15 mcg/kg i.v once a day for five days.

Adverse effects: Fatigue fever, diarrhea, malaise, chills, stomatitis, hypocalcaemia, hyperpigmentation of previously radiated areas, acne, alopecia, pancytopenia, thrombocytopenia, hepatotoxicity, anaphylaxis.

Patient information: Avoid inhalation of vapours or contact with skin mucous membrane or eyes.

ARSENIC TRIOXIDE

Dosage form and strength: *Injection:* 1 mg/ml

Indications: Refractory or relapsed acute promyelocytic leukemia.

Contraindications/Precautions: Hypersensitivity to arsenic. Use caution in hepatic or renal impairment, prolongs QTc interval, risk of APL differentiation syndrome and hyperleukocytosis. Check ECG and RFT (including Mg^{2+}) before therapy. Can cause fetal harm; advise of potential risk to a fetus and use of effective contraception. During therapy, maintain potassium concentrations above 4 mEq/L and magnesium concentrations above 1.8 mg/dL to avoid cardiac conduction abnormalities. A human carcinogen; monitor patients for development of second primary malignancies. Monitor patient's electrolyte, hematologic and coagulation profiles and obtain ECGs. Examine weight for patient regularly.

Dosage schedule: *Newly diagnosed low-risk acute promyelocytic leukemia (APL):* Induction cycle: Arsenic trioxide 0.15 mg/kg IV qDay until bone marrow remission; not to exceed 60 days. Oral Tretinoin 22.5 mg/m² twice daily until bone marrow remission; not to exceed 60 days. Differentiation syndrome prophylaxis consisting of prednisone 0.5 mg/kg daily from day 1 until the end of induction therapy is recommended. Consolidation cycle: Arsenic trioxide 0.15 mg/kg IV daily x Days 1-5 on Weeks 1-4 of an 8-week cycle for a total of 4 cycles in combination with tretinoin. Oral Tretinoin 22.5 mg/m² twice daily x Days 1-7 on Weeks 1, 2, 5, 6; omit tretinoin during weeks 5-6 of the fourth cycle of consolidation.

Adverse effects: Fatigue, pyrexia, headache, abdominal pain, vomiting, tachycardia, diarrhea hyperglycemia, sore throat, prolonged QTc interval,

constipation, chest pain, epistaxis, hypotension, dizziness, hypoxia, ALT increased depression, thrombocytopenia, hyperkalemia, and weight gain. Patient information: Consult the doctor right away if the following effects occur: unusual/unexplained fever, shortness of breath/difficulty breathing, and/or weight. Inform the doctor if you have any medical history of heart problems.

AZATHIOPRINE

Dosage form and strength: *Tablet:* 25 mg and 50 mg; *Injection:* 50 mg

Indications: Refractory rheumatoid arthritis, renal transplants to prevent graft rejection.

Contraindications/Precautions: Breast-feeding, hypersensitivity, hepatic impairment, renal impairment, elderly, pregnancy and breastfeeding. Avoid use of live vaccines. Monitor for toxicity throughout treatment. Monitor complete blood counts frequently. Assess increased temperature, WBC, sputum, urine for infection. Monitor CBC, discontinue if leukocytes are $<3000/\text{mm}^3$ or platelets $<100,000/\text{mm}^3$. Discontinue if signs of hepatotoxicity (dark urine, jaundice, itching, light-coloured stools, increased LFTs) are seen.

Dosage schedule: *Rheumatoid arthritis:* 1 mg/kg/day IV/PO initially in single daily dose or divided q12hr; after 6-8 weeks, increase by 0.5 mg/kg/day every 4 weeks; not to exceed 2.5 mg/kg/day. Maintenance: Reduce daily dose by 0.5 mg/kg every 4 weeks until lowest effective dosage is reached.

Adverse effects: Hepatotoxicity, vomiting, diarrhoea, fever, rash, hypersensitivity reactions include malaise, dizziness, vomiting, diarrhoea, fever, rigors, myalgia, arthralgia, rash, hypotension, and interstitial nephritis; dose-related myelosuppression, liver impairment, cholestatic jaundice; hair loss and increased susceptibility to infections and colitis in patients also receiving corticosteroids, nausea, rarely pancreatitis and pneumonitis, hepatic veno-occlusive disease, herpes zoster infection, secondary malignancy.

Drug and food Interactions: Increased incidence of leukopenia when taken with ACE inhibitors, sulfamethoxazole-trimethoprim. Increased myelosuppression with cyclosporine, mercaptopurine. Decreased immune response of vaccines and toxoids.

Patient information: Report unexplained bruising or bleeding, purpura, fever or sore throat. Avoid crowds and people with infections. Take with food to decrease GI intolerance. Use soft-bristled toothbrush to avoid bleeding.

CALCIUM FOLINATE (CALCIUM LEUCOVORIN)

Dosage form and strength: *Tablet:* 15 mg. *Solution:* 10 mg/ml, 50 mg/5 ml

Indications: Prevention of methotrexate-induced adverse effects, Suspected methotrexate overdosage

Contraindications/Precautions: Avoid in intrathecal injection. Use caution in pernicious anaemia or other megaloblastic anemias caused by vitamin B₁₂ deficiency; Pregnancy, breast feeding: not known to be harmful; benefit outweighs risk.

Dosage schedule:

• *Prevention of methotrexate-induced adverse effects:* intramuscular/

intravenous injection/ intravenous infusion, adult: 15 mg every 6 hours for 24 hours, to be started usually 12–24 hours after start of methotrexate infusion, then oral dose may be continued (consult local treatment protocol for further information)

- *Suspected methotrexate overdose*: intravenous injection/ intravenous infusion, adult: Initial dose equal to or exceeding dose of methotrexate, to be given at a maximum rate of 160 mg/minute (consult poisons information centres for advice on continuing management)

Adverse effects: After high doses: agitation, depression. After parenteral use: pyrexia

Drug and food interaction: Avoid concurrent use with methotrexate

CAPECITABINE

Dosage form and strength: *Tablet/Capsules*: 500 mg.

Indications: Colorectal cancer, breast cancer.

Contraindications/Precautions: Hypersensitivity to capecitabine or FU, DPD deficiency, severe renal impairment. Breastfeeding, children, radiation therapy, anticoagulation. Take with a glass of water within 30 minutes after a meal. Stop the drug in case of grade 2-4 hyperbilirubinemia.

Dosage schedule: *Colorectal cancer*: 1250 mg/m² twice daily for 2 weeks q21 days.

Adverse effects: Diarrhea, hand-foot skin reaction, liver dysfunction, moderately emetogenic.

Drugs and food interaction: Increases bleeding risk with anticoagulants, NSAIDs, salicylates, platelet inhibitor, thrombolytic, phenytoin, aluminium and magnesium containing laxatives.

Patient information: To avoid food with citric acid, hot or rough texture if stomatitis is present. To notify prescriber if pregnancy is planned. To report any sign of infection; increased temperature, sore throat, flu like syndrome. To report immediately if severe diarrhea, vomiting, stomatitis.

CARBOPLATIN

Dosage form and strength: *Lyophilized powder for injection*: 50, 150, 450 mg vials. *Aqueous solution for injection*: 50 mg/5 ml vial, 150 mg/15ml vial, 450 mg/45 ml vial, 600 mg/60 ml vial.

Indications: Initial treatment of advanced ovarian cancer in combination with other agents. Palliative treatment of relapsed ovarian carcinoma if the patient is platinum-sensitive. Germ cell tumours, small and non-small cell lung cancers, bladder cancer, endometrial cancer.

Contraindications/Precautions: Pregnancy, breastfeeding, hypersensitivity, significant bleeding. Geriatric patients, radiation therapy within 1 month, renal diseases and hepatic diseases. To be only used by experienced in the use of chemotherapeutic products, in a specialized care setting. Renal studies during therapy. Hepatic studies before, during therapy as needed or monthly. When carboplatin-paclitaxel regimen is used, carboplatin should be given *after* paclitaxel. Risk of hypersensitivity increases with increasing number of cycles.

Dosage schedule: *Advanced ovarian carcinoma*: Single agent: 360 mg/m²

IV q4Weeks. Combination treatment: 300 mg/m² IV (plus cyclophosphamide 600 mg/m² IV) q4Weeks

Adverse effects: Myelosuppression is significant and dose limiting with thrombocytopenia most common, renal toxicity, peripheral neuropathy, mild elevation of liver enzymes.

Drug and food interaction: Increases nephrotoxicity or ototoxicity with aminoglycosides, amphotericin B increases. Bleeding risk with aspirin, NSAIDs, thrombolytics, anticoagulants, platelet inhibitors.

Patient information: To report ringing/roaring in the ears, numbness, tingling in face, extremities, weight gain. Not to breastfeed during treatment. To avoid over the counter products with aspirin, NSAIDs, alcohol, not to receive vaccinations during treatment.

CHLORAMBUCIL

Dosage form and strength: *Tablet:* 2 mg.

Indications: Waldenstrom macroglobulinaemia, chronic lymphocytic leukemia, some non-Hodgkin lymphomas, Hodgkin disease.

Contraindications/Precautions: Bleeding disorders, pregnancy, gout, radiation and/or cytotoxic therapy within 1 month. Renal impairment, severe hepatic impairment.

Dosage schedule: *Chronic lymphocytic leukemia:* 0.1 mg/kg/day for 3-6 weeks or 0.4 mg/kg (increased by 0.1 mg/kg/dose until response/toxicity observed) biweekly or 0.4 mg/kg (increased by 0.1 mg/kg/dose until response observed) monthly or 0.03-0.1 mg/kg/day continuously. Reduce initial dose if administered within 4 weeks after a full course of radiation/myelosuppressive therapy or patients with bone marrow disease. Not to exceed 0.1 mg/kg/day if bone marrow infiltrated with lymphocytes

Adverse effects: Bone marrow suppression, rashes, may develop to Steven-Johnson syndrome, nausea, vomiting, hyperuricemia (avoid concomitant use with allopurinol or colchicines) stomach upset, diarrhoea, easy bleeding.

Drug and food interactions: Interaction with nalidixic acid

Patient's information: Avoid contact with people who have infections that may spread to others (such as chickenpox, measles, and flu). To lower the chance of getting cut, bruised, or injured, use caution with sharp objects like razors and nail cutters, and avoid activities such as contact sports. Consult your doctor if you are pregnant or plan to become pregnant.

CISPLATIN

Dosage form and strength: *Injection:* 1 mg/ml.

Indications: Metastatic testicular tumor, ovarian carcinoma, advanced bladder cancer and cancer of cervix, endometrium, prostate and oesophagus.

Contraindications/Precautions: Hypersensitivity to platinum compounds, severe myelosuppression, renal impairment, hearing impairment, pregnancy, lactation. Avoid aluminium needles/equipments, paediatric patient, hearing impairment, neuromuscular disease.

Dosage schedule: *Metastatic testicular tumors:* Usual dose in combination with other approved chemotherapeutic agents is 20 mg/m²/day IV for 5 days/cycle. Pretreatment hydration: 1-2 L fluid infused for 8-12 hr before dose

Adverse effects: Nausea, vomiting, nephrotoxicity, ototoxicity, myelosuppression, anaphylaxis, alopecia.

CYCLOPHOSPHAMIDE

Dosage form and strength: *Tablets:* 25 mg, 50 mg; *Injections:* 500 mg, 1 g, 2 g.

Indications: Chronic lymphatic leukaemia, non-Hodgkin's lymphoma, ovarian carcinoma, breast carcinoma, Hodgkin's diseases, mycosis fungoides, neuroblastoma, sarcomas.

Contraindications/Precautions: Bone marrow depression, hypersensitivity. Fetal harm when administered to a pregnant woman. Advised to avoid pregnancy. Radiation therapy, cardiac disease, anaemia, dental disease, geriatric patients. Monitor temperature every 4 hr; elevated temperature may indicate beginning infection. Pulmonary function tests, chest x-ray films before, during therapy; chest film should be obtained every 2 weeks during treatment. Bone marrow depression; CBC, differential, platelet, count baseline, weekly; Hepatotoxicity; Hepatic studies before, during therapy (bilirubin, AST, ALT, LDH) as needed; jaundice of skin, sclera.

Dosage schedule:

- *Daily IV injection:* 3-6 mg/kg body weight (120-240 mg/m²) twice weekly. Massive intermittent therapy: 20-40 mg/kg body weight (800-1600 mg/m²) in divided doses over a period of 2-5 days with therapy free intervals of 10-20 days.
- *Massive intermittent therapy:* 10-15 mg/kg body weight (400-600 mg/m²) with therapy free intervals of 7-10 days. Oral dose: 1-5 mg/kg/day for both initials and maintenance therapy.

Adverse effects: Myocardial fibrosis, myelosuppression, nausea, vomiting, diarrhoea, hemorrhagic cystitis, alopecia, sterility, secondary malignancies, SIADH.

Drug and food interactions: Digoxin: Cyclophosphamide decreases levels of digoxin by inhibiting gastrointestinal absorption. Anticoagulants: Increases the effects of them by unknown mechanism also increases the potential thrombocytopenic effect. CYP 450 inducers (rifampicin, phenobarbitone): Increases the toxic effect of cyclophosphamide. Allopurinol: There may be an increase in bone marrow depression.

Patient information: To take adequate fluids (2-3 L/d) to reduce the risk of hemorrhagic cystitis. To report any changes in breathing or coughing. To avoid foods with citric acid, hot and spices. To report signs of infection and anemia.

CYTARABINE

Dosage form and strength: *Injection* 100, 500 mg 2 g; *suspension gel, liposomal for intrathecal use* 100 mg/ml.

Indications: Acute myelocytic leukemia (AML), acute non lymphocytic leukemia, chronic myelocytic leukemia, lymphomatous meningitis.

Contraindications/Precautions: Pregnancy, hypersensitivity. Breastfeeding, children, renal/hepatic disease, tumors lysis syndrome, infection, hyperkalemia, hyperphostemia, hyperuricemia. Administer allopurinol

to maintain uric acid level and alkalinisation of the urine and administer antiemetic 30-60 min before giving this.

Dosage schedule:

- *AML*: Adults; Cont i.v infusion 100 mg/m²/day for 7 days every 2 weeks as single agents.
- *Meningeal leukemia*: Adult/child; intrathecal 5-70 mg/m² variable daily for 4 days to every 2-7 days.

Adverse effects: Myelosuppression manifested by leukopenia, thrombocytopenia and anaemia, nausea and vomiting, anorexia, diarrhoea, fever, rash and alopecia.

Drugs and food interaction: Do not use with live virus vaccine .Do not use within 24 hr of chemotherapy; increase toxicity with immune suppressants, methotrexates, radiation .Increase bleeding risk with anticoagulants, platelets inhibitor.

Patient information: To report any coughing, chest pain changes in breathing; may indicate beginning of pneumonia, pulmonary oedema. To report any sign of infection; increased temperature, sore throat, flulike symptoms. To report bleeding. To avoid use of razors.

DAUNORUBICIN

Dosage form and strength: *Injection*: 20 mg vial.

Indications: Combined with other anti-neoplastic drugs in acute leukemia.

Contraindications/Precautions: Pregnancy and breastfeeding, CHF, arrhythmia. Active infections, chronic illness, elderly, reduced bone marrow suppression, may reactivate skin lesions by previous radiation therapy, hepatic or renal impairment. Irritant to tissues. Assess for bleeding and monitor for bone marrow suppression; apply pressure at venipuncture sites for 10 minutes. Assess signs for infection (neutropenia), anemia. Assess for cardiotoxicity which manifests as Congestive Heart Failure, which occurs 1-6 months after therapy. Chest X-ray, echocardiography, ECGs and ejection fraction should be ordered before and periodically throughout therapy.

Dosage schedule:

- *Acute nonlymphocytic leukemia*: In combination with cytarabine 100 mg/m²/day IV for 7 days first course, for 5 days subsequent courses ; <60 years old: 45 mg/m² IVP days 1, 2, 3 first course; days 1, 2 subsequent courses; >60 years old; 30 mg/m² IVP days 1, 2, 3 first course; days 1, 2 subsequent courses.
- *Acute lymphocytic leukemia*: 45 mg/m² IVP days 1, 2, 3.

Adverse effects: Rhinitis, nausea, vomiting, red urine, alopecia, anemia, leukopenia, thrombocytopenia, phlebitis, esophagitis, arrhythmia, hyperuricemia, irreversible gonadal suppression.

Drug and Food Interactions: Increased risk of myelosuppression with other antineoplastics, immunosuppressants or radiation therapy. Increased adverse effects with live vaccines.

Patient information: Notify if irregular heartbeat, shortness of breath or swelling of lower extremities occur. Inspect oral mucosa for erythema and ulceration. If ulceration occurs, brush and rinse after eating and drinking. Consult health professional if severe. Hair loss (Alopecia).Urine may be

reddish for 1-2 days after administration. Inform health professional if fever, sore throat, gum bleeding or other signs of infection occurs. Avoid crowds or other persons with infection. Do not drink alcoholic beverages and be careful while taking aspirin. Notify if pain or irritation occurs at injection site and if extravasation occurs.

DOCETAXEL

Dosage form and strength: *Injection:* 20 mg, 80 mg, and 120 mg.

Indications: Breast cancer, non small cell lung cancer metastatic prostate cancer, squamous cell carcinoma of head and neck, gastric cancer, bladder cancer.

Contraindications/Precautions: Pregnancy, breastfeeding, hypersensitivity. Children, cardiovascular disease, pulmonary disorders, bone marrow depression, pleural effusion. Closely monitor LFT and CBC. Should receive steroid premedication. Monitor weight, I/O chart monitoring and peripheral edema daily to evaluate for fluid retention syndrome.

Dosage schedule: For breast cancer; adult: Intra venous 60 -100 mg/m² given over 1 hr in every 3 weeks; if neutrophil count is < 500 cells/mm³ for > 1 week, reduce dose by 25%.

Adverse effects: Seizures, myocardial infarction, sinus tachycardia, hepato-toxicity, neutropenia, leucopenia, thrombocytopenia, anemia, myelosuppression, alopecia, Steven Johnson syndrome, pulmonary fibrosis, embolism, hypersensitivity reactions (common in first two cycles).

Drug and food interaction: Cytochrome P450 CYP3A4 inhibitors/activators. Patient information: To report signs of infection ; fever , sore throat, flu like symptoms or anemia like fatigue, headache, faintness, shortness of breath , irritability or bleeding. To use barrier contraception during and for several month after treatment, pregnancy; to avoid breast feeding.

DOXORUBICIN

Dosage form and strength: *Injection:* 10 mg vial.

Indication: Acute leukemia, carcinoma of the breast, bladder, stomach, ovary and thyroid, neuroblastoma, wilm's tumor, non-Hodgkin's and Hodgkin's lymphoma, soft tissue sarcoma, neuroblastoma, osteosarcoma, non small cell lung cancer, small cell lung cancer.

Contraindications/Precautions: Pregnancy, breast-feeding, cardiac disorders. hepatic impairment, cardiac disease, electrolyte imbalance, infection, hyperuricemia. Avoid sun exposure and wear sun protection. Rapid injection can cause facial flushing or erythema along the vein. Care should be taken during extravasation. Perform complete blood count every week. Reduce dose if WBC count is <1500/mm³ or platelet count is <50,000/mm. Monitor ECG, watch for ST-T wave changes, low QRS and T wave.

Dosage schedule: 60-75 mg/m² of body surface.

Adverse effects: Nausea and vomiting, myelosuppression, alopecia, cardiomyopathy, cardiac arrhythmias, acute left ventricular failure facial flushes, hepatotoxicity, thrombocytopenia, leukopenia, anaemia, hyperpigmentation, red discoloration of urine. Cardiotoxicity can be reduced with dexrazoxane.

Drug and food interactions: Precipitates with dexamethasone, 5-FU and heparin. So, avoid concomitant use. Increase QT prolongation with other drugs that cause QT prolongation. Increases neutropenia, thrombocytopenia with progesterone. Increased cardiomyopathy with calcium channel blockers. Increased toxicity with other anti-neoplastics. Increased risk of cystitis and cardiac toxicity with cyclophosphamide.

Patient's information: There may be hair loss. Report any bleeding, white spots, ulceration in mouth Avoid pregnancy, avoid crowds and persons with infections when granulocyte count is low.

EPIRUBICIN

Dosage form and strength: *Injection:* 10 mg, 50 mg vial.

Indications: Adjuvant therapy for breast cancer with axillary node involvement after resection; bladder, gastric, lung, ovarian, lung.

Contraindications/Precautions: Pregnancy and breast-feeding, heart failure, recent MI, cardiomyopathy, anthracyclines. Children, elderly cardiac/renal/hepatic disease, angina, herpes, hyperkalemia, hypertension, hyperkalemia, hypertension, hyperphosphatemia, hyperuricemia, hypocalcaemia, infection, infertility, ventricular dysfunction. Perform Complete Blood Count every week and withhold product if neutrophil count $<1500/\text{mm}^3$. Nadir occurs after 10-14 days and recovers by day 21. Do not use intramuscular or subcutaneous because of severe tissue necrosis. If extravasation occurs, stop and complete through another vein. Rapid injection can cause facial flushing or erythema, avoid administration time of <3 minutes. Monitor cardiac function at baseline and periodically thereafter.

Dosage schedule: *Adjuvant breast cancer treatment:* Day 1 dose schedule; Day 1: Epirubicin $100 \text{ mg}/\text{m}^2$ IV, AND 5-fluorouracil $500 \text{ mg}/\text{m}^2$ IV, AND cyclophosphamide $500 \text{ mg}/\text{m}^2$ IV. Repeat q21Days x 6 cycles

Adverse effects: Severe hepatic disease, bone marrow depression, heart failure, extravasation, secondary malignancy, bradycardia, extrasystoles, cardiomyopathy, tumor lysis syndrome, infection, nausea, vomiting, amenorrhea, alopecia.

Drug and food Interactions: Increased toxicity with other antineoplastics, radiation, cimetidine. Increased risk of ventricular dysfunction, CHF with Trastuzumab. Increased risk of heart failure with calcium channel blockers. Don't use heparin and cimetidine concomitantly. Perform complete blood count every week and withhold product if neutrophil count $<1500/\text{mm}^3$. Nadir occurs after 10-14 days and recovers by day 21. Do not use Intramuscular or subcutaneous because of severe tissue necrosis. If extravasation occurs stop and complete through another vein. Rapid injection can cause facial flushing or erythema, avoid administration time of <3 minutes. Monitor cardiac function at baseline and periodically thereafter.

Patient information: Red-orange urine.

ETOPOSIDE

Dosage form and strength: *Capsule* 50 mg; *Injectable solution:* 20mg/ml; *Powder for injection:* 100 mg

Indications: Germ cell tumors, small cell carcinoma of lungs, Non Hodgkin

lymphoma, acute non-lymphocytic leukemia, kaposi sarcoma associated with AIDS.

Contraindications/Precautions: Hypersensitivity to the drug, pregnancy (teratogenic in animal studies), lactation. Infection, decreased bone marrow reserve, renal and hepatic impairment. In patients with advanced liver disease and low serum albumin or elevated bilirubin plasma level of drug may be increased precipitating toxicity. Administer the drug over 30-60 minutes to reduce the risk of hypotension.

Dosage and schedule:

- *Testicular neoplasms:* IV (Adults) dosage ranges from 50-100 mg/m² daily for 5 days to 100 mg/m² on days 1, 3 and 5; repeat at 3-4 weeks interval.
- *Small cell carcinoma of lungs:* oral dosage range from 70 mg/m² daily for 4 days to 100 mg/m² daily for 5 days; repeat at 3-4 weeks intervals. IV dosage range from 35 mg/m² daily for 4 days to 50 mg/m² daily for 5 days, repeat at 3-4 weeks intervals.

Adverse drug reactions: Myelosuppression, nausea, vomiting, anorexia, stomatitis, diarrhoea, alopecia, fever, anaphylaxis, secondary malignancies.

Drug and food interactions: Bone marrow depression may occur with other antineoplastic drugs and radiation therapy thus causing toxicity. May alter immune response to live virus vaccine.

FLUDARABINE

Dosage form and strength: *Injection:* 100 mg.

Indications: Chronic lymphocytic leukemia, non Hodgkin lymphoma.

Contraindications: Pregnancy, breastfeeding, hypersensitivity, decreased kidney functions.

Dosage schedule: Adult-IV 25 mg/ml over 30 min for 5 days.

Adverse effects: Central nervous system toxicity, angina pectoris, infection, pneumonia, upper respiratory tract infection, urinary tract infection, asthenia, cough, diarrhea, dyspnea, edema, fatigue, fever, gastrointestinal hemorrhage, myalgia, nausea, pain, paresthesia, skin rash, visual disturbance, vomiting, anorexia, chills, and diaphoresis.

FLUOROURACIL

Dosage form and strength: *Capsule:* 250 mg; *Injection:* 50 mg/ml.

Indications: Used alone or in combination with other modalities (radiation therapy, surgery) in treatment of colorectal cancer, upper GI neoplasms, breast cancer, pancreatic cancer, head and neck cancer.

Contraindications/Precautions: Bone marrow suppression, active ischemic heart disease, hypersensitivity to drug, pregnancy and lactation. It is cautiously used in infections, depressed bone marrow, patients with oedema, ascites.

Dosage schedule: Oral, maintenance 15 mg/kg weekly; maximum in one day 1 g.

Adverse effects: Anorexia, nausea, stomatitis, diarrhoea, mucosal ulcers, myelosuppression, thrombocytopenia, anemia, alopecia, dermatitis, atrophy of skin, hand foot syndrome consisting of erythema, desquamation, pain, and sensitivity to touch of palm and soles, myelopathy.

Drug and food interactions: Combination therapy with irinotecan may produce unacceptable toxicity (desquamation, sepsis.). Additive bone marrow depression with other bone marrow depressants, including anti-neoplastic and radiation therapy. May decrease antibody response to live viral vaccines and increase risk of toxicity.

HYDROXYUREA

Dosage form and strength: *Capsules:* 200, 300, 400, 500 mg.

Indications: Melanoma, chronic myelogenous leukaemia, recurrent or metastatic ovarian cancer, squamous cell carcinoma of head and neck, sickle cell anaemia.

Contraindications/Precautions: Leukopenia ($<2500/\text{mm}^3$), thrombocytopenia ($100,000/\text{mm}^3$), monitor CBC weekly. Renal disease (severe), anaemia, bone marrow suppression, dental disease geriatric patients, HIV, hyperuricemia. Hydroxyurea may cause severe myelosuppression; do not administer if bone marrow function is markedly depressed; monitor blood counts at baseline and throughout treatment. Interrupt treatment and reduce dose as necessary in patients receiving long-term hydroxyurea for myeloproliferative disorders, such as polycythemia vera and thrombocythemia, secondary leukemias have been reported. It is unknown whether this leukemogenic effect is secondary to hydroxyurea or is associated with the patients' underlying disease

Dosage schedule:

- *Ovarian cancer, malignant melanoma:* Adult; oral 80 mg/kg as a single dose every 3 days or 20- 30 mg/day as a single dose daily. Ovarian cancer in combination with radiation: Adults; oral 80 mg/day as a single dose every 3 days.
- *Chronic myelogenous leukemia/ acute myelogenous leukemia:* Adults; oral WBC $> 100,000/\text{mm}^3$, 50- 75 mg/kg/day; WBC $< 100,000/\text{mm}^3$, 10-30 mg/kg/day; adjust for WBC. Child; 10- 20 mg/kg/day, adjust to hematologic response.

Adverse effects: Seizures, stomatitis, constipation, hepatotoxicity, increased BUN, uric acid, leukopenia, anaemia, thrombocytopenia, megaloblastic erythropoiesis, secondary cancers, tumor lysis syndrome.

Drugs and food interaction: Hydroxyurea increases risk of pancreatitis/hepatotoxicity if taken with with didanosine, stavudine. Bleeding risks is increased with NSAIDs, anticoagulants, thrombolytics, salicylates. Probenecid, sulfipyrazone increase uric acid level if taken with hydroxyurea. Patient information: Report signs of infection; elevated temperature, sore throat, flu like symptom. Report signs of anaemia: fatigue, headache, faintness. Report bleedings; avoid use of razors, commercial mouthwash. Patients should notify prescriber if pregnancy is planned or suspected.

IRINOTECAN

Dosage form and strength: *Injection:* 40 mg, 100 mg.

Indications: Metastatic colorectal carcinoma, epithelial lung cancers.

Contraindications/Precautions: Hypersensitivity, pregnancy, lactation. Previous pelvic or abdominal irradiation or age >65 years (there is increased

risk of myelosuppression) active infections, underlying bone marrow depression, concurrent chronic illness, old age, paediatric and geriatric patients. Potentially life threatening diarrhoea may occur more than 24 hours after a dose and may be accompanied by severe dehydration and electrolyte disturbances.

Dosage schedule: IV (adults) weekly dosage schedule- 125 mg/m² once weekly for 4 weeks followed by 2 weeks rest period .Once every 3 week schedule- 350 mg/m² every 3 week.

Adverse effects: Nausea and vomiting, myelosuppression, dizziness, headache, coughing, dyspnea, diarrhoea, abdominal pain, cramps, dyspepsia, stomatitis, colonic ulcerations, rashes, alopecia, pancytopenia

Drug and food interactions: Inhibitors of CYP 3A4 increase toxicity of Irinotecan. Combinations with fluorouracil may result in serious toxicity (dehydration, neutropenia, sepsis). Increased bone marrow suppression when used along with other antineoplastics and radiation therapy. Concurrent use of diuretics may increase risk of dehydration.

Patient information: Report occurrence of diarrhoea immediately especially if it occurs 24 hours after drug administration.

INTERFERON BETA

Dosage form and strength: *Lyophilized powder for injection: 0.3mg/vial*

Indications: For relapsing, remitting multiple sclerosis (characterised by at least two attacks of neurological dysfunction over the previous 2 or 3 years, followed by complete or incomplete recovery) who are able to walk unaided, For a single demyelinating event with an active inflammatory process (if severe enough to require intravenous corticosteroid and patient at high risk of developing multiple sclerosis): subcutaneous injection, adult:

Contraindications/Precautions: Avoid in decompensated liver disease, severe depressive illness. Use caution in history of cardiac disorders, history of depressive disorders (avoid in severe depression or in those with suicidal ideation), history of seizures, history of severe myelosuppression. Effective contraception required during treatment. Monitor for signs of hepatic injury, thrombotic microangiopathy (TMA), thrombocytopenia, new onset hypertension, fever, central nervous system symptoms (e.g. confusion and paresis), nephrotic syndrome and impaired renal function. Caution in severe hepatic impairment. and renal impairment. Pregnancy (C). Breast feeding: avoid

Dosage schedule: *Relapsing/remitting multiple sclerosis, exacerbations:* subcutaneous, adult: 0.0625 mg every other day initially. Gradually increase over 6 week to 0.25 mg (8 million U; 1 mL) every other day. May increase by 0.0625 mg 2week

Adverse effects: Alopecia, anaphylaxis, blood disorders, chills, confusion, convulsions, fever, hepatitis, hypersensitivity reactions, influenza-like symptoms (decreasing over time), irritation at injection site (including inflammation, hypersensitivity, necrosis), malaise, menstrual disorders, mood and personality changes, myalgia, nausea, nephrotic syndrome, suicide attempts, thrombotic microangiopathy, thyroid dysfunction, urticaria, vomiting

INTERFERON GAMMA-1B

Dosage form and strength: *Injectable solution:* 100 mcg/0.5mL (single-dose vial). 50mcg = 1 million units/m²

Indications: To reduce the frequency of serious infection in chronic granulomatous disease/ severe malignant osteoporosis

Contraindications/Precautions: Avoid in hypersensitivity to interferon gamma or E. coli-derived products. Use caution in arrhythmias, cardiac disease, congestive heart failure, ischemia, seizure disorders (including seizures associated with fever), immunocompromised patients, potential for hepatotoxicity. Reduce dose or discontinue if decreased mental status, gait disturbance, dizziness occur. Monitor CBC, urinalysis, renal function and liver function every 3 month. Pregnancy (C). Use effective contraception required during treatment

Dosage schedule:

- *To reduce the frequency of serious infection in chronic granulomatous disease:* subcutaneous injection, adult: 50 mcg/m² 3 times a week
- *To reduce the frequency of serious infection in severe malignant osteoporosis:* subcutaneous injection, adult: 50 mcg/m² 3 times a week

Adverse effects: Abdominal pain, arthralgia, chills, depression, diarrhoea, fatigue, fever, headache, injection-site reactions, myalgia, nausea, rash, vomiting, flu-like symptoms, confusion, systemic lupus erythematosus, neutropenia, proteinuria, raised liver enzymes, thrombocytopenia

Drug and food interaction: Avoid simultaneous administration of foreign proteins including immunological products (risk of exaggerated immune response)

LOMUSTINE

Dosage form and strength: *Capsule:* 10 mg

Indications: Brain tumors and lymphomas.

Contraindications/Precautions: Hypersensitivity, myelosuppression, hepatotoxicity. Avoid pregnancy. Take the medicine on an empty stomach. Avoid alcohol.

Dosage schedule: Used alone, 120-130 mg/m² body surface every 6-8 weeks.

Adverse effects: Permanent bone marrow damage with prolonged use, nausea, vomiting

Drug and food interactions: Cimetidine increases its toxicity.

MELPHALAN

Dosage form and strength: *Tablets:* 2 mg and 5 mg; *Injection:* 50 mg

Indications: Multiple myeloma, advanced ovarian adenocarcinoma, advanced breast cancer.

Contraindications/Precautions: Abnormal renal function.

Dosage schedule: Advanced breast cancer, oral 150 micrograms/kg daily for 5-6 days, repeated every 6 weeks.

Adverse effects: Marrow toxicity, hepatitis, thrombocytopenia, pulmonary fibrosis, secondary malignancies.

Drug and food interactions: Should be taken on an empty stomach.

Patient information: Usually sterility, amenorrhea occur, reversible after

discontinuing treatment. Avoid use of aspirin products, alcohol, NSAIDS.

MERCAPTOPURINE (6-MERCAPTOPURINE)

Dosage form and strength: *Tablet:* 50 mg. *Suspension:* 20 mg per 1 ml

Indications: Severe acute Crohn's disease, maintenance of remission of Crohn's disease, ulcerative colitis, acute leukaemias, chronic myeloid leukaemia

Contraindications/Precautions: Avoid in absent thiopurine methyltransferase activity. Use caution in reduced thiopurine methyltransferase activity. Hepatic and renal impairment: reduce dose. Pregnancy (X) Breast feeding: Avoid. Consider measuring thiopurine methyltransferase (TPMT) activity before starting the therapy. Monitor liver function, Complete blood count.

Dosage schedule:

- *Severe acute Crohn's disease/maintenance of remission of Crohn's disease/ulcerative colitis:* oral, adult: 1-1.5 mg/kg daily, some patients may respond to lower doses
- *Acute leukemias/chronic myeloid leukaemia:* oral (tablet), adult: Initially 2.5 mg/kg daily, adjusted according to response) alternatively initially 50-75 mg/m² daily (adjusted according to response). OR, oral (suspension), adult: Initially 25-75 mg/m² daily, (adjusted according to response)

Adverse effects: Pancreatitis, transient oligospermia, intestinal ulceration, lymphoma, alopecia, anorexia, bone-marrow suppression, hepatotoxicity, hyperuricaemia, nausea, oral mucositis, thromboembolism, tumour lysis syndrome, vomiting

Drug and food interaction: Avoid use with febuxostat

METHOTREXATE

Dosage form and strength: *Tablet:* 2.5 mg; *Injection:* 50 mg vial.

Indications: Neoplasms (acute lymphoblastic leukemia), gestational trophoblastic neoplasm, CNS lymphoma, osteogenic sarcoma, carcinoma breast, lung, head and neck) Immunosuppression for suppression of graft vs host reaction, organ transplantation, dermatomyositis, granulomatosis, crohn's disease.

Contraindications/Precautions: Pregnancy, breastfeeding. renal insufficiency, pleural effusion, ascites. Consider the conditions where drug excretion is decreased and titrate dose as per the conditions to prevent potential nephrotoxicity.

Dosage schedule: Oral, leukemia in children (maintenance) 15 mg/m² weekly in combination with other drugs.

Adverse effects: Bone marrow suppression, mucositis, renal toxicity, dermatitis, alopecia, interstitial pneumonitis, nephrotoxicity, defective spermatogenesis or oogenesis, abortion, teratogenic, increase in hepatic enzymes.

Drug and food interactions: Sulfonamides, salicylates, tetracyclines, chloramphenicol, and phenytoin can displace it from plasma albumin and precipitate toxicity. NSAIDs, nephrotoxic drugs (cisplatin), weak organic acids (piperacillin), delay drug excretion and leads to myelosuppression. PPIs increase toxicity of this drug.

Patient information: Stop folic acid supplementation while on methotrexate.

MITOMYCIN

Dosage form and strength: *Injections:* 2 mg and 10 mg.

Indications: Upper gastro-intestinal and breast cancers, superficial bladder cancer

Contraindications/Precautions: Safe use of drug in pregnancy and breast-feeding has not been established. Abnormal liver function.

Dosage schedule: By intravenous infusion usually at 6-weekly.

Adverse effects: Myelosuppression manifested by thrombocytopenia and leucopenia, nausea and vomiting, mouth ulcers, alopecia, pain on injection, thrombophlebitis, renal toxicity and lung fibrosis. It causes delayed bone-marrow toxicity and therefore usually administered at 6-weekly intervals.

Patient information: To report signs of IV site reaction, redness, inflammation, burning pain. To report fever, flu-like symptoms, sore throat. To immediately report urine retention, absence of urine, dyspnea, bleeding, jaundice, signs of pulmonary toxicity. To report if pregnancy is planned or suspected; pregnancy 1st trimester, don't breastfeed.

MITOXANTRONE

Dosage form and strength: *Injections:* 2 mg/ml, 10 mg/ml, 12.5 mg/ml, and 15 mg/ml.

Indications: Acute myelogenous leukemia (adult), relapsed leukemia; used with steroids to treat bone pain (advanced prostate cancer), multiple sclerosis.

Contraindications/Precautions: Pregnancy, hypersensitivity, breastfeeding children, myelosuppression, renal/cardiac/hepatic disease, gout.

Dosage schedule:

- *Secondary progressive multiple sclerosis:* 12 mg/m² short IV (5-15 minutes) infusion q3Months. Not to exceed lifetime cumulative dose of 140 mg/m².
- *Acute nonlymphocytic leukemia:* Induction; 12 mg/m²/day IV on days 1-3 with cytarabine 100 mg/m²/day IV continuous infusion on days 1-7. Second induction with same doses of mitoxantrone for 2 days & cytarabine for 5 days may be given if incomplete antileukemic response & no severe nonhematologic toxicity in first induction. Consolidation: 12mg/m²/day for 2 days, repeat in 4 weeks.
- *Prostate cancer:* 12-14 mg/m² q21Days every 3 weeks in combination with corticosteroids

Adverse effects: Myelosuppression, nausea and vomiting, mucositis and diarrhea, cardiotoxicity, alopecia, secondary AML.

OXALIPLATIN

Dosage form and strength: *Injections:* 50 mg, 100 mg, 200 mg vial.

Indication: Colorectal carcinoma, gastro-oesophageal, lung, pancreatic cancers.

Contraindication/Precautions: Hypersensitivity, pregnancy (risks are unknown). Elderly, grade 2/3 neuropathy, renal impairment. Administer drug under supervision of specialist. In case of anaphylactic like reaction, treat

with epinephrine, corticosteroids or antihistamines. Avoid exposure to cold following drug administration, which can trigger or worsen neurotoxicity.

Dosage schedule:

- *Colon carcinoma:* Day 1 oxaliplatin 85 mg/m² IV+ leucovorin 200 mg/m² IV for 2 hr; then 5-FU 400mg/m² IV bolus 2-4 minute; then 5-FU 400mg/m² IV over 22 hour. Day 2: Repeat without oxaliplatin. Repeat every 2 weeks.
- *Adjuvant treatment in stage 3 colon Ca:* 12 cycles every 2 week as per schedule above for 6 months after surgical resection

Adverse effects: Acute and chronic neurotoxicity (risk increases upon exposure to cold, nausea and vomiting, diarrhoea, myelosuppression, allergic reactions, hepatotoxicity).

Drug and food interactions: Bacitracin- increased nephrotoxicity and ototoxicity. Drug is unstable in presence of chloride or alkaline solution.

Patient instruction: Monitor temperature; may indicate beginning infection. Bleeding, alopecia, edema may occur and report accordingly. Blankets, hat, gloves for cold prevention.

PACLITAXEL

Dosage form and strength: *Injections:* 30 mg, 60 mg, 100 mg.

Indication: Ovarian cancer, breast cancer, NSCLC, SCLC, head and neck cancer, esophageal ca, prostate cancer, bladder cancer, AIDS related kaposi sarcoma.

Contraindications/Precautions: Anaphylaxis, hypersensitivity, pregnancy. Abnormal liver function, prior history of diabetes mellitus or neuropathy, ischemic heart disease. Give premedication to prevent the incidence of hypersensitivity reaction. Don't give in patient with solid tumor who have baseline neutrophil <1500 cells/mm³ and not to AIDS related Kaposi Sarcoma if neutrophil <1000 cells/mm³

Dosage schedule:

- *Previously untreated ovarian Ca:* 175 mg/m² over 3 hour every 3 week followed by Cisplatin.
- *Previously treated ovarian Ca:* 175 mg/m² over 3 hour every 3 week.
- Similar doses apply to breast cancer, non small cell lung cancer, AIDS related kaposi Sarcoma.

Adverse effects: Myelosuppression, hypersensitivity reaction, neurotoxicity, nausea and vomiting, myalgia alopecia, mucositis.

Drug and food interactions: Inducers or inhibitors of P450 CYP3A4 may affect paclitaxel metabolism. Quinidine, Amiodarone, Atorvastatin increases paclitaxel effect and toxicity.

Patient information: Report signs of infection: fever, sore throat, flulike symptoms, anemia, bleeding. Avoid use of aspirin, ibuprofen. Hair may be lost during treatment. Pain in muscles and joints 2-5 days after infusion is common.

PEMETREXED

Dosage form and strength: *Injection:* 500 mg vial.

Indications: Malignant pleural mesotheliomas, NSCLC.

Contraindication/Precautions/Warnings: NSAIDS (renal toxicity),

pregnancy. Decrease dose with decrease in creatinine clearance, renal impairment. Premedication regimen: Folic acid, vitamin B₁₂, dexamethasone. 350 mcg/d of folic acid beginning 7 days prior to initiation and 1000 mcg of vit B₁₂ IM every 3 cycles. Monitor CBC, RFT, LFT

Dosage schedule:

- *Malignant pleural mesothelioma*: Combination use with cisplatin- 500 mg/m² IV over 10 minute on Day 1 of each 21 day cycle; with cisplatin 175 mg/m² IV over 2 hour 30 minute after end of pemetrexed infusion.
- *Non-squamous small cell carcinoma*: single agent use; 500 mg/m² IV infusion over 10 minute on day 1 of each 21 day cycle. Combination with cisplatin: 500 mg/m² IV over 10 minutes.

Adverse effects: Alopecia, dermatitis, interstitial pneumonitis, severe myelosuppression, nausea, fatigue, constipation, chest pain.

Drug and food interaction: Aspirin: increased level, action and toxicity. Bacitracin: increased nephron/oto toxicity. Diclofenac: increased level, toxicity, myelosuppression.

PROCARBAZINE

Dosage form and strength: *Capsule*: 50 mg

Indications: Hodgkin's disease, non-Hodgkin's lymphomas, brain tumors.

Contraindications/Precautions: Pregnancy and breast feeding. liver or renal impairment.

Dosage schedule: Used alone. Initially, 50 mg daily, increased by 50 mg daily to 250-300 mg daily in divided doses; maintenance (on remission) 50-150 mg daily to cumulative total of at least 6 g.

Adverse effects: Myelosuppression, severe nausea and vomiting, CNS toxicity, hypersensitivity reactions, neuropathies, mental depression, ascites, edema and cough.

Drug and food interactions: Use of alcohol may result into disulfiram like reaction. Hypertensive crisis with tyramine foods. Concurrent use with antihistamines can result in respiratory depression. Can potentiate the hypoglycemic effects of sulfonylureas and insulin.

Patient information: To avoid sunlight or UV exposure. To wear protective clothing and sunscreen. To report any bleeding, white spots, ulceration in mouth to prescriber. To avoid driving, activities requiring alertness because dizziness may occur. To use effective contraception, to avoid breastfeeding; that product may cause infertility.

TACROLIMUS

Also see section under 16.5 Inflammatory skin infections in Drugs Used in Skin Conditions, Chapter 16

Dosage form and strength: *Capsule*: 0.5 mg, 1 mg, 5 mg

Indications: Prophylaxis of graft rejection following kidney transplantation

Contraindications/Precautions: Use only with transplant specialist prescription. Increase risk of infection and lymphoma. Use caution in. close monitoring of serum drug concentration as per protocol. Severe hepatic impairment: reduce dose. Pregnancy (C). Breast feeding: avoid. Efficacy and safety of the drug has not been established in children

Dosage schedule: *Prophylaxis of graft rejection following kidney transplantation, used concomitantly with azathioprine and/or mycophenolate mofetil and corticosteroid:* oral, adult: Initially 200–300 mcg/kg daily in 2 divided doses

Adverse effects: Acne, alopecia, anemia, anorexia, anxiety, arthralgia, ascites, bile-duct abnormalities, bloating, blood disorders, cholestasis, confusion, constipation, depression, diarrhoea, dizziness, dyspepsia, dyspnoea, electrolyte disturbances, flatulence, gastro-intestinal inflammation, gastrointestinal perforation, gastro-intestinal ulceration, haemorrhage, headache, hepatic dysfunction, hyperglycemia, hyperkalaemia, hypertension, hyperuricaemia, hypokalaemia hypophosphatemia, hypomagnesemia, impaired hearing, ischaemic events, jaundice, leucopenia, mood changes, muscle cramp, nausea, nephrotoxicity, oedema, pancytopenia, paraesthesia, parenchymal lung disorders, peripheral neuropathy, photophobia, pleural effusion, psychosis, renal failure, renal impairment, renal tubular necrosis, seizures, sleep disturbances, sweating, tachycardia, thrombocytopenia, thromboembolic events, tinnitus, tremor, urinary abnormalities, visual disturbances, vomiting, weight changes

Drug and food interaction: Avoid with amphotericin B, cidofovir, oral neomycin. Avoid in hypersensitivity with castor oil. Use caution with nephrotoxic drugs, calcium channel blockers. Adjust dose when used with CYP3A enzyme inducer or inhibitor

TEMOZOLOMIDE

Dosage form and strength: *Tablet or capsule:* 20 mg, 100 mg, and 250 mg.

Indications: Anaplastic astrocytoma with relapse, glioblastoma multiforme, malignant glioma, metastatic melanoma.

Contraindications/Precautions: Pregnancy, breastfeeding, hypersensitivity to its products, carbazine or gelatine. Geriatric patients, radiation therapy, renal/hepatic disease, bone marrow suppression, infection, myelosuppression. Assess tumor response during treatment. Assess CBC on day 22 (21 days after 1st dose), CBC weekly until recovery if $ANC < 1.5 \times 10^9$. Assess hepatic studies before, during therapy (bilirubin, AST, ALT, LDH). Avoid sun exposure. Should get PCP prophylaxis when temozolomide is used with radiotherapy.

Dosage schedule: *Anaplastic astrocytoma:* Initial 150 mg/m² PO/IV qDay for 5 days; repeat at 28-day cycles. Maintenance: May increase/maintain dose at 200 mg/m² PO/IV qDay for 5 days/28-day cycle if $ANC > 1500 \text{ mm}^3$ and platelets $> 100,000 \text{ mm}^3$. Infuse IV over 90 minutes.

Adverse effects: Seizures, thrombocytopenia, leucopenia, anemia myelosuppression, neutropenia, rash, pruritus, anaphylaxis, secondary malignancy, nausea and vomiting, fatigue, photosensitivity.

Drug and food interaction: Don't use within 24 hr of sargramostin, filgrastin, G-CSF, NSAIDs, anticoagulant, platelet inhibitors, thrombolytics, digoxin, live vaccines, toxoids.

Patient information: Report sign of infection: fever, sore throat, flu like symptoms. Report signs of anemia: fatigue, headache, faintness, SOB, irritability. Report bleeding; avoid use of razors, commercial mouthwash. Don't breastfeed.

TOPOTECAN

Dose form and strength: *Injections:* 2.5 mg, 4 mg.

Indications: Ovarian cancer that has spread to other parts of the body. Small cell lung cancer that has come back or spread. Cervical cancer that has come back after radiotherapy or has spread.

Contraindications/Precautions: Pregnancy, breastfeeding, hypersensitivity, severe bone marrow suppression. Children, renal disease, gelatin hypersensitivity. Avoid use of live vaccines. Dose of topotecan should be reduced to 0.75 mg/m² per day in patients with moderate renal dysfunction. Topotecan should not be administered to patient with severe renal impairment.

Dosage schedule:

- *Cervical cancer:* Indicated for combination therapy with cisplatin for stage IV-B, recurrent or persistent cervical carcinoma which cannot be treated with surgery and/or radiation therapy; 0.75 mg/m² IV infused over 30 min on Days 1,2, & 3 (with cisplatin 50 mg/m² on Day 1); repeat at 21-day cycles.
- *Ovarian cancer:* Indicated for metastatic ovarian cancer after failure of initial or subsequent chemotherapy; 1.5mg/m² IV qDay x5 days; repeat at 21-day cycles .

Adverse effects: Myelosuppression, hair loss and thinning, diarrhea, elevated liver transaminase, nausea and vomiting ,mouth sores, fatigue .

Drugs and food interactions: Avoid use with P-glycoprotein, breast cancer resistance protein inhibitors (amiodarone, clarithromycin, diltiazem, erythromycin, indinavir), quinidine, testosterone, verapamil, tamoxifen, cisplatin, NSAIDS, anticoagulants, thrombolytics, platelet inhibitors.

Patient information: Try to avoid crowds or people with colds and those not feeling well. Report fever or any other signs of infections. Drinking alcoholic beverages should be kept to minimum or avoid completely.

TRETINOIN

Dosage form and strength: *Tablet or Capsule:* 10 mg.

Indications: Acute promyelocytic leukemia

Contraindications/Precautions: Pregnancy, hypersensitivity to retinoids or sensitivity to parabens, breastfeeding. Assess hepatic function, coagulation, hematologic parameters, also cholesterol and triglycerides.

Dosage schedule: *Acute promyelocytic leukemia:* Remission Induction;45 mg/m²/day PO divided q12hr, discontinue 30 days after complete remission or 90 days after start of treatment (whichever comes first). Remission Induction in combination with an Anthracycline;45 mg/m²/day PO divided q12hr , discontinue 30 days after complete remission or 90 days after start of treatment (whichever comes first)

Adverse effects: Headache, fever, sweating, cardiac arrhythmia, nausea, vomiting, hemorrhage, dyspepsia, retinoic acid syndrome.

Drug and food interactions: Ketoconazole, tetracyclines, aminocaproic acid, aprotinin, tranexamic acid.

Patient information: Notify prescriber if pregnancy is planned or suspected. Don't crush, chew or dissolve capsule while oral intake.

VINCRISTINE

Dosage form and strength: *Solution for injection:* 1 mg/ml in 1ml, 2 ml and 5 ml vial. To be stored at a temperature of 2-8°.

Indications: Acute leukemia, for combination therapy of variety of cancers

Contraindications/Precautions: Avoid in Charcot-marie- tooth syndrome use caution during intrathecal administration, may be fatal. Use caution in bone marrow depression, neuropathy, neuromuscular disease, pulmonary disease, hepatic impairment. Pregnancy (D). Breast feeding: Avoid

Dosage schedule:

- *Acute leukemia:* intravenous, adult: 1.4 mg every week. intravenous, child: 2 mg/m² every week. <10 kg: 0.05 mg.kg.dose every week, >10 kg: 1.5-2 mg/m²/dose
- *For combination therapy of variety of cancers including leukemias, lymphomas, and some solid tumors (e.g. breast and lung cancer):* (consult local protocol)

Adverse effects: Alopecia, peripheral neuropathy, paresthesia, sensory loss, acute uric acid nephropathy, loss of deep tendon reflexes, hypertension, hypotension, nausea, vomiting, constipation, paralytic ileus, myelosuppression, leukopenia, gait change, jaw pain, amenorrhea.

Drug and food interaction: Use caution when administering neurotoxic agents, ototoxic agents concomitantly

VINBLASTINE

Dosage form and strength: *Solution for injection:* 1 mg/ml in 10mg/10ml vials

Indications: For combination therapy of variety of cancers

Contraindications/Precautions: Avoid in hypersensitivity, active bacterial infection, myelosuppression. avoid in intrathecal (it) administration. Use caution in pulmonary disease, liver impairment, intestinal obstruction, paralytic ileus, previous radiation treatment or chemotherapy. Monitor CBC, liver function. Hepatic impairment: bilirubin 1.5-3 mg/dl or AST 60-180 units: Administer 50% of the regular dose. bilirubin 3-5 mg/dl: Administer 25% of the regular dose. bilirubin >5 mg/dl or AST >180 units: Avoid. Pregnancy (D). Breast feeding: avoid

Dosage schedule:

- *For combination therapy of variety of cancers (including squamous ca of head and neck, Kaposi's sarcoma, histiocytic lymphoma, mycosis fungoides, histiocytosis X):* Intravenous (over 1 minute), adult: initially 3.7 mg/m²/day then increase dosing by 1.85 mg/m² every week until WBC equal to 3000/mm³. Dose range 5.5-7.4 mg/m². Maximum dose: 18.5 mg/m²
- *Hodgkin's Lymphoma :* intravenous (over 1 minute), adult: 6 mg/m² every 2 week; part of combination treatment
- *Testicular Cancer:* intravenous (over 1 minute), adult: 6 mg/m²/day for 2 days every 3-4 week; part of combination treatment
- *Bladder Cancer:* intravenous (over 1 minute), adult: 3 mg/m² every 7d for 3 out of 4week; part of combination treatment

Adverse effects: Anemia, leukopenia, myelosuppression, alopecia, peripheral neuropathy, hypertension, bronchospasm, nausea, vomiting,

anorexia, diarrhea, constipation, paralytic ileus. Risk of jaw pain, aspermia, amenorrhea. jaw/parotid pain, hoarseness & dysphagia due to cranial neuropathy

Drug and food interaction: Use caution when administering neurotoxic agents, ototoxic agents concomitantly

VINOURELBINE

Dosage form and strength: *Injections:* 10 mg, 50 mg.

Indications: Non small cell lung carcinoma, Hodgkin's disease, breast/ovarian/head and neck cancer, desmoid tumour.

Contraindications/Precautions: Pregnancy, breastfeeding, infants, hypersensitivity, granulocyte count <1000 cells/mm³ pretreatment. Children, geriatric patients, renal/hepatic/pulmonary/neurologic disease, anemia, bone marrow suppression. Assess BP during administration. Assess hepatic function test: AST, ALT, bilirubin, LDH.

Dosage schedule: *Non-small cell lung carcinoma:* Monotherapy; 30 mg/m² IV over 6-10 minutes qWeek . Combo Therapy; 25 mg/m² IV qWeek with IV cisplatin 100 mg/m² q4Weeks OR 30 mg/m² IV qWeek with cisplatin 120 mg/m² on Days 1 & 29 & then q6Weeks.

Adverse effects: Myelosuppression, paresthesias, seizures, hepatotoxicity, GI obstruction/perforation, neutropenia, anemia, thrombocytopenia, granulocytopenia, rash, alopecia, dyspnea, pulmonary edema, acute bronchospasm, acute respiratory distress syndrome.

Drug and food interaction: NSAIDs, aprepitant, clarithromycin, danazol, diltiazem, erythromycin, fluconazole, barbiturates, carbamazepine, rifampin. Patient information: Report change in gait or numbness in extremities, continuing constipation. Examine mouth daily for bleeding, white spots, ulcerations. Report sore throat, fever, flu like symptoms. Avoid crowds, people with infections, vaccinations, OTC products.

14.2 Targeted drugs

BEVACIZUMAB

Dosage form and strength: *Injections:* 100 mg, 400 mg.

Indication: Metastatic colorectal cancer, non small cell lung cancer, renal Cell carcinoma, cervical cancer.

Contraindication/Precautions: Serious bleeding, hypertensive crisis, recent surgery. Severe or fatal hemorrhage, hemoptysis, gastrointestinal bleeding, CNS hemorrhage, and vaginal bleeding are increased in bevacizumab-treated patients. Gastrointestinal (GI) perforation, fistula formation, and/or intra-abdominal abscess unrelated to therapy duration reported in patients with colorectal cancer as well as other types of cancers, hypertension, proteinuria. Discontinue therapy in patients with wound dehiscence requiring medical intervention. Discontinue therapy permanently in patients with GI perforation.

Dosage schedule: Indicated for first-line and second-line treatment for metastatic colorectal carcinoma (in combination with 5-fluorouracil-based chemotherapy)

• *Fluorouracil based chemotherapy*: 5-10 mg/kg IV every 2 weeks

• *Non-small cell lung cancer*: 15 mg/kg IV every 3 weeks

Adverse effects: Hypertension, abdominal pain, proteinuria, epistaxis, ovarian failure, diarrhoea, alopecia, GI hemorrhage dyspepsia, taste alteration, dry skin, exfoliative dermatitis, fatigue, flatulence, hypokalemia skin discoloration, thromboembolic events, myalgia, hypotension .

BORTEZOMIB

Dosage form and strength: *Injection*: 2 mg, 3.5 mg/vial.

Indications: Mantle cell lymphoma, multiple myeloma.

Contraindications/Precautions: Hypersensitivity to any component or boron or mannitol; intrathecal administration. Fatal events with inadvertent intrathecal administration reported .Use caution in hepatic impairment, diabetes mellitus, high tumor load (risk of tumor lysis syndromes), severe lung disease, acute diffuse infiltrative pulmonary disease, hypotension syncope history, dehydration. Monitor complete blood counts regularly throughout treatment and closely monitor patients with high tumor burden. Monitor hepatic enzymes during treatment .Use subcutaneous route to reduce the risk of neuropathy.

Dosage schedule: Mantle cell lymphoma : *Previously untreated MCL*: 1.3 mg/m²/dose IV twice weekly for 2 weeks (days 1, 4, 8, 11) followed by a 10-day rest period (days 12 to 21) for six 3-week cycles; may continue for 8 cycles if response is first seen at cycle 6. Give with rituximab 375 mg/m² IV, cyclophosphamide 750 mg/m² IV, and doxorubicin 50 mg/m² IV on day 1, plus prednisone 100 mg/m² IV on days 1-5. *Relapsed MCL*: 1.3 mg/m²/dose IV/SC twice weekly for 2 weeks (days 1, 4, 8, 11) followed by a 10-day rest period (days 12 to 21). Therapy extending beyond 8 cycles: give standard schedule.

Adverse effects: Nausea, diarrhoea, anorexia, constipation, thrombocytopenia, pyrexia, vomiting, anemia, arthralgia, headache, insomnia, limb pain ,dizziness, dyspnea, edema, neutropenia, paresthesia, rash, cough, dehydration.

Drugs and food interaction: Green tea and supplements block the efficacy of bortezomib and should be avoided.

CETUXIMAB

Dosage form and strength: *Injections*: 100 mg, 500 mg.

Indications: Used in RAS-wild metastatic colorectal carcinoma, head and neck cancer.

Contraindications/Precautions: Hypersensitivity to this product. Pregnancy, breastfeeding, children, geriatric patients, cardiovascular/renal/hepatic disease, ocular, pulmonary disorders. RAS-testing is mandatory before using this drug in metastatic colorectal cancer-use only if RAS mutations are absent. Also, don't use in adjuvant setting, use only in metastatic setting.

Dosage schedule: *Colorectal cancer*: Initial dose: 400 mg/m² IV infuse over 2 hr. Subsequent doses: 250 mg/m² IV infuse over 60 min qWeek (not to exceed an infusion rate of 10 mg/min) until disease progression or unacceptable toxicity. Complete cetuximab administration 1 hr prior to

FOLFIRI. Not to exceed infusion rate of 10 mg/min

Adverse effects: Rashes, infusion reactions, hypocalcemia, hypomagnesemia, interstitial lung disease, asthenia.

Patient information: To report adverse reactions immediately; shortness of breath, severe abdominal pain, skin eruptions. To use contraception during treatment, not to breastfed.

ERLOTINIB

Dosage form and strength: *Tablet or capsule:* 100 mg, 150 mg.

Indications: EGFR mutant non small cell lung cancer.

Contraindications/Precautions: Pregnancy, breast feeding, children, geriatric patients, ocular/pulmonary/renal/hepatic disorders, bradycardia, heart failure, hypokalemia. EGFR mutation on exons 19 and 21 should be done in adenocarcinoma of lung (squamous are usually negative) and erlotinib used only if EGFR positive.

Dosage schedule: EGFR mutant non small cell lung cancer; Adult ;oral 150 mg/day.

Adverse effects: Pruritus, dry skin, diarrhoea, interstitial pneumonitis, increased serum transaminases, anorexia.

Drug and food interactions: Avoid grapefruit and grapefruit juice. Inhibitors of CYP3A4 increase drug levels and may increase toxicity.

Patient information: To report severe diarrhoea, CNS effects. To report overgrowth of infection, black, furry tongue, vaginal bleeding, foul smelling stools.

GEFITINIB

Dosage forms and strength: *Tablet:* 250 mg.

Indications: Same as erlotinib.

Contraindications/Precautions: Hypersensitivity to the drug, pregnancy, lactation. Idiopathic pulmonary fibrosis, concurrent use of strong inhibitors of CYP3A4 enzyme system. Therapy can be interrupted for about 14 days in patients with poorly tolerated diarrhoea with dehydrations or severe rashes or other changes .Liver function tests should be monitored periodically. Monitor for change in prothrombin time and INR in patients taking warfarin.

Dosage schedule: Oral, 250 mg once a day.

Adverse effects: Skin rashes, diarrhoea, nausea, anorexia, itching, mouth ulcerations, conjunctivitis, corneal erosion, ulcer, hepatotoxicity.

Drug and food interactions: Strong inducers of CYP3A4 enzyme system like rifampin and phenytoin decrease blood level and thus decrease therapeutic effects of Gefitinib. Strong inhibitors of CYP3A4 like itraconazole and ketoconazole increase level and potentiate toxicity. Drugs that increase gastric P^H like ranitidine may decrease absorption. Monitor for change in prothrombin time and INR in patients taking warfarin.

Patient information: Consult health professional if severe persistent diarrhoea, nausea, vomiting or anorexia occurs and if pregnancy is planned or suspected.

IMATINIB

Dosage form and strength: Tablets: 100 mg, 400 mg.

Indications: Newly diagnosed Philadelphia +ve (Ph+) chronic myeloid leukemia (CML), CML in blast crisis, accelerated phase, or in chronic phase after failure of Interferon alpha treatment, Kit(CD117) positive Gastrointestinal stromal tumors (GIST), metastatic/ unresectable malignant GIST, myelodysplastic, myeloproliferative disease, dermatofibrosarcoma protuberans.

Contraindications/Precautions: Hypersensitivity, pregnancy, breastfeeding, hepatic impairment, cardiac disease (severe congestive heart failure and left ventricular dysfunction may occur), should be cautiously used in pediatric and geriatric population. Monitor liver function before and by monthly during treatment or when clinically indicated. Monitor CBC before and during therapy. General fluid retention may occur and is more common in blast crisis and elderly patients. So diuretics and other supportive therapy may be required.

Dosage schedule:

- *Chronic myeloid leukemia (CML):* oral (adults); chronic phase- 400 mg once daily, may be increased to 600 mg once daily; accelerated phase or blast crisis- 600 mg once daily; may be increased up to 800 mg/day on twice daily basis. Oral (children);
- *Newly diagnosed Ph+ve CML:* 340 mg/m²/day; CML recurrent after failure of bone marrow transplant or resistance to Interferon alpha- 260 mg/m²/day. GIST: oral (adults); metastatic or unresectable-400 mg/day; may be increased up to 400 mg twice daily if well tolerated and response is insufficient.
- *Ph(+) Acute lymphoblastic leukemia:* oral(adults); 600 mg/day. Myelodysplastic/ Myeloproliferativedisease: oral (adults); 400 mg/day.
- *Dermatofibrosarcoma protuberans:* oral (adults); 800 mg/day.

Adverse effects: Fatigue, headache, weakness, cough, dyspnea, epistaxis, nasopharyngitis, pneumonia, abdominal pain, anorexia, dyspepsia, diarrhoea, hepatotoxicity, skin rashes, edema, bleeding, neutropenia , thrombocytopenia, arthralgia, muscle cramps.

Drug and food interactions: CYP3A4 inhibitors like itraconazole, ketoconazole, clarithromycin, ritonavir, when concurrently used can increase blood levels of Imatinib and precipitate its toxicity. Efficacy is decreased by concurrent use of CYP3A4 inducers like dexamethasone, phenytoin, rifampin, phenobarbital.

Patient information: Take with food and large glass of water to decrease the risk of GI irritation. Avoid use of grape fruit juice.

NILOTINIB

Dose form: Capsules: 150 mg, 200 mg.

Indication: Imatinib resistant or newly diagnosed Chronic myelogenous leukemia, GI stromal tumors.

Contraindications/Precautions: Hypokalemia, hypomagnesemia, patients with QT prolongation. Never administer before correcting hypokalemia, hypomagnesemia, patients with hepatic impairment, myelosuppressive disorders, pancreatitis, total gastrectomy. Monitor Mg⁺⁺ and K⁺ level before

administration and periodically. Decrease dose in patient with hepatic impairment.

Dosage schedule:

- *New CML*: 300 mg oral BD
- *Resistant/Intolerant*: 400 mg BD

Adverse effects: Abdominal pain, vomiting, QT prolongation, CHF, pleural effusion, hepatic impairment rashes, neutropenia.

Drug and food interaction: Strong CYP3A4 inhibitors shouldn't be concomitantly used. If must, decrease the dose by 100 mg. Food interferes with absorption of drug.

Patient information: Take on empty stomach at least 1 hour before or 2 hours after meal.

OSIMERTINIB

Dosage form and strength: *Tablets*: 40 mg, 80 mg

Indications: Non small cell lung carcinoma-adenocarcinoma with EGFR mutation both first line or second line after progression on erlotinib/gefitinib/afatinib due to T790M mutation.

Contraindications/Precautions: Interstitial lung disease, pneumonitis, cardiomyopathy, pregnancy, QT prolongation. Monitor closely in patients with prior renal, hepatic or cardiac diseases.

Dosage schedule: 80 mg oral/day until disease progression or until unacceptable toxicity. Adjust in case of renal impairment, hepatic impairment, cardiac diseases.

Adverse effects: Diarrhoea, lymphopenia, thrombocytopenia, anemia, cardiomyopathy.

Drug and food interactions: Can be taken with or without food. Avoid concurrent administration with strong CYP3 inhibitors. If must, monitor for toxicity closely. Decreased plasma concentration of drug if used with strong CYP3 inducers.

Patient instruction: Do not breastfeed while taking drug.

RITUXIMAB

Dosage form and strength: *Injections*: 100 mg, 500mg

Indication: B cell lymphoma, mantle cell lymphoma, chronic myelogenous lymphoma, combination with CHOP and radiotherapy, rheumatoid arthritis, Wegener's granulomatosis, microscopic polyangiitis.

Contraindication/Precautions: Hypersensitivity, murine proteins. Fatal infusion reactions may occur. Hepatitis B virus reactivation, progressive multifocal leukoencephalopathy. Caution should be exercised in high number of circulatory malignant cell ($>10^9/L$). Pretreatment with antihistamines dampens adverse reactions. Do not administer as IV push or bolus. Transient hypotension may occur during infusion.

Dosage schedule:

- *CLL/NHL*: Slow IV infusion; 237 mg/m² infusion weekly for 4 weeks.
- *RA*: 2 IV infusions of 1000 mg each separated by 2 weeks.

Adverse effects: Infusion reactions, late onset neutropenia, skin toxicity, abdominal pain, bleeding gum, bloating of face and limbs, blurred vision.

Drug and food interaction: Used with methotrexate to treat moderate to severe form of RA.

SUNITINIB

Dosage form and strength: *Tablet or capsule:* 25 mg, 50 mg

Indications: Gastrointestinal stromal tumors after disease progression or intolerance to imatinib, advanced renal carcinoma, pancreatic neuroendocrine tumor in patients with unresectable locally advanced/metastatic disease.

Contraindications/Precautions: Pregnancy, breastfeeding, hypersensitivity. Children, geriatric, active infections, QT prolongations, torsades de pointes, stroke, heart failure. Assess ANC and platelets; if ANC $<1 \times 10^9/L$ and/or platelets $<50 \times 10^9/L$, stop until ANC $>1.5 \times 10^9/L$ and/or platelets $>75 \times 10^9/L$. Assess CV status; hypertension, QT prolongation can occur. If bilirubin $>3 \times IULN$, with-hold sunitinib until bilirubin levels return to $<1.5 \times IULN$. Monitor LFTs before treatment, monthly; if liver transaminase $>5 \times IULN$, withhold sunitinib until transaminase levels return to $<2.5 \times IULN$.

Dosage schedule: *Gastrointestinal stromal tumor:* 50 mg PO qDay for 4 weeks, then 2 weeks drug-free, repeat cycle

Adverse effects: Hypertension, hypothyroidism, bleeding complications, fatigue, diarrhoea, myelosuppression, increased risk of left ventricular dysfunction.

Drug and food interactions: Bevacizumab, class IA/III antidysrhythmics, local anesthetics, haloperidol, erythromycin, acetaminophen.

Patient information: Report adverse reactions immediately: SOB, bleeding. Avoid persons with known upper respiratory infections. Avoid grapefruit juice.

TRASTUZUMAB

Dosage form and strength: *Injection:* 440 mg.

Indications: Treatment of HER2-overexpressing breast cancer. Treatment of HER2-overexpressing metastatic gastric cancer or gastroesophageal junction adenocarcinoma.

Contraindications/Precautions: Pregnancy, hypersensitivity, breastfeeding, children, geriatric patients, pulmonary disease, anemia, leucopenia

Dosage schedule: *Metastatic breast cancer:* Treat as a single agent or in combination with paclitaxel. 4 mg/kg IV over 90 min, then 2 mg/kg IV over 30 min, qWeek, continue until disease progression.

Adverse effects: Infusion related symptoms, cardiotoxicity, nausea and vomiting, pain, asthenia, headache, pulmonary toxicity. Evaluate cardiac function prior to and every 3 months during treatment. Discontinue trastuzumab for absolute decrease in LVEF by $\geq 16\%$. Discontinue trastuzumab for anaphylaxis, angioedema, interstitial pneumonitis, or acute respiratory distress syndrome. Exposure to Herceptin during pregnancy can result in oligohydramnios, in some cases complicated by pulmonary hypoplasia and neonatal death. Advise patients of these risks and the need for effective contraception.

Drug and food interaction: Warfarin, anthracyclines, cyclophosphamide, vaccines and toxoids.

Patient information: Take acetaminophen for fever. Avoid hazardous tasks

because confusion, dizziness may occur. Report signs of infection: sore throat, fever, diarrhoea, vomiting. Use contraception while taking this product, avoid breastfeeding.

14.3 Hormonal drugs

ANASTROZOLE

Dosage form and strength: *Tablet or capsule:* 1 mg.

Indications: Adjuvant treatment of oestrogen receptor positive early invasive breast cancer in postmenopausal women, Adjuvant treatment of oestrogen receptor positive early breast cancer in postmenopausal women following 2-3 years of tamoxifen therapy, Advanced breast cancer in postmenopausal women which is oestrogen receptor positive or responsive to tamoxifen, uterine leiomyoma, endometriosis.

Contraindications/Precautions: Pregnancy, breastfeeding, hypersensitivity, premenopausal women. Children, geriatric patients, osteoporosis, hepatic or cardiac disease. Avoid if creatinine clearance less than 20 ml/minute. Bone mineral density assessment before treatment and at regular intervals. To prevent over immune suppression, physicians may decrease the dose of the maintenance immune suppression regimen. If an anaphylactic reaction occurs, terminate the infusion immediately and implement emergency treatment.

Dosage schedule:

- *Renal graft rejection, delaying onset of rejection (start within 24 hours of transplant):* 15 mg/kg IV every day x 14 days, then every day x 14 days (total of 21 doses in 28 days).
- *Treatment of rejection:* 10-15 mg/kg IV every day x 14 days, then every day PRN (total of 21 doses in 28 days).
- *Aplastic anemia:* 10-20 mg/kg IV every day x 8-14 days, then every day PRN up to total of 21 doses.

Adverse effects: Hot flushes, osteoporosis, asthenia, arthralgia, headache, peripheral edema chest pain, bone pain, cutaneous vasculitis, hypertension, thrombophlebitis, MI, DVT, altered taste sensation, leucopenia, steven Johnson syndrome, pulmonary embolism, slight increase in total cholesterol level.

Drug and food interactions: Do not use with oral contraceptives: estrogen, tamoxifen.

Patient information: Vaginal bleeding, pruritis, hot flashes reversible after discontinuing treatment. To take adequate calcium and vitamin D due to risk for bone loss /fractures.

EXEMESTANE

Dosage form and strength: *Tablet:* 25 mg.

Indication: Adjuvant treatment of oestrogen receptor positive in postmenopausal women early breast cancer following 2-3 years of tamoxifen therapy, advanced breast cancer in postmenopausal women in whom anti-oestrogen therapy has failed.

Contraindications/Precautions: Pregnancy, breastfeeding, premenopausal

women, hypersensitivity. Children, geriatric patients, renal / hepatic disease. Do not administer to premenopausal women.

Dosage schedule: Adult; oral 25 mg/day after meals, administer after meals at same time of day, store at room temperature.

Adverse effects: Headache, depression, insomnia, anxiety, hot flashes, diaphoresis, lymphopenia, dyspnea, nausea, vomiting.

Patient information: To report any complaints, side effects to prescriber. Hot flashes are reversible after treatment. To use reliable contraception, not to breastfeed. Vitamin D, calcium can be used for bone loss.

FULVESTRANT

Dosage form and strength: *Injections:* 250 mg, 500 mg

Indications: Advanced breast carcinoma in estrogen receptor positive patients

Contraindications/Precautions: Pregnancy, breastfeeding, children, hypersensitivity. Drugs should be used with caution in hepatic disease, jaundice, thrombocytopenia, biliary tract disease, coagulopathy.

Dosage schedule: IM 500 mg as 2, 5 ml injections on days 1, 15, 29 and monthly thereafter.

Adverse effects: Headache, nausea, hepatitis, hepatic failure, hyperbilirubinemia, anemia, rash, hot flashes, angioedema, bone pain, arthritis, pharyngitis, dyspnea, cough.

Drug and food interactions: Increase bleeding with anticoagulants. So do not use concurrently.

Patient information: To use contraception to prevent pregnancy. Premenopausal women must use birth control because ovulation may be induced. Not to breastfeed.

TAMOXIFEN

Dosage form and strength: *Tablets:* 10 mg, 20 mg, should be protected from light.

Indication: Early breast cancer in peri-menopausal, pre-menopausal and post-menopausal women, advanced breast cancer in post-menopausal women, endometrial cancer, chemoprevention against breast cancer in women who are at high risk of developing breast cancer.

Contraindications/Precautions: Pregnancy, breastfeeding, hypersensitivity, thromboembolic diseases. Women of child bearing age, leucopenia, thrombocytopenia, cataracts, endometrial cancer, stroke. Regularly assess CBC. Withdraw product if WBC count is <3500 or platelet count is <100000. Periodic eye examination is necessary.

Dosage schedule:

- *Breast cancer:* 20 mg daily as a single dose or in 2 divided doses.
- *Anovulatory infertility:* 20 mg daily on second to fifth day of cycle and if necessary, increased to 40 mg daily then 80 mg daily for subsequent courses. If cycle irregular, start initial course on any day, with subsequent course starting 45 days later or on second day of cycle if menstruation occurs.

Adverse effects: Hot flushes, nausea, vomiting, menstrual irregularities,

rash, vaginal bleeding and vaginal discharge, increased risk of endometrial polyps and headache are reported. Hypercalcemia may occur during initial therapy in patients with bone metastases.

Drug and food interactions: Increases the risk of bleeding when taken with anticoagulants. Increases thromboembolic events with cytotoxics. Drug level is decreased when taken with aminoglutethimide, rifampin.

Patient information: Use non-hormonal contraception during and for 2 months after discontinuing treatment. Hair may be lost during treatment.

Section II - Chapter 15

Immunologicals

15.1 Diagnostic agents

Tuberculin, Purified protein derivative (PPD)

15.2 Sera and immunoglobulins

Anti-D immunoglobulin (human)

Antirabies hyperimmune serum

Polyvenum antsnake serum

Tetanus immunoglobulins (human)

15.3 Vaccines

15.3.1 For universal immunization

Diphtheria, tetanus, pertussis, hepatitis B, Haemophilus influenzae type B (Pentavalent) vaccine

Measles vaccine

Measles, mumps, rubella (MMR) vaccine

Normal immunoglobulin

Poliomyelitis vaccine (Oral)/OPV (Live Attenuated)

Rotavirus vaccine

Tetanus toxoid

15.3.2 For specific group of individuals

Diphtheria antitoxins

Hepatitis B immunoglobulin

Human papillomavirus vaccine

Influenza vaccine

Rabies vaccine

Typhoid vaccine

Yellow fever vaccine

15.1 Diagnostic agents

TUBERCULIN, PURIFIED PROTEIN DERIVATIVE (PPD)

Dosage form and strength: *Solution:* 2 units is equivalent to 0.1 mL of 20 units/mL strength, 10 units is equivalent to 0.1 mL of 100 units/mL strength.

Indications: Test for hypersensitivity to tuberculo-protein (Mantoux test)

Contraindications/Precautions: It should not be used within 4 weeks of receiving live viral vaccination, viral and bacterial infections (including HIV and severe tuberculosis), malignant disease, corticosteroid or other immunosuppressive therapy, malnourished patients, elder patients. Mantoux test response to tuberculin may be suppressed by live viral vaccines, viral infection, sarcoidosis, corticosteroid therapy, or immunosuppression due to disease or treatment. Let the prescriber or your physician know if any of the above symptoms do not go away or worsen.

Dosage schedule: Intradermal injection: 10 units for 1 dose.

Adverse effects: Headache, nausea, malaise, rash, itch, vesicle formation, ulceration, necrosis or pain at the administered site.

Drug and food interactions: Corticosteroids (e.g. prednisone), immunosuppressives (e.g. certain cancer medicines, cyclosporine), or live vaccines (e.g. measles) because the effectiveness of tuberculin purified protein derivative (PPD) may be decreased.

15.2 Sera and immunoglobulins

ANTI-D IMMUNOGLOBULIN (HUMAN)

Dosage form and strength: *Solution:* 300 µg/2 ml.

Indications: Prevention of formation of antibodies to rhesus positive blood cells in rhesus negative patients.

Contraindications/Precautions: Known hypersensitivity, cautiously used in rhesus positive patients for treatment of blood disorders, rhesus negative patients with anti D antibodies in the serum.

Use only those immunoglobulin preparations which have been screened adequately.

Dosage schedule:

- *Rhesus-negative woman for prevention of D sensitization following abortion or birth of rhesus-positive infant:* Deep intramuscular injection: 500 units immediately or within 72 hours; for transplacental bleed in excess of 4 ml fetal red cells, extra 100-125 units per ml fetal red cells.
- *Following any potentially sensitizing episode (e.g. still birth):* Deep intramuscular injection up to 20 weeks gestation 250 units per episode, after 20 weeks of gestation: 500 units. Immediately or within 72 hours of such event.
- *Following Rh₀(D) incompatible blood transfusion:* Deep intramuscular injection: 100-125 units/ ml transfused rhesus-positive red cells.
- *To rhesus-negative woman for prevention of Rh (D) sensitization antenatal prophylaxis:* deep intramuscular injection, 500 units to be given at weeks 28 and 34 of pregnancy, if infant rhesus-positive, a further dose is still needed immediately or within 72 hours of delivery, subcutaneous route used for patients with bleeding disorders.

Adverse effects: Soreness at the site of injection, fever, anemia, intravascular

hemolysis, renal insufficiency.

ANTIRABIES HYPERIMMUNE SERUM

Dosage form and strength: *Injection:* 150 IU/ml in vial.

Indications: As passive immunization either post exposure or suspected ones in unimmunized individuals (in conjunction with rabies vaccine)

Contraindications/Precautions: Intravenous injection. Use only those immunoglobulin preparations which have been screened adequately. Safety in pregnancy is not established, use only when benefits outweigh possible risks. Notify and consult physician if pregnancy is suspected. Inquiry should be made for history of allergy. Should only be given after skin test.

Dosage schedule

- *Pre-exposure:* intramuscular/intradermal: 3 doses on 0, 7 and 21 or 28 days.
- *Post-exposure:* intramuscular: 5 doses on 0, 3, 7, 14 and 28 days.
- Adult and Child: 20 units/kg by infiltration in and around the cleansed wound; if wound is not visible/healed or if infiltration of whole volume not possible, give remainder by IM injection into anterolateral thigh.

Adverse effects: Soreness at the site of injection and mild temperature elevations may be observed at times. Sensitization to repeated injections has occurred occasionally in immunoglobulin-deficient patients. Angioedema, skin rash, nephrotic syndrome, and anaphylactic shock have rarely been reported after intramuscular injection

Drug and food interactions: Other antibodies in the immunoglobulin preparation may interfere with the response to live vaccines such as measles, mumps, polio or rubella. Therefore, immunization with live vaccines should not be given within 3 months after immunoglobulin administration.

POLYVENUM ANTISNAKE SERUM

Dosage form and strength: Depends on the specific antivenom used

Indication: Venomous snake bite

Contraindications/Precautions: Known hypersensitivity. Resuscitation facilities should be made available in case adverse reactions occur. Only use if there is a clear indication of systemic involvement or severer local involvement as severe adverse reactions may occur. Resuscitation facilities should be made available. Antivenom sera should never be injected into a finger or toe. If it is given intramuscularly it should be injected into a large muscle mass such as the gluteal region. Nerve trunk must be avoided. Snake venoms may precipitate spontaneous abortion so notify the physician if you are pregnant or pregnancy is suspected.

Dosage schedule: Depends on the specific antivenom used. Read the insert leaflet.

Adverse effects: Anaphylaxis with urticaria, hypotension, dyspnea and shock thermal sickness, serum sickness.

TETANUS IMMUNOGLOBULIN (HUMAN)

Dosage form and strength: *Solution:* 500 IU in a vial.

Indications: Passive immunization against tetanus as a part of management of tetanus prone wound

Contraindications/Precautions: Hypersensitivity to immunoglobulin. Should not be given intravenously. In patients who have severe

thrombocytopenia or any coagulation disorder. Safety in pregnancy is not established, use only when benefits outweigh possible risks. Notify the physician if pregnancy is planned or suspected.

Dosage schedule: *Management of tetanus prone wound:* intramuscular injection: 250 units. Increase to 500 units if wound older than 24 hours or there is a risk of heavy contamination, or following burns.

Adverse effects: Soreness at the site of injection and temperature elevation may be noted at times; angioneurotic edema, nephrotic syndrome, and anaphylactic shock after injection are rare.

Drug and food interactions: Antibodies in immunoglobulin preparations may interfere with the response to live viral vaccines such as measles, mumps, polio, and rubella. Therefore, use of such vaccines should be deferred until approximately 3 months after tetanus immunoglobulin injection.

15.3 Vaccines

Vaccines may consist of live attenuated or inactivated form of a virus or bacteria, or an extract of or detoxified exotoxin produced by micro-organism. Some inactivated vaccines are adsorbed onto an adjuvant to enhance the antibody response.

Adverse effects: Vaccines are generally both effective and safe. Adverse reactions are usually mild and commonly include injection site reactions (such as pain, erythema, and inflammation), fever, and malaise. These reactions generally occur within 1–2 days of immunization. However, the systemic symptoms that may arise with the measles or the measles, mumps and rubella (MMR) vaccine occur 5–12 days after vaccination. Serious reactions are rare, but hypersensitivity reactions including anaphylaxis (see section 3) have been reported. If a serious adverse event occurs (such as severe allergy or anaphylaxis) following a dose of any vaccine, subsequent doses should not be given. In addition, certain components of the vaccine (for example, aluminium adjuvant, antibiotics, excipients, or preservatives) occasionally cause reactions. Some vaccines are prepared using hens' eggs; caution is required when the patient is known to have egg sensitivity. Vaccines are contraindicated in individuals with known severe hypersensitivity to any component; consult the manufacturer's literature for the specific composition of individual vaccines.

HIV infection

The likelihood of successful immunization is reduced in some HIV-infected individuals, but the risk of serious adverse effects remains low, except for BCG. Specific precautions and contraindications in HIV infection are given in the listings for the individual vaccines.

Live vaccines

When 2 live virus vaccines are required (and are not available as a combined preparation) they should be given either simultaneously at different sites or with an interval of at least 4 weeks. Live vaccines should not be routinely administered to pregnant women because of the possible harm to the fetus but where there is significant risk of exposure, the need for immunization may outweigh any possible risk to the fetus.

Post-immunization fever

If fever develops after childhood immunization, the infant can be given a

dose of paracetamol (60 mg), followed if necessary by a second dose 4–6 hours later. If fever persists after the second dose, medical advice should be sought. Fever from any cause, including immunization, increases risk of febrile convulsions when there is a personal or family history of febrile convulsions. When immunization of these children is recommended, advice on prevention of fever should be given before administration of the vaccine.

15.3.1 For universal immunization

DIPHTHERIA, TETANUS, PERTUSSIS, HEPATITIS B, Haemophilus influenzae type B (PENTAVALENT VACCINE)

Dosage form and strength: Each dose of 0.5 ml contains diphtheria toxoid: ≥ 30 IU, tetanus toxoid: ≥ 40 IU, B. pertussis (whole cell): ≥ 4.0 IU, HBsAg (rDNA): ≥ 10 μ g, purified capsular Hib Polysaccharide (PRP) conjugated to tetanus toxoid (carrier protein): 10 μ g

Indication: All newborns (As per EPI schedule, see page number 312)

Contraindication: See under vaccine introductory notes

Dosage schedule: Intramuscular, child: 0.5 ml 3 doses at 6, 10 and 14 weeks of birth.

Adverse effects: See under vaccine introductory notes

Instructions and warning: Pentavalent Vaccine should be started for any child aged more than 6 weeks and can be given up to 1 year of age

Patient information: A child whose vaccination schedule has been initiated with DPT/hepatitis B vaccine will continue to receive subsequent doses of DPT/hepatitis B and not pentavalent vaccine

MEASLES VACCINE

Dosage form and strength: Lyophilized powder for reconstitution: ≥ 1000 TCID₅₀

Indications: Active immunization against measles

Contraindications/Precautions: Hypersensitivity to any antibiotic present in vaccine, hypersensitivity to egg or gelatin, respiratory tract infection, tuberculosis, AIDS. Pregnancy, febrile illness, seizure, cerebral injury

Dosage schedule:

• *Infant:* at 9 months: 0.5 ml.

• *Prophylaxis in susceptible children after exposure to measles; over 9 months:* 0.5 ml within 72 h of contact.

Adverse effects: local lymphadenopathy, rash, rarely thrombocytopenia purpura

MEASLES, MUMPS, RUBELLA (MMR) VACCINE

Dosage form and strength: Lyophilized powder for reconstitution: ≥ 1000 , 12500, 1000 TCID₅₀

Indication: Primary immunisation against MMR, rubella immunisation (in seronegative women, susceptible to rubella and in unimmunised, seronegative women, postpartum), Children presenting for pre-school booster, who have not received the primary immunisation

Contraindication/Precaution: Antibody response to measles component may be reduced after immunoglobulin administration or blood transfusion—leave an interval of at least 3 months before MMR immunization. MMR

vaccine should not be administered on the same day as yellow fever vaccine; there should be a 4-week minimum interval between the vaccines.

Dosage schedule:

- *Primary immunisation against MMR (first dose):* intramuscular injection/ deep subcutaneous injection, child 12–13 months: 0.5 ml for 1 dose
- *Primary immunisation against MMR (second dose):* intramuscular injection/ deep subcutaneous injection, child 40 months–5 years: 0.5 ml for 1 dose
- *Children presenting for pre-school booster, who have not received the primary immunisation (first dose) immunisation for patients at school-leaving age or at entry into further education, who have not completed the primary immunisation course/control of measles outbreak/immunisation for patients travelling to areas where measles is endemic or epidemic, who have not completed the primary immunization:* intramuscular injection/ deep subcutaneous 0.5 ml for 1 dose

Adverse effects: Parotid swelling (usually in the third week), sleep disturbances, unusual crying in infants. Rare Arthropathy (2 to 3 weeks after immunisation), idiopathic thrombocytopenic purpura, optic neuritis, peripheral neuritis

NORMAL IMMUNOGLOBULIN

Dosage form and strength: Injection: 5 gm/100 ml in vial

Indications: Hepatitis A, measles, mumps, rubella and varicella, prophylaxis of infections after bone marrow transplantation, raise platelet count in patients with idiopathic thrombocytopenic purpura, Kawasaki disease, Guillain-Barre syndrome, allogenic bone marrow transplantation, polymyositis/dermatomyositis control outbreaks of hepatitis A, prophylaxis against hepatitis A in immunocompromised patients, Primary rubella in pregnant women whereby pregnancy termination is unacceptable, Immunocompromised patients or patients with primary antibodies deficiency, common variable immunodeficiency.

Contraindications/Precautions: Patients with selective IgA deficiency who have known antibody against IgA. Monitor for acute renal failure. Storage: Store at 2-8°C. If no contraindication, hydration of patient has to be IV immunoglobulin preparations containing maltose which may falsely elevate blood glucose tests that use nonspecific methods based on glucose dehydrogenase pyrroloquinolinequinone (GDH-PQQ) or glucose-dye oxidoreductase.

Dosage schedule: (read the insert leaflet carefully before use)

- *Prophylaxis of infections after bone marrow transplantation:* Adult, Intravenous: 500 mg/kg/weeks, adjust dose according to response.
- *Raise platelet count in patients with idiopathic thrombocytopenic purpura:* Adult, intravenous: 400 mg/kg/day for 2-5 consecutive days. Alternatively, a dose of 800-1000 mg/kg may be given on day 1 and repeated on day 3 if needed. Doses to be given via IV infusion. Treatment may be repeated if relapse occurs.
- *Kawasaki disease:* Adult, Intravenous: 1.6-2 g/kg in divided doses over 2-5 days, or 2 g/kg given as a single dose. To be used in conjunction with acetylsalicylic acid.
- *Guillain-Barre syndrome:* Adult, Intravenous: 400 mg/kg daily for 5 consecutive days, may repeat every 4 weeks if needed.

- *Allogenic bone marrow transplantation*: Adult, Intravenous: As part of the conditioning regimen and after transplantation: 500 mg/kg/wk, starting 7 days before transplantation and for up to 3 months after transplantation. In cases of persistent lack of antibody production, 500 mg/kg/mth may be used to normalise the antibody level.
- *Control outbreaks of hepatitis A*: Adult, Intramuscular: Recommended dosage: 500 mg. Child, Intramuscular: Recommended dosage: <10 years: 250 mg; ≥10 years: 500 mg
- *Prophylaxis against hepatitis A in immunocompromised patients*: Adult, Intramuscular: Recommended dosage: 500 mg. Child, Intramuscular: Recommended dosage: <10 years: 250 mg; ≥10 years: 500 mg
- *Prevent or modify measles attack in immunocompromised patients*: Adult, Intramuscular: For prevention of an attack: 750 mg as an IM inj; to be given within 6 days after exposure (better efficacy if given within 72 hours). To modify an attack: 250 mg as an IM injection. Child, Intramuscular: For prevention of an attack: <1 years: 250 mg; 1-2 years: 500 mg; ≥3 years: 750 mg, as a single IM injection. Dose should be given within 6 days after exposure (better efficacy if given within 72 hours). To modify an attack: <1 years: 100 mg and ≥1 years: 250 mg, as a single IM injection.
- *Primary rubella in pregnant women whereby pregnancy termination is unacceptable*: Adult, Intramuscular: 750 mg
- *Immunocompromised patients or patients with primary antibodies deficiency*: Adult, intravenous: Initially, 400-800 mg/kg, then 200 mg/kg every 3 weeks, adjust according to trough-immunoglobulin levels; maintenance dose: 200-800 mg/kg/month. In patients with secondary immunodeficiency syndromes: 200-400 mg/kg every 3-4 weeks may be used. Alternatively, dose may be given via SC route: Initial loading dose of 200-500 mg/kg (divided over several days), followed by maintenance doses at repeated intervals to achieve a cumulative monthly dose of 400-800 mg/kg.

Adverse effects: Dizziness, light-headedness, nausea, vomiting, allergic and cutaneous reactions. Local pain and tenderness at the site of injection IV admin may lead to systemic effects such as headache, chills and fever.

Drug and food interactions: May interfere with the immune response to live measles vaccine, live mumps vaccine, live rubella vaccine and live varicella vaccine, therefore these vaccines should be given at least 3 weeks before or 3 months after the admin of the immunoglobulins.

POLIOMYELITIS VACCINE (ORAL)/ OPV (LIVE ATTENUATED)

Dosage form and strength: Bivalent oral solution

Indications: Active immunization against poliomyelitis.

Contraindications/Precautions: Primary immunodeficiency or immunosuppression; not to be taken with food which contains a preservative; hypersensitivity to any antibiotic present in vaccine, pregnancy

Dosage schedule:

- *Primary immunization of children against poliomyelitis*: oral, child: 3 drops at birth and at 6, 10, and at 14 weeks of age. Reinforcing immunization of children against poliomyelitis: oral, child: 3 drops at least 3 years after completion of primary course and a further 3 drops at 15-19 years of age.
- *Primary immunization of unimmunized adult against poliomyelitis*: oral,

adult: doses, each of 3 drops, with an interval of at least 4 weeks between each dose. Reinforcing immunization of adults against

Adverse effects: Rarely, vaccine-associated poliomyelitis in recipients of vaccine and contacts of recipients.

ROTAVIRUS VACCINE

Indications: Immunisation against gastro-enteritis caused by rotavirus

Dosage schedule: *Immunisation against gastroenteritis caused by rotavirus:* oral, 6–24 weeks: 1.5 ml at least every 4 weeks for 2 doses, first dose must be given between 6–15 weeks of age; course should be completed before 24 weeks of age (preferably before 16 weeks)

Contraindications/Precautions: History/predisposition to intussusception, severe combined immunosuppression. Postpone vaccination in diarrhea, vomiting, immunosuppression with the exception of severe combined immunodeficiency: in immunosuppressed patients.

Adverse effects: Abdominal cramps, abdominal pain, diarrhea, nausea, vomiting

TETANUS TOXOID

Dosage form and strength: Tetanus toxoid absorbed vaccine solution in 0.5 ml and 5 ml vial

Indications: Active immunization against tetanus and neonatal tetanus; tetanus prophylaxis as part of wound management (tetanus-prone wounds and clean wounds).

Contraindication: Anaphylactic reaction, hypersensitivity, mild cold. If schedule requires tetanus vaccine and antitetanus immunoglobulin to be administered at the same time, they should be administered using separate syringes and separate sites

Dosage schedule:

- *Primary immunization of unimmunized adolescents and adults (including women of child-bearing age) against tetanus:* intramuscular injection, adult and adolescent: 3 doses, each of 0.5 ml, with an interval of not less than 4 weeks between the first and second doses and 6 months between the second and third doses; followed by 2 reinforcing doses, each of 0.5 ml, the first at least 1 year after completion of the primary course and the second dose at least 1 year later. Reinforcing immunization of adults against tetanus: intramuscular injection, adult: 2 doses, each of 0.5 ml, the first 10 years after completion of the primary course, and the second dose 10 years later.
- *Immunization of unimmunized pregnant women against tetanus:* intramuscular injection, adult: 2 doses, each of 0.5 ml, with an interval of at least 4 weeks between each dose (second dose at least 2 weeks before delivery), followed by a third dose of 0.5 ml 6 months later; and 2 booster doses, each of 0.5 ml, the first at least 1 year after completion of the primary course and the second dose at least 1 year later.
- *Management of tetanus-prone wounds and clean wounds:* intramuscular injection, adult: 0.5 ml as a single dose (the dose schedule will be dependent upon the immune status of the patient and the level of contamination of the wound).

Adverse effects: Tetanus component rarely, associated with peripheral

neuropathy; seizures, neurological disturbance, fever, loss of appetite

15.3.2 For specific group of individuals

DIPHTHERIA ANTITOXINS

Dosage form and strength: *Solution:* 10000 IU, 20000 IU in vial

Indications: Passive immunization in suspected cases of diphtheria

Contraindications/Precautions: Known hypersensitivity. Patients allergic to any product prepared from horse serum may also be allergic to diphtheria antitoxin. Initial test dose should be given to exclude hypersensitivity; full dose administration should be under observation and resuscitation facilities should be available.

Dosage schedule: *Therapeutic use, pharyngeal or laryngeal diphtheria:* intravenous infusion, adult: 20000 to 40000 units; child (<10 years): half of adult dose.

Adverse effects: Anaphylaxis with urticaria, hypotension, dyspnea and shock thermal sickness; serum sickness, can occur up to 12 days after injection.

HEPATITIS B IMMUNOGLOBULIN

Dosage form and strength: *Solution:* 250 units/ml.

Indications: Prevention of infection in health care workers dealing with blood products and also for persons who have been accidentally inoculated, to babies of mothers who have become infected with this virus in pregnancy.

Contraindications/Precautions: Anaphylactic or severe systemic reaction to human globulin; thrombocytopenia or a coagulation disorder that would contraindicate IM injection. Monitor liver transplant patients for serum anti-HBs antibody levels using a quantitative assay. It should be given at the same time as the vaccine when the exposure has been certain and severe. Skin test must be done prior to giving the sera. Therapy is useful as post exposure prophylaxis as soon after exposure as possible (preferably within 7 days).

Dosage form and strength: *Intramuscular injection (as soon as possible after exposure):* adult and child >10 years: 500 units, child <5 years: 200 units; 5-9 years: 300 units; neonate: 200 units as soon as possible after birth.

Adverse effects: Hypertension, hypotension, malaise, agitation, amnesia, essential tremor, fatigue, light-headedness/fainting pyrexia. Angioedema, pruritus, rash, urticaria, nausea, vomiting, aphthous stomatitis, diarrhea, dyspepsia, gingival hyperplasia, infectious diarrhea. Decreased WBC, ecchymosis, splenomegaly. elevated alkaline phosphatase, elevated AST, elevated creatinine, pleural effusion pneumonia. myalgia, joint stiffness, back pain.

HUMAN PAPILLOMA VIRUS VACCINE

Dosage form and strength: *Vaccine suspension for injection:* 0.5 ml pre-filled disposable syringes.

Indications: Prevention of premalignant genital (cervical, vulvar and vaginal) and anal lesions, cervical and anal cancers, and genital wart, prevention of premalignant genital (cervical, vulvar, and vaginal) and anal lesions, cervical and anal cancers, and genital warts (alternative schedule)

Dosage schedule:

• *Prevention of premalignant genital (cervical, vulvar and vaginal) and*

anal lesions, cervical and anal cancers, and genital warts: Intramuscular injection, child >9 years (female): 0.5 ml for 1 dose, followed by 0.5 ml after 1 month for 1 dose, second dose to be given at least 1 month after the first dose, then 0.5 ml after 3 months, third dose to be given at least 3 months after the second dose, schedule should be completed within 12 months of the first dose, dose to be administered preferably into deltoid region or higher anterolateral thigh, if the course is interrupted, it should be resumed (using the same vaccine) but not repeated, allowing the appropriate interval between the remaining doses.

- *Prevention of premalignant genital (cervical, vulvar, and vaginal) and anal lesions, cervical and anal cancers, and genital warts (alternative schedule):* intramuscular injection/ child 9–13 years (female): 0.5 ml, for 1 dose, followed by 0.5 ml after 6 months for 1 dose, if the second dose is administered earlier than 6 months after the first dose, a third dose should be administered, dose to be administered preferably into deltoid region or higher anterolateral thigh, if the course is interrupted, it should be resumed (using the same vaccine) but not repeated, even if more than 24 months have elapsed since the first dose or if the girl is then aged 15 years or more.

Contraindication/Precaution: Pregnancy: not known to be harmful, but vaccination should be postponed until completion of pregnancy. To avoid confusion, prescribers should specify the brand to be dispensed.

INFLUENZA VACCINE

Dosage form and strength: *Suspension for injection:* 0.5 ml in pre-filled syringes

Indications: Annual immunisation against seasonal influenza, annual immunisation against seasonal influenza

Dosage schedule:

- *Annual immunisation against seasonal influenza (for children who have not received seasonal influenza vaccine previously):* intramuscular injection, child 6 months–9 years: 0.5 ml for 1 dose, followed by 0.5 ml after at least 4 weeks for 1 dose. Intranasal administration: child 2–9 years: 0.1 ml for 1 dose, followed by 0.1 ml after at least 4 weeks for 1 dose, 0.1 ml dose to be administered into each nostril
- *Annual immunisation against seasonal influenza:* intramuscular injection: 0.5 ml for 1 dose

Contraindications/Precautions: Child under 5 years- increased risk of febrile convulsions. Individuals with a history of egg allergy can be immunised with either an egg free influenza vaccine.

Adverse effects: Epistaxis, febrile convulsions, transient thrombocytopenia, vasculitis (in adults)

RABIES VACCINE

Indications: Active immunisation against rabies; pre-exposure prophylaxis, post-exposure treatment.

Contraindications/Precautions: Febrile illness, pregnancy, acute illness. If schedule requires rabies vaccine and rabies immunoglobulin to be administered at the same time, they should be administered using separate syringes and separate sites.

Dosage schedule:

- *Pre-exposure prophylaxis against rabies*: intramuscular injection, adult and child: 3 doses, on days 0, 7, and 28; alternatively, by intradermal injection: 3 doses, each of 0.1 ml, on days 0, 7, and 28.
- *Booster dose*. Periodic booster dose are recommended only for individuals whose occupation puts them at continuous or frequent risk of rabies exposure. In such cases, a booster dose should be given at intervals dictated by regular testing for rabies antibodies.
- *Post-exposure treatment against rabies in unimmunized individuals*: intramuscular injection: adult and child: 1 dose given on days 0, 3, 7, 14, and 28 (total of 5 doses); alternatively, 2 doses on day 0 (one in each deltoid or thigh), followed by 1 dose each on days 7 and 21 (total of 4 doses).
- *Post-exposure treatment against rabies in unimmunized individuals*: intradermal injection, adult and child (8-site regimen): 1 dose of 0.1 ml administered at 8 separate sites on day 0 (one in each upper arm, one in each lateral thigh, one on each side of the suprascapular region, and one on each side of the lower quadrant region of the abdomen), followed by 1 doses of 0.1 ml in each upper arm and each lateral thigh on day 7, and 1 dose of 0.1 ml in one upper arm on days 30 and 90; alternatively (2-site regimen), 1 dose of 0.1 ml at 2 sites on days 0, 3, 7, and 28 (total of 8 doses).
- *Post-exposure treatment against rabies in fully immunized individuals*: intramuscular or intradermal injection, adult and child: 2 doses, separated by 3 days.

Adverse effects: Mild gastrointestinal disturbance, headache, dizziness

TYPHOID VACCINE

Dosage form and strength: *Injection*: 25 µg derived from *S. typhi* Ty2 strain/0.5 ml; *Oral capsule*: 2-6X10⁹ CFU of viable *S. typhi* Ty21a and 5-50X10⁹ bacterial cells of non-viable *S. typhi* Ty21a

Indications: Active immunization against typhoid

Contraindications/Precautions: Hypersensitivity. Illness, infection, allergy, radiation therapy, pregnancy. Proguanil, mefloquine and antibiotics should be stopped from 3 days before until 3 days after the administration of Ty21a.

Dosage schedule:

- *Immunization against typhoid fever*: oral, capsules: adult and child (> 5 years): one dose given on days 1, 3, 5, and 7 (total of 4 doses); suspension, adult and child > 2 years: one dose given on days 1, 3, and 5 (total of 3 doses); reinforcing doses can be given every year for travelers to disease endemic countries and every 3 years for those living in disease-endemic areas.
- *Immunization against typhoid fever (Vi capsular polysaccharide vaccine)*: subcutaneous/intramuscular injection: adult and child ≥ 2 years and over, 1 dose of 0.5 ml, with reinforcing doses every 3 years for those at continued risk.

Adverse effects: Anaphylactoid reaction; nausea; vomiting; fever; redness; itching; abdominal pain.

YELLOW FEVER VACCINE

Dosage form and strength: *Injection*: >= 4.74 log₁₀ plaque forming units/0.5 ml

Indications: Active immunization against yellow fever

Contraindications/Precautions: Not recommended for infants under 9 months of age; pregnancy; individuals with severe immunodeficiency or severe egg allergy, acute illness

Dosage schedule:

- *Immunization of children against yellow fever:* deep subcutaneous/ intramuscular injection, infant (9–12 months): 0.5 ml as a single dose.
- *Immunization of travellers and other at-risk individuals against yellow fever:* deep subcutaneous/ intramuscular injection: adult and child (over 9 months): 0.5 ml as a single dose.

Adverse effects: Headache, myalgia, weakness; very rarely encephalitis (infants more susceptible), viscerotropic disease, multiple organ failure (the elderly more susceptible).

EPI Schedule of Nepal, 2017

S.N.	Age (from birth)	Immunization	Prophylaxis/Indication
1.	At birth	B.C.G.	Tuberculosis
2.	6 weeks	Rota (first dose)	Rota virus induced diarrhea
		Polio (first dose)	Polio
		FIPV (first dose)	Polio
		PCV (first dose)	Pneumococcal Pneumonia and other infection
		DPT-Hep B- Hib (first dose)	Diphtheria, pertussis, tetanus, hepatitis B and hemophilus influenza
3.	10 weeks	Rota (second dose)	Rota virus induced diarrhea
		Polio (second dose)	Polio
		PCV (second dose)	Pneumococcal Pneumonia and other infection
		DPT-Hep B- Hib (second dose)	Diphtheria, pertussis, tetanus, hepatitis B and hemophilus influenza
4.	14 weeks	Polio (third dose)	Polio
		FIPV (second dose)	Polio
		DPT-Hep B- Hib (third dose)	Diphtheria, pertussis, tetanus, hepatitis B and hemophilus influenza
5.	9 months	PCV (third dose)	Pneumococcal Pneumonia and other infection
		Measles and rubella (first dose)	Measles and rubella
6.	12 months	Japanese encephalitis	Japanese encephalitis
7.	15 months	Measles and rubella (second dose)	Measles and rubella

Section II - Chapter 16

Drugs used in Skin Disorders

16.1 *Bacterial skin infections*

Benzoic acid and Salicylic acid
Fusidic Acid
Metronidazole
Mupirocin
Silver Sulfadiazine

16.2 *Fungal skin infections*

Amorolfine
Amphotericin B
Clotrimazole
Gentian violet
Griseofulvin
Ketoconazole
Miconazole nitrate
Neomycin
Nystatin
Sertaconazole
Terbinafine

16.3 *Parasitic skin infections*

Benzyl Benzoate
Ivermectin
Permethrin

16.4 *Viral skin infections*

Aciclovir

16.5 *Inflammatory skin infections*

Clobetasone butyrate
Clobetasol propionate
Dithranol (Anthralin)
Flucinolone acetonide
Fluticasone
Hydrocortisone
Hydrocortisone butyrate
Hydrocortisone with Fusidic acid.
Mometasone furoate.
Tacrolimus
Triamcinolone

16.6 *Retinoid and related drugs*

Acitretin
Adapalene
Adapalene with Benzoyl peroxide
Isotretinoin
Tazarotene

-
- 16.7 Coal tar and related**
Coal tar
Coal tar with Salicylic acid and Precipitated Sulfur
- 16.8 Vitamin D and analogues**
Calcipotriol
Calcitriol
- 16.9 Antiperspirants**
Aluminium chloride hexahydrate
- 16.10 Antimuscarinics**
Glycopyrronium bromide (Glycopyrrolate)
- 16.11 Drugs used in photodamage**
- 16.11.1 Antimetabolites**
Fluorouracil
- 16.11.2 Antipruritus**
Doxepin
- 16.12 Anti-acne**
Clindamycin
- 16.13 Anticomedonals**
Azelaic acid
Benzoyl peroxide with Clindamycin
Erythromycin
- 16.14 Essential trace element**
Selenium sulphide
- 16.15 Scalp and hair condition**
- 16.15.1 Alopecia**
Minoxidil
- 16.15.2 Hirsutism**
Eflornithine
- 16.16 Skin cleansers, antiseptics and desloughing agents**
Chlorhexidine
Imiquimod
Potassium permanganate
Salicylic acid
- 16.17 Depigmenting agents**
Azelaic acid
Capsaicin
Hydroquinone
Psoralen

16.1 Bacterial skin infections

BENZOIC ACID AND SALICYLIC ACID

Dosage form and strength: *Ointment/Cream:* 6% w/w of benzoic acid and 3% w/w of salicylic acid in a suitable base

Indication: Superficial dermatophyte infections - *Tinea corporis*, *Tinea cruris*

Contraindications/Precautions: Hypersensitivity (to any of the components). Salicylate toxicity may occur particularly if applied on large areas of skin. Avoid broken or inflamed skin, avoid contact with eyes, and avoid contact with mucous membranes

Dosage schedule: Apply twice daily until the infected skin is shed (usually at least 4 weeks).

Adverse effects: Erythema, hypersensitivity reactions, itching, mild burning sensation, occasional local irritation

Patient information: Treatment should be discontinued if side effects are severe.

FUSIDIC ACID

Dosage form and strength: *Cream/Ointment:* 2%

Indications: *Staphylococcal* skin infection (impetigo, folliculitis), erythrasma, pitted keratolysis

Contraindications/Precautions: Allergy to fusidic acid and its salt or any of its ingredient. Avoid contact of cream or ointment with eyes. To avoid the development of resistance, fusidic acid should not be used for longer than 10 days

Dosage schedule: *Staphylococcal skin infection:* apply 3–4 times a day in the skin

Adverse effects: Hypersensitivity reactions

Patient information: Avoid contact of cream or ointment with eyes.

METRONIDAZOLE

Dosage form and strength: *Cream:* 0.75%; *Gel:* 0.75%

Indications: Rosacea, malodorous gravitational and decubitus ulcers

Contraindications/Precautions: Hypersensitivity to this product or nitroimidazoles, parabens. Hepatic disease, blood dyscrasias, children. Watery eyes, metallic taste in mouth, numbness and paraesthesias or any other side effects may occur and need to be reported.

Dosage schedule:

- *Acute inflammatory exacerbation of rosacea:* Apply twice daily for 8 weeks, to be applied thinly
- *Inflammatory papules and pustules of rosacea:* Apply twice daily for 6 weeks (longer if necessary)
- *For malodorous fungating tumours and malodorous gravitational and decubitus ulcers:* Apply 1–2 times a day, to be applied to clean wound and covered with non-adherent dressing

Adverse effects: Dryness, itching, burning, stinging

Drug and food interactions: May cross-react in patients with allergy to oral forms.

Patient information: Topical skin products are not for intravaginal therapy

and are for external use only; do not use skin products near the eyes, nose, or mouth. Avoid exposure to strong sunlight or UV light.

MUPIROCIN

Dosage form and strength: *Ointment:* 2%

Indication: Bacterial skin infections, particularly those caused by Gram positive organisms (except pseudomonal infection)

Contraindications/Precautions: Known hypersensitivity. Renal impairment, burns, large open wounds, pregnancy, lactation. If reactions suggesting chemical irritation or sensitivity occur, treatment should be discontinued and alternative therapy for the infection should be instituted.

Dosage schedule: *Impetigo, skin infections (Staphylococcus aureus, Streptococcus pyogenes):* Apply up to 3 times a day for up to 10 days

Adverse effects: Burning sensation, local reactions, pruritus, rash, urticaria
Patient information: Avoid contact with the eyes. The medication should be discontinued in case of irritation, severe itching or rash and health care provider should be contacted. If impetigo has not improved by 3-5 days, contact with health care provider.

SILVER SULFADIAZINE

Dosage form and strength: *Cream:* 1% w/w

Indications: Minor burns

Contraindications/Precautions: Hypersensitive to sulphonamides, pregnancy [C, X (near term)], breastfeeding and neonates. Hepatic, renal impairment, G-6PD deficiency. Owing to the association of sulfonamides with severe blood and skin disorders, treatment should be stopped immediately if blood disorders or rashes develop.

Dosage schedule: Apply once daily or twice daily if exudative

Adverse effects: Allergic reactions, argyria (following treatment of large areas of skin or prolonged use), burning, itching, leucopenia, rashes

Drug and food interactions: Decreases effects of collagenase, pepsin, trypsin

16.2 Fungal skin infections

AMOROLFINE

Dosage form and strength: *Nail lacquer:* 5%; *Cream:* 0.25%

Indications: Fungal nail infections, dermatophyte infections, yeasts infection

Contraindications/Precautions: Hypersensitivity. Avoid contact with ears, avoid contact with eyes and mucous membranes, use with caution in child likely to suck affected digits. Do not use in children under 12 years.

Dosage schedule:

- *Fungal nail infections:* By transungual application, Apply 1–2 times a week for 6 months to treat finger nail and for toe nails 9–12 months (review at intervals of 3 months), apply to infected nails after filing and cleansing, allow drying for approximately 3 minutes.
- *Dermatophytes/yeast infections:* Apply once daily on affected areas for 4 weeks.

Adverse effects: Burning sensation, erythema, hypersensitivity reactions,

itching, occasional local irritation

Patient information: Treatment should be discontinued if side-effects are severe. Avoid nail varnish or artificial nails during treatment

AMPHOTERICIN B: See under antifungal drugs.

CLOTRIMAZOLE

Dosage form and strength: Cream: 1% w/w; Gel: 1% w/w; Solution: 1% w/w

Indications: Tinea pedis, T. cruris, T. corporis, T. versicolor, Cutaneous candidiasis

Contraindications/Precautions: Hypersensitivity to any of the formulation components. Contact with eyes and mucous membranes should be avoided. Treatment should be discontinued if side effects are severe.

Dosage schedule: Apply 2-3 times daily for 4-6 weeks

Adverse effects: Local irritation, erythema, hypersensitivity reactions, itching, mild burning sensation

Patient information: Contact with eyes and mucous membranes should be avoided

GENTIAN VIOLET

Dosage form and strength: Solution: 1% w/v

Indications: Cutaneous/mucocutaneous infections caused by *Candida albicans*.

Contraindications/Precautions: Avoid use in ulcerated lesions, broken skin, mucous membranes.

Dosage schedule: Local application: apply locally, 2-3 times daily

Adverse effects: Irritation/ sensitivity reactions, mucous membranes ulcerations

GRISEOFULVIN: See under antifungal drugs.

KETOCONAZOLE: See under antifungal drugs.

MICONAZOLE NITRATE

Dosage form and strength: Ointment: 2% w/w; Ovule: 200 mg

Indications: Fungal skin infections, fungal nail infections, oral fungal infection, vaginal candidiasis

Contraindications/Precautions: Hypersensitivity to this product or imidazoles. Avoid in acute porphyrias, contact with eyes and mucous membranes should be avoided. Treatment should be discontinued if side effects are severe.

Dosage schedule:

- *Fungal skin infections:* Apply twice daily continuing for 10 days after lesions have healed

- *Fungal nail infections:* Apply 1-2 times a day

Adverse effects: Local irritation and burning.

Patient information: Contact with eyes and mucous membranes should be avoided.

NEOMYCIN

Dosage form and strength: *Combination ointment:* Neomycin 1000 units, Polymyxin 5000 units and Bacitracin 1500 units

Indications: Steroid responsive dermatoses with infection, prophylaxis of skin infection in minor injury.

Contraindications/Precautions: Hypersensitivity. Pregnancy(C), Lactation use with caution.

Dosage schedule: Apply cream/ointment BID-QID for 7 days.

Adverse effects: Sensitization, burning, itching, irritation, dryness

Drug and food interactions: Not recommended in allogenic cultured keratinocytes/fiboblasts in bovine collagen.

NYSTATIN

Dosage form and strength: *Cream/Ointment:* 100,000 units/g; *Powder:* 100,000 units/g

Indications: Mucocutaneous infection, vaginal infections

Contraindications/Precautions: Hypersensitivity. Pregnancy (B), Lactation—not known. Cream preferred to ointment in candidiasis involving intertriginous areas. Moist lesions best treated with powder.

Dosage schedule:

• *Mucocutaneous infection:* Apply to affected area q8-12hr for 2 weeks.

• *Vaginal infections:* Insert 1 tab/day qHS for 2 weeks.

Adverse effects: Non-toxic well tolerated by all age groups, contact dermatitis, Steven-Johnson syndrome, acneiform eruption (rare)

Patient information: Report if hypersensitivity occurs.

SERTACONAZOLE

Dosage form and Strength: *Cream:* 2%

Indications: Tinea pedis

Contraindications/Precautions: Hypersensitivity, not indicated for ophthalmic, oral or intravaginal use. Pregnancy (C). Sensitivity to imidazole antifungals (cross reactivity may occur). If no improvement 2 weeks after treatment period, review diagnosis.

Dosage schedule: Apply BID for 4 weeks; apply enough to cover affected area, and immediately surrounding healthy skin

Adverse effects: Contact dermatitis, dry skin, burning, erythema, vesiculation, desquamation, hyperpigmentation

TERBINAFINE

Dosage form and strength: *Cream:* 1%

Indications: Tinea infections

Contraindications/Precautions: Breastfeeding, hypersensitivity to this drug. Pregnancy (B). Not for oral, intravaginal, ophthalmic use; no more than 4 weeks

Dosage schedule:

• *Tinea pedis:* To the affected area using cream. Apply 1–2 times a day for up to 1 week, to be applied thinly.

• *Tinea corporis and Tinea cruris:* To the affected area using cream. Apply

1–2 times a day for up to 1–2 weeks, to be applied thinly, review treatment after 2 weeks

Adverse effects: Erythema, hypersensitivity reactions, itching, mild burning sensation, occasional local irritation.

Patient information: Avoid contact with eyes and mucous membranes.

16.3 Parasitic skin infections

BENZYL BENZOATE

Dosage form and strength: *Lotion:* 25%

Indications: Scabies

Contraindications/Precautions: Children; broken or secondarily infected skin. Contact with eyes and mucous membranes. For use in children, dilute the product to reduce irritant effect

Dosage schedule: Apply over the whole body; repeat without bathing on the following day and wash off 24 hours later; a third application may be required in some cases

Adverse effects: Burning sensation (especially on genitalia and excoriations), rashes, skin irritation.

Patient information: Avoid contact with eyes and mucous membranes, suspend breastfeeding until the product has been washed off.

IVERMECTIN

Dosage form and strength: *Lotion:* 0.5%; *Cream:* 1%

Indications: Lice, rosacea

Contraindications/Precautions: Hypersensitivity. Pregnancy (C). To prevent ingestion, administer to children only with direct adult supervision. Not for oral, ophthalmic or intravaginal use.

Dosage schedule:

- *Lice:* Apply 0.5% lotion to dry hair in amount sufficient (up to one 4-oz tube) to thoroughly coat the hair and scalp; leave lotion on hair for 10 minutes, and then rinse with water. (For single use only, do not retreat).
- *Rosacea (Indicated for inflammatory lesions caused by Rosacea):* Apply small amount of 1% cream to affected area(s) q day.

Adverse effects: Conjunctivitis, ocular hyperemia, eye irritation, dandruff, dry skin, skin burning sensation.

Patient information: Use a pea size amount for each area of face (forehead, cheek, nose) Avoid use in eyes and lips.

PERMETHRIN

Dosage form and strength: *Cream:* 5%; *Lotion:* 1%

Indications: Scabies, body lice, head lice

Contraindications/Precautions: Hypersensitivity. Avoid contact with eyes, children aged 2 months–2 years, medical supervision required for dermal cream (scabies), do not use on broken or secondarily infected skin. Pregnancy (B), Lactation: not known, distributed in breast milk, may temporarily withhold the drug while mother is nursing.

Dosage schedule:

- *Scabies and body lice:* Apply cream over whole body and wash off after

8-12 hours (if hands washed with soap within 8 hours of application for treating scabies, treat again) repeat after 7 days for scabies and 10 days for body lice.

- *Head lice*: Apply lotion to clean damp hair and rinse after 10 minutes, repeat after 10 days.

Adverse effects: Local irritations, rashes, itching, erythema

Patient information: Avoid contact with eyes. For external use only.

16.4 Viral skin infections

ACICLOVIR

Dosage form and strength: *Cream/Ointment*: 5%

Indications: Herpes labialis, genital herpes, herpetic keratitis

Contraindications/Precautions: Hypersensitivity. Pregnancy (B). Excretion in milk unknown. Not recommended for recurrent infections. Use cautions in immunocompromised patients. Not for use on eye or inside mouth.

Dosage schedule:

- *Herpes labialis*: Apply topically to lips and around mouth 5 times per day for 4 days.
- *Initial genital herpes*: Apply sufficient quantity to adequately cover all lesions Q3hr, 6 times/day for 7 days.

Adverse effects: Burning/stinging, pruritus, dry lips, rash, angioedema, vulvitis
Patient information: Avoid physical contact when lesions are present. For external use only. Use rubber gloves when applying to prevent autoinoculation of other body sites and transmission of infection to others.

16.5 Inflammatory skin infections

CLOBETASONE BUTYRATE

Dosage form and strength: *Cream*: 0.05%

Indications: Eczemas and dermatitis of all types

Contraindications/Precautions: Hypersensitivity, use of some preparations on face, axilla, groin; monotherapy for primary bacterial infections. Pregnancy (C), breastfeeding, children. Do not use with occlusive dressings. Treatment should be limited to 2 wks.

Dosage schedule: *Eczemas and dermatitis of all types*: Maintenance between courses of more potent corticosteroids. Child: Apply 1–2 times a day, to be applied thinly

Adverse effects: Hyperglycemia, burning, folliculitis, pruritus, dermatitis, irritation, erythema, hypertrichosis, acne

CLOBETASOL PROPIONATE

Dosage form and strength: *Cream*: 0.05%; *Lotions*: 0.05%

Indications: Corticosteroids responsive dermatoses, scalp psoriasis, plaque psoriasis

Contraindications/Precautions: Hypersensitivity, use of some preparations on face, axilla, groin; monotherapy for primary bacterial infections. Pregnancy(C), breastfeeding, children. Do not use with occlusive dressings. Treatment should be limited to 2 week.

Dosage schedule: *Recalcitrant eczemas unresponsive to less potent corticosteroids and Psoriasis:* Apply 1–2 times a day for up to 2 weeks, to be applied thinly, maximum 50 g of 0.05% preparation per week

Adverse effects: Hyperglycemia, Burning, folliculitis, pruritus, dermatitis, irritation, erythema, hypertrichosis, acne

DITHRANOL (ANTHRALIN)

Dosage form and strength: *Cream:* 0.1%, 0.25%, 0.5%, 1% and 2%

Indications: Psoriasis

Contraindications/Precautions: Acute and pustular psoriasis, hypersensitivity. Avoid sensitive areas of skin, avoid use near eyes.

Dosage schedule: *Subacute and chronic psoriasis:* For application to skin or scalp, 0.1–0.5% cream suitable for overnight treatment, 1–2% cream for maximum 1 hour (consult product literature)

Adverse effects: Local burning sensation, local irritation, stains hair, stains skin

Patient information: When applying Dithranol, hands should be protected by gloves or they should be washed thoroughly afterwards. Dithranol should be applied to chronic extensor plaques only, carefully avoiding normal skin. Dithranol can stain the skin, hair and fabrics.

FLUOCINOLONE ACETONIDE

Dosage form and strength: *Cream:* 0.025%

Indications: Severe inflammatory skin disorders such as Eczemas, Psoriasis

Contraindications/Precautions: Hypersensitivity, use of some preparations on face, axillae, groin; monotherapy for primary bacterial infections. Pregnancy(C), breastfeeding, children. Do not use with occlusive dressings.

Dosage schedule: Severe inflammatory skin disorders such as eczemas, psoriasis Apply 1–2 times a day, to be applied thinly, reduce strength as condition responds

Adverse effects: Hyperglycemia, Burning, folliculitis, pruritus, dermatitis, irritation, erythema, hypertrichosis, acne

Patient information: Do not apply medicine for long period of time.

FLUTICASONE

Dosage form and strength: *Cream:* 0.05%; *Ointment:* 0.005%

Indications: Dermatitis and eczemas unresponsive to less potent corticosteroids, Psoriasis

Contraindications/Precautions: Hypersensitivity. Pregnancy (C), children, breast-feeding, skin infections, skin atrophy, children. Not to use with occlusive dressings, below 2 months child

Dosage schedule: Apply 1–2 times a day, to be applied thinly

Adverse effects: Burning, pruritus, dermatitis, hypertrichosis, hives, hyperglycemia, glycosuria, HPA axis suppression, Cushing syndrome

Patient information: To apply sparingly in a thin film and rub gently into the cleansed, affected area.

HYDROCORTISONE

Dosage form and strength: *Cream:* 0.1%, 0.5%, 1%, 2.5%; *Ointment/Lotion*

1%, 2.5%

Indications: Mild inflammatory skin disorders such as eczemas, nappy rash

Contraindications/Precautions: Underlying infection, hypersensitivity, ophthalmic use. Pregnancy (C), breastfeeding, children, HPA suppression (with higher potency used >2 weeks). Avoid use in face, ano-genital region, broken or infected skin (including cold sores, acne, and athlete's foot)

Dosage schedule:

- *Eczema:* Apply 1–2 times a day, to be applied thinly for 2 weeks.
- *Nappy rash:* Apply as required for no more than 1 week, discontinued as soon as the inflammation subsides

Adverse effects: Burning, folliculitis, pruritus, dermatitis, maceration, hyperglycemia, glycosuria, striae

Patient information: Apply only for short period of time if not responsive consult dermatologist.

HYDROCORTISONE BUTYRATE

Dosage form and strength: *Scalp lotion:* 0.1%; *Topical emulsion:* 0.1%; *Lipocream:* 0.1%; *Ointment:* 0.1%

Indications: Severe inflammatory skin disorders such as eczema unresponsive to less potent corticosteroids, Psoriasis

Contraindications/Precautions: Children under 10 years or for pregnant women; face, anogenital region, broken or infected skin (including cold sores, acne, and athlete's foot)

Dosage schedule: Apply 1–2 times a day, to be applied thinly

Adverse effects: Similar to other topical steroids

HYDROCORTISONE WITH FUSIDIC ACID

Dosage form and strength: *Cream:* Fusidic acid 2% and Hydrocortisone acetate 1%

Indications: Mild inflammatory skin disorders such as eczemas

Contraindications/Precautions: Impetigo, rosacea, acne, perioral dermatitis, fungal infections. Limit treatment to short duration. Long term application might lead to complication of topical steroids.

Dosage schedule: To be applied thinly

Adverse effects: Acneiform eruptions, flaring of infections

Patient information: Apply only for short period of time, if not responsive consult dermatologist.

MOMETASONE FUROATE

Dosage form and strength: *Scalp lotion:* 0.1%; *Cream:* 0.1%; *Ointment:* 0.1%

Indications: Severe inflammatory skin disorders such as eczemas unresponsive to less potent corticosteroids and Psoriasis

Contraindications/Precautions: Hypersensitivity, primary infectious ulcers, acne vulgaris. Pregnancy, lactation, children, old age. Avoid in patients with active local infections, known hypersensitivity.

Dosage schedule: Apply once daily, to be applied thinly (to scalp in case of lotion)

Adverse effects: Burning, tingling, pruritis; when applied over large areas,

over abraded or in occlusive dressing can lead to systemic absorption with adrenal suppression

Patient information: Used with caution in dressing over large areas or in occlusive dressing. If there is irritation discontinue use.

TACROLIMUS

Dosage form and strength: *Ointment:* 0.03% and 0.1%

Indications: Atopic eczema and Pityriasis alba, Seborrheic Dermatitis, Vitiligo, Lichen sclerosus et atrophicus

Contraindications/Precautions: Breastfeeding, application to malignant or potentially malignant skin lesions, application under occlusion, avoid contact with eyes and mucous membranes, congenital epidermal barrier defect; generalized erythroderma, immunodeficiency, infection at treatment site. Pregnancy(C), UV light (avoid excessive exposure to sunlight and sunlamps). Avoid using in patients with active local infections

Dosage schedule:

- *Short-term treatment of moderate to severe atopic eczema (including flares) in patients unresponsive to, or intolerant of conventional therapy:* Apply twice daily until lesion clears (consider other treatment if eczema worsens or no improvement after 2 weeks), initially 0.1% ointment to be applied thinly, reduce frequency to once daily or strength of ointment to 0.03% if condition allows
- *Prevention of flares in patients with moderate to severe atopic eczema and 4 or more flares a year who have responded to initial treatment with topical tacrolimus:* Apply twice weekly, 0.1% ointment to be applied thinly, with an interval of 2–3 days between applications, use short-term treatment regimen during an acute flare; review need for preventative therapy after 1 year
- *Short-term treatment of facial, flexural, or genital psoriasis in patients unresponsive to, or intolerant of other topical therapy:* Apply twice daily until symptoms resolve, 0.1% ointment to be applied thinly, reduce to once daily or switch to 0.03% ointment if condition allows, maximum duration of treatment 4 weeks.

Adverse effects: Application-site infections; application-site reactions, herpes simplex infection; irritation (at application-site), Kaposi's varicelliform eruption; pain at application-site; rash

Drug and food interactions: Interactions do not generally apply to tacrolimus used topically; Concomitant use with drugs that cause immunosuppression (may be prescribed in exceptional circumstances by specialists); Risk of facial flushing and skin irritation with alcohol consumption (does not apply to tacrolimus taken systemically)

Patient information: Avoid use in case of irritation, burning sensation, known hypersensitivity to any of its active agents.

TRIAMCINOLONE

Dosage form and strength: *Ointment:* 0.1%; *Injectable:* 10 mg/ml, 40 mg/ml

Indications: Alopecia areata, keloid, hypertrophic scar, oral lichen planus

Contraindications/Precautions: Active local infections. See under hydrocortisone.

Dosage schedule:

- *Alopecia areata*: 10 mg/ml every month till hair grows.
- *Keloid*: 40 mg/ml every month till lesions become flat.

Adverse effects: See under hydrocortisone. Steroid related side effects.

Patient information: Not to use drug for prolonged period of time.

16.6 Retinoid and related drugs

ACITRETIN

Dosage form and strength: *Capsules*: 10 mg and 25 mg

Indications: Psoriasis, severe congenital ichthyosis, Darier's disease

Contraindications/Precautions: Hyperlipidaemia, hypersensitivity to retinoids, pregnancy (X), breastfeeding, severe hepatic impairment, severe renal impairment. Avoid excessive exposure to sunlight and unsupervised use of sunlamps; diabetes (can alter glucose tolerance—initial frequent blood glucose checks); in children use only in exceptional circumstances and monitor growth parameters and bone development (premature epiphyseal closure reported); investigate atypical musculoskeletal symptoms. Check liver function at start, then every 2–4 weeks for first 2 months and then every 3 months. Monitor serum-triglyceride and serum-cholesterol concentrations before treatment, 1 month after starting, then every 3 months.

Dosage schedule:

- *Severe extensive psoriasis resistant to other forms of therapy, Palmoplantar pustular psoriasis*
- *Severe congenital ichthyosis (under expert supervision)*: Initially 25–30 mg daily for 2–4 weeks, then adjusted according to response to 25–50 mg daily, increased to up to 75 mg daily, dose only increased to 75 mg daily for short periods in psoriasis
- *Severe Darier's disease (keratosis follicularis) (under expert supervision)*: Initially 10 mg daily for 2–4 weeks, then adjusted according to response to 25–50 mg daily

Adverse effects: >10%: cheilitis, alopecia, hypertriglyceridemia, skin peeling, dry skin, dysglycemia, increased LFT, nail disorder, pruritus, rhinitis, arthralgia, changes in phosphorus, potassium, sodium, & magnesium levels, dry mouth, epistaxis, erythematous rash, hepatotoxicity, hyperesthesia, paresthesia, paronychia, rigors, skin atrophy, spinal hyperostosis, sticky skin, xerophthalmia; edema, flushing, depression, fatigue, headache, insomnia, somnolence, abdominal pain, anorexia, diarrhea, gingivitis, increased appetite, nausea, stomatitis, vomiting, hot flashes, vision changes, corneal epithelial abnormality, sinusitis

Drug and food interactions: Avoid concomitant use of keratolytics

- *Tetracyclines*: Both acitretin and tetracyclines can cause increased intracranial pressure.
- *Methotrexate*: Either increases toxicity of the other by pharmacodynamic synergism. Risk of additive hepatotoxicity
- *Ethanol*: Ethanol converts acitretin to etretinate, a teratogenic substance that can remain in the body for years. Women on acitretin should totally abstain from ethanol during and 2 months after stopping acitretin.
- *Contraceptives*: Acitretin decreases effects of medroxyprogesterone;

norethindrone acetate and norethindrone. Contraceptive failure may result.

- *Nitazoxanide*: Either increases levels of the other by mechanism: pharmacodynamic synergism. Use Caution/Monitor.
- *Ospemifene*: Either increases levels of the other by plasma protein binding competition. Modify therapy/monitor closely.

Patient information: Females of child-bearing potential must be advised on pregnancy prevention for at least 3 years after last use of drug. Do not donate blood during and for 2 years after stopping therapy (teratogenic risk)

ADAPALENE

Dosage form and strength: *Cream*: 0.1%; *Gel*: 0.1%

Indications: Mild to moderate acne vulgaris

Contraindications/Precautions: Pregnancy, children, not applied to cuts, abrasions, eczematous skin or sun burnt skin. Avoid accumulation in angles of the nose, avoid contact with eyes, nostrils, mouth and mucous membranes, eczematous, broken or sunburned skin, avoid exposure to UV light (including sunlight, solariums), avoid in severe acne involving large areas, caution in sensitive areas such as the neck, to use below 12 years of age. Avoid using in case of irritation. Start with night time application in dry skin every alternate day to avoid irritation. Daily use once drug is tolerated.

Dosage schedule: Apply once daily, apply thinly in the evening

Adverse effects: Skin irritation, erythema, scaling, stinging and burning sensation, dryness and pruritus.

Patient information: If sun exposure is unavoidable, an appropriate sunscreen or protective clothing should be used.

ADAPALENE WITH BENZOYL PEROXIDE

Dosage form and strength: *Gel*: Adapalene 0.1 % and Benzoyl peroxide 2.5%

Indications: Acne vulgaris

Dosage schedule: Apply once daily, to be applied thinly in the evening

Adverse effects: Local irritation

Patient information: Start with night time application, stop using in case of irritation.

ISOTRETINOIN

Dosage form and strength: *Capsule*: 5 mg, 10 mg, 20 mg, and 40 mg

Indications: Acne vulgaris, ichthyosiform disorders

Contraindications/Precautions: Pregnancy (X), breastfeeding, hepatic impairment; diabetes, dry eye syndrome (associated with risk of keratitis), history of depression- monitor for depression. With topical use- allow peeling (resulting from other irritant treatments) to subside before using a topical retinoid, alternating a preparation that causes peeling with a topical retinoid may give rise to contact dermatitis (reduce frequency of retinoid application, avoid accumulation in angle of the nose, avoid contact with eyes, nostrils, mouth and mucous membranes; eczematous, broken or sun burned skin, avoid exposure to UV light (including sunlight, solariums), avoid in severe acne involving large areas, avoid use of topical retinoids with abrasive cleaners, comedogenic or astringent cosmetics; caution in sensitive areas

such as the neck ; personal or familial history of non-melanoma skin cancer.

Dosage schedule:

- *Topical treatment of mild to moderate acne:* Apply 1–2 times a day, to be applied thinly.
- *Severe acne (acne which is associated with psychological problems, acne which has not responded to an adequate course of a systemic antibacterial)/Systemic treatment of nodulo-cystic and conglobate acne:* per oral:-Initially 500 micrograms/kg daily in 1–2 divided doses, increased if necessary to 1 mg/kg daily for 16–24 weeks, repeat treatment course after a period of at least 8 weeks if relapse after first course; maximum 150 mg/kg cumulative dose per course

Adverse effects: With oral use: anaemia, arthralgia, dryness of eyes (with blepharitis and conjunctivitis), dryness of lips (sometimes cheilitis), dryness of nasal mucosa (with epistaxis), dryness of pharyngeal mucosa (with hoarseness), dryness of skin (with dermatitis, scaling, thinning, erythema, pruritus), epidermal fragility (trauma may cause blistering); haematuria; headache; myalgia; neutropenia; proteinuria; raised blood-glucose concentration; raised plasma-triglyceride concentration; raised serum cholesterol concentration (with reduced high-density lipoprotein concentration); raised serum-transaminase concentration; thrombocytopenia; thrombocytosis

Drug and food interactions: Alcohol increased risk of teratogenicity in women of child-bearing potential; Antibacterials: possible increased risk of benign intracranial hypertension when retinoids given with tetracyclines (avoid concomitant use); Anticoagulants: acitretin possibly reduces anticoagulant effect of coumarins; Antiepileptics: isotretinoin possibly reduces plasma concentration of carbamazepine; Antifungals: plasma concentration of alitretinoin increased by ketoconazole; possible increased risk of tretinoin toxicity when given with fluconazole, ketoconazole and voriconazole; Cytotoxics: acitretin increases plasma concentration of methotrexate (also increased risk of hepatotoxicity) avoid concomitant use; Lipid-regulating drugs: alitretinoin reduces plasma concentration of simvastatin

TAZAROTENE

Dosage form and strength: *Gel:* 0.05% and 1%

Indications: Psoriasis and acne

Contraindications/Precautions: Pregnancy (X); hypersensitivity, eczema. Avoid contact with eczematous skin, eyes, face, hair-covered scalp, inflamed skin, intertriginous areas. Effective contraception required (oral progestogen-only contraceptives not considered effective). Re-evaluate if not healed in 10 days.

Dosage schedule: Mild to moderate plaque psoriasis affecting up to 10% of skin area: Apply once daily usually for up to 12 weeks, apply in the evening

Adverse effects: Rare: Dry or painful skin, stinging and inflamed skin. Frequency not known: Burning, contact dermatitis, desquamation, erythema, local irritation, non-specific rash, pruritus, worsening of psoriasis

Patient information: Avoid excessive exposure to UV light (including sunlight, PUVA or UVB treatment). Do not apply emollients or cosmetics within 1 hour of application. Wash hands immediately after use.

16.7 Coal tar and related drugs

COAL TAR

Dosage form and strength: *Emulsion:* 40%, *Shampoo:* Coal tar extract 2%, *Bath additive:* 40%

Indications: Psoriasis, Chronic atopic eczema

Contraindications/Precautions: Avoid in broken or inflamed skin, avoid eye area, genital area, mucosal areas, rectal area, infection, sore, acute, or pustular psoriasis. Application to face. Application to skin flexures. Avoid using in case of irritation.

Dosage schedule:

- *Psoriasis, chronic atopic eczema:* Using paste: In Child and adult : Apply 1–3 times a day, start application with low-strength preparations; using shampoo: In Child and adult: 100 ml/bath, to be added to an adult sized bath; add proportionally less for a child's bath. Use coal tar solution
- *Psoriasis, seborrhoeic dermatitis, scaling, itching:* using shampoo : Apply every 2–3 days; using lotion in psoriasis : Apply 2–3 times a day, to be applied to skin or scalp. Can be diluted with a few drops of water before applying.

Adverse effects: Acne-like eruptions, photosensitivity, skin irritation

Patient information: May stain skin, hair and fabric.

COAL TAR WITH SALICYLIC ACID AND PRECIPITATED SULFUR

Dosage form and strength: *Ointment:* Coal tar solution 120 mg/g, Salicylic acid 20 mg/g, Sulfur precipitated 40 mg/g

Indications: Psoriasis, seborrhoeic dermatitis and dandruff

Contraindications/Precautions: Avoid broken or inflamed skin; avoid eye area; genital area; mucosal areas; rectal area; infection; sore, acute, or pustular psoriasis. Application to face, application to skin flexures, to use below 12 years of age. Avoid use in case of irritation/burning.

Dosage schedule: Scaly scalp disorders including psoriasis, eczema, seborrhoeic dermatitis and dandruff. Initially using scalp ointment. In 12 years and above: apply once weekly as required, alternatively apply daily for the first 3–7 days (if severe), shampoo off after 1 hour

Adverse effects: Acne-like eruptions, photosensitivity, skin irritation

Patient information: May stain skin, hair and fabric

16.8. Vitamin D and analogues

CALCIPOTRIOL

Dosage form and strength: *Ointment:* 50 µg/g; *Solution:* 50 µg/g

Indications: Psoriasis

Contraindications/Precautions: Calcium metabolism disorders. Avoid excessive exposure to sunlight and sun lamps, avoid use on face, erythrodermic exfoliative psoriasis (enhanced risk of hypercalcaemia), generalized pustular psoriasis (enhanced risk of hypercalcaemia).

Dosage schedule:

- *Plaque psoriasis:* using ointment: Apply 1–2 times a day, when preparations are used together maximum total calcipotriol 5 mg in any one week (e.g.

scalp solution 60 mL with ointment 30 g or scalp solution 30 mL with ointment 60 g); maximum 100 g per week

- *Scalp psoriasis*: using scalp lotion: Apply twice daily, when preparations are used together maximum total calcipotriol 5 mg in any one week (e.g. scalp solution 60 ml with ointment 30 g or scalp solution 30 ml with ointment 60 g); maximum 60 ml per week.

Adverse effects: Common or very common: burning, dermatitis, erythema, itching, local skin reactions, paraesthesia. Rare: facial dermatitis, perioral dermatitis. Frequency not known: aggravation of psoriasis, dry skin, photosensitivity

Patient information: Hands should be washed thoroughly after application to avoid inadvertent transfer to other body areas.

CALCITRIOL (1, 25-DIHYDROXYCHOLECALCIFEROL)

Dosage form and strength: *Ointment*: 3 µg/g

Indications: Mild to moderate plaque psoriasis

Contraindications/Precautions: Do not apply under occlusion, patients with calcium metabolism disorders. Erythrodermic exfoliative psoriasis (enhanced risk of hypercalcaemia), generalized pustular psoriasis (enhanced risk of hypercalcaemia), pregnancy, breastfeeding. Monitor urine- and serum-calcium concentration in pregnancy.

Dosage schedule: *Mild to moderate plaque psoriasis*: Apply twice daily, not more than 35% of body surface to be treated daily; maximum 30 g per day.

Adverse effects: Common or very common: Burning, dermatitis, erythema, itching, local skin reactions, paraesthesia. Frequency not known: Aggravation of psoriasis

Patient information: Hands should be washed thoroughly after application to avoid inadvertent transfer to other body areas.

16.9 Antiperspirants

ALUMINIUM CHLORIDE HEXAHYDRATE

Dosage form and strength: *Spray*: 20%, *Solution*: 20%

Indications: Hyperhidrosis; bromidrosis; intertrigo; prevention of tinea pedis and related conditions

Contraindications/Precautions: Known allergy or hypersensitivity. Avoid contact with eyes and mucous membranes; avoid use on broken or irritated skin; do not shave axillae or use depilatories within 12 hours of application. Store at room temperature between 59-86°F (15-30°C) away from heat. Do not use near an open flame.

Dosage schedule: Hyperhidrosis affecting axillae, hands or feet: Spray or solution in adult: Apply once daily, apply liquid formulation at night to dry skin, wash off the following morning, reduce frequency as condition improves, do not bathe immediately before use

Adverse effects: Skin irritation

Drug and food interactions: Deodorants, other antiperspirants, disulfiram, metronidazole, tinidazole.

Patient information: Avoid contact with clothing.

16.10 Antimuscarinics

GLYCOPYRRONIUM BROMIDE (GLYCOPYRROLATE)

Dosage form and strength: *Cream, solution or pads:* 0.5%, 2%, 4%

Indications: Hyperhidrosis of axilla, face, Frey's syndrome

Contraindications/Precautions: Heat stroke, extremely dry or irritated skin. Cautions applicable to systemic use should be considered; however, glycopyrronium is poorly absorbed and systemic effects unlikely with topical use. Care should be taken to avoid nose, mouth and particularly eyes.

Dosage schedule: Spray or lotion: Only 1 site to be treated at a time, maximum 2 sites treated in any 24 hours, and not to wash treated area for 3-4 hours. Treatment is suggested not to be repeated within 7 days.

Adverse effects: Tingling at administration site, dryness

Patient information: Solution has a short expiry of 1 month and cream based up to 3 months.

16.11 Drugs used against photodamage

16.11.1 Antimetabolites

FLUOROURACIL

Dosage form and strength: *Cream:* 5%

Indications: Superficial malignant and pre-malignant skin lesions like actinic keratoses

Contraindications/Precautions: Pregnancy and breastfeeding, severely debilitated or in patients with bone marrow suppression due to either radiotherapy or chemotherapy. Avoid contact with eyes and mucous membranes; do not apply to bleeding lesion. A nonmetallic applicator, gloved hands or fingertips used for application. If fingertips used, wash hands immediately afterwards.

Dosage schedule: using cream: Apply 1-2 times a day for 3-4 weeks (usual duration of initial therapy), apply thinly to the affected area, maximum area of skin 500 cm².

Adverse effects: Burning, crusting, redness, discoloration, irritation, pain, itching, rash, or soreness at the site of application.

Drug and food interactions: Fluorouracil's efficacy is decreased when used alongside allopurinol, which can be used to decrease fluorouracil induced stomatitis through use of allopurinol mouthwash.

Patient information: A very serious allergic reaction to this drug is rare. However, seek immediate medical attention if you notice any of the following symptoms: rash, itching/swelling (especially of the face/tongue/throat), severe dizziness, trouble breathing.

16.11.2 Antipruritus

DOXEPIN

Dosage form and strength: *Cream:* 5%; *Tablets:* 25 mg

Indications: Pruritus (eczema)

Contraindications/Precautions: Hypersensitivity, urinary retention,

closed-angle glaucoma, prostatic hypertrophy, acute recovery from MI. Avoid application to large areas, breastfeeding, geriatric patients, seizures, pregnancy (B), mania, hepatic impairment, to use in below 12 years of age. Before using this medication, tell your doctor or pharmacist your medical history, especially of bleeding problems, breathing problems, liver problems, recent heart attack, problems of urination (such as due to enlarged prostate), overactive thyroid (hyperthyroidism), personal or family history of glaucoma (angle-closure type), personal or family history of mental/mood conditions (such as bipolar disorder, psychosis), family history of suicide, seizures, conditions that may increase your risk of seizures (such as other brain disease, alcohol/sedative withdrawal). Doxepin may cause a condition that affects the heart rhythm (QT prolongation). QT prolongation can rarely cause serious (rarely fatal) fast/irregular heartbeat and other symptoms (such as severe dizziness, fainting) that need medical attention right away.

Dosage schedule: Apply up to 3 g 3–4 times a day, apply thinly; coverage should be less than 10% of body surface area; maximum 12 g per day

Adverse effects: Dizziness, drowsiness

Drug and food interactions: Arbutamine, thyroid supplements, anticholinergic drugs (such as benztropine, belladonna alkaloids), central-acting drugs to treat high blood pressure (such as clonidine, guanabenz, reserpine). Taking Monoamine oxidase inhibitors with this medication may cause a serious (possibly fatal) drug interaction. Avoid taking MAO inhibitors (isocarboxazid, linezolid, methylene blue, moclobemide, phenelzine, procarbazine, rasagiline, safinamide, selegiline, tranylcypromine)

Patient information: Drowsiness may affect performance of skilled tasks (e.g. driving). Effects of alcohol enhanced.

16.12 Antiacne

CLINDAMYCIN

Dosage form and strength: *Gel:* 1%

Indications: Acne vulgaris

Contraindications/Precautions: Hypersensitivity, history of regional enteritis, ulcerative colitis and pseudomembranous colitis, not indicated for inflammatory acne. Pregnancy (B). Lactation: excretion in milk unknown, use with caution. Avoid contact with eyes, Not to be used as a monotherapy due to resistance. Diarrhoea, bloody diarrhoea and colitis (including pseudomembranous colitis reported from topical use of clindamycin).

Dosage schedule: Apply a thin layer to affected area twice a day .

Adverse effects: Dryness, oiliness, erythema, peeling, burning, itching

Patient information: To inform doctor if diarrhoea occurs.

16.13 Anticomedomals

AZELAIC ACID

Dosage form and strength: *Cream:* 20%, *Gel:* 15%

Indications: Facial acne vulgaris, papulopustular rosacea

Contraindications/Precautions: Hypersensitivity. Avoid contact with eyes, mouth and mucous membranes; Pregnancy (B), breastfeeding; patients with

dark complexions should be monitored for early signs of hypopigmentation, children below 12 years. Patients with dark complexions should be monitored for early signs of hypopigmentation

Dosage schedule:

- *Facial acne vulgaris*: Apply twice daily, discontinue if no improvement after 1 month
- *Papulopustular rosacea*: Apply twice daily, discontinue if no improvement after 2 months

Adverse effects: Local irritation (reduce frequency or discontinue temporarily).

Patient information: To avoid concurrent use of alcoholic cleansers, astringents, abrasives, and peeling agents.

BENZOYL PEROXIDE WITH CLINDAMYCIN

Dosage form and strength: *Gel*: Benzoyl peroxide 30 mg/g, Clindamycin 10 mg/g; Benzoyl peroxide 50 mg/g, Clindamycin 10 mg/g

Indications: Acne vulgaris

Contraindications/Precautions: Hypersensitivity, History of regional enteritis, Ulcerative colitis, Pseudomembranous colitis. Atopic individuals, children below 12 years. Bacterial or fungal superinfection may result from prolonged use.

Dosage schedule: Apply once daily, dose to be applied in the evening

Adverse effects: Application site pain, exfoliation, irritation, erythema, burning, pruritus, scaling, dryness

Drug and food interactions: Do not use Clindamycin and Erythromycin containing products together. Concomitant topical acne therapy may result in cumulative irritation (especially with the use of peeling, desquamating or abrasive agents).

Patient information: For external use only. Avoid contact with eyes and mucous membranes.

ERYTHROMYCIN

Dosage form and strength: *Ointment/Gel*: 2%

Indications: Acne vulgaris

Contraindications/Precautions: Hypersensitivity. Pregnancy (B), Lactation-Unknown. Concomitant topical acne therapy may result in cumulative irritation especially with the use of peeling, desquamating or abrasive agents.

Dosage schedule: Apply topically BID to affected areas after skin is thoroughly washed and patted dry.

Adverse effects: Contact sensitization, dryness, erythema, skin irritation, skin tenderness.

Patient information: For external use only. Avoid contact with eyes and mucous membranes.

16.14 Essential trace elements**SELENIUM SULPHIDE**

Dosage form and strength: *Shampoo*: 2.5% w/v

Indications: Seborrheic dermatitis, dandruff, Tinea versicolor

Contraindications/Precautions: In damaged skin due to the risk of systemic toxicity children under 5 years of age. Hypersensitivity. Not for ophthalmic, oral, anal or intravaginal use. Pregnancy (C). Avoid contact with all mucous membranes, including eyes, lips, broken/inflamed skin. Risk of systemic toxicity.

Dosage schedule:

- *Seborrhoeic dermatitis:* Apply twice weekly for 2 weeks, then apply once weekly for 2 weeks, then apply as required
- *Tinea versicolor:* Apply daily for 7 days to the affected area and leave on for 10 minutes before rinsing off. The course may be repeated if necessary. Diluting with a small amount of water prior to application can reduce irritation

Adverse effects: Local irritation, tremors, pain in lower abdomen, vomiting.
Patient information: Avoid using 48 hours before or after applying hair coloring, straightening or waving preparations.

16.15 Scalp and hair conditions

16.15.1 Alopecia

MINOXIDIL

Dosage form and strength: *Scalp foam:* 5%; *Solution:* 2% and 5%

Indications: Androgenetic alopecia

Contraindications/Precautions: Pheochromocytoma, pregnancy. Avoid contact with broken, infected, shaved, or inflamed skin, avoid contact with eyes; avoid inhalation of spray mist; avoid occlusive dressings. Avoid in case of headache, irritation and rashes.

Dosage schedule: Apply 1 ml twice daily, to be applied to the affected areas of scalp; discontinue if no improvement after 1 year

Adverse effects: Headache, local irritation, when used topically systemic effects unlikely, only about 1–2% absorbed (greater absorption may occur with use on inflamed skin).

Drug and food interactions: Caution avoid topical drugs which enhance absorption.

Patient information: Ensure hair and scalp dry before application, patients and their care taker should be advised to wash hands after application of liquid or foam. Treatment must continue for the long term, or new hair will be lost.

16.15.2 Hirsutism

EFLORNITHINE

Dosage form and strength: *Cream:* 11.5%

Indications: Adjunct to laser therapy for facial hirsutism in women

Contraindications/Precautions: Hypersensitivity. Pregnancy(c), lactation

Dosage schedule: Apply twice daily, to be applied thinly, discontinue use if no improvement after 4 months of treatment

Adverse effects: Acne, burning at application site, rash, stinging at application site, anorexia, alopecia, fever.

Patient information: Medicines must be rubbed in thoroughly; Cosmetics may be applied over treated area 5 minutes after eflornithine; do not wash treated area for 4 hours after application.

16.16 Skin cleansers, antiseptics and desloughing agents

CHLORHEXIDINE

Dosage form and strength: *Solution:* 5% (digluconate) for dilution; *Solution:* 4%; *Ointment:* 4%

Indications: Skin disinfection, umbilical cord stump care

Contraindications/Precautions: Hypersensitivity. Alcoholic solutions not suitable before diathermy, for use on neonatal skin; not for use in body cavities (deep wound cleansing). Avoid contact with brain, eyes, meninges and middle ear. Not for presurgery preparation of face and head. Avoid when irritation occurs.

Dosage schedule:

- *Wound cleaning:* Rinse area with water, apply to wound area and wash gently and then rinse thoroughly.
- *For pre-operative skin preparation:* dilute 1 in 10 (0.5%) with alcohol 70%. For general skin disinfection, dilute 1 in 100 (0.05%) with water.

Adverse effects: Chemical burns in preterm neonates; sensitivity.

Patient information: Avoid contact with eyes. External use only.

IMIQUIMOD

Dosage form and strength: *Cream:* 5% and 3.75%

Indications: Warts (external genital and perianal), superficial basal cell carcinoma, actinic keratosis.

Contraindications/Precautions: Hypersensitivity. Pregnancy (C). Autoimmune disease. Avoid broken skin. Avoid contact with eyes, lips, nostrils, open wounds, immunosuppressed patients. Not suitable for internal genital warts. Uncircumcised males (risk of phimosis or stricture of foreskin). Do not use until skin has fully healed from previous drug or surgical treatment. Avoid or minimize sun exposure.

Dosage schedule:

- *Warts (external genital and perianal):* 5% cream: Apply 3 times a week until lesions resolve (maximum 16 weeks), to be applied thinly at night.
- *Superficial basal cell carcinoma:* 5% cream: Apply daily for 5 nights of each week for 6 weeks, to be applied to lesion and 1 cm beyond it, assess response 12 weeks after completing treatment. *Actinic keratosis:* 5% cream: Apply 3 times a week for 4 weeks, to be applied to lesion at night, assess response after a 4 week treatment-free interval; repeat 4-week course if lesions persist, maximum 2 courses.
- *Actinic keratosis:* 3.75% cream: Apply once daily for 2 weeks, to be applied at bedtime to lesion on face or balding scalp, repeat course after a 2-week treatment-free interval, assess response 8 weeks after second course; maximum 2 sachets per day.

Adverse effects: Common: Burning sensation, erosion, erythema, excoriation, headache, influenza-like symptoms, itching, local reactions, myalgia, oedema, scabbing; Uncommon: Alopecia, local ulceration; Rare:

Cutaneous lupus erythematosus-like effect. Stevens-Johnson syndrome; Very rare: Dysuria; Frequency not known: Permanent hyperpigmentation, permanent hypopigmentation

Patient information: Avoid sexual contact while cream is on skin. 5% cream: Should be rubbed in and allowed to stay on the treated area for 6–10 hours for warts or for 8 hours for basal cell carcinoma and actinic keratosis, then washed off with mild soap and water (uncircumcised males treating warts under foreskin should wash the area daily).

POTASSIUM PERMANGANATE

Dosage form and strength: *Powder:* 20 g; *Tablets for cutaneous solution:* 400 mg

Indications: Cleansing and deodorizing suppurating eczematous reactions and wounds

Contraindications/Precautions: Hypersensitivity. Irritant to mucous membranes.

Dosage schedule: Wet compress twice daily till lesions dry up. For wet dressings, use approximately (1 in 40,000 to 1:25000) solution for weeping or oozing, 1:25000 for medicated bath. Potassium permanganate 0.1% solution to be diluted 1 in 10 to provide a 0.01% (1 in 10 000) solution. With potassium permanganate tablets for solution, 1 tablet dissolved in 4 liters of water provides a 0.01% (1 in 10 000) solution. Concentrated solution may cause irritation, dryness or erosion.

Adverse effects: Corrosion, irritation, redness, pain and burns

Patient information: Can stain clothing, skin and nails (especially with prolonged use). Should be diluted in a tub of water until light pink. If it is too red, throw away the solution and dilute adding water to make it light pink only.

SALICYLIC ACID

Dosage form and strength: *Cream:* 2% to 40%

Indications: Hyperkeratotic skin disorders; warts and calluses; acne

Contraindications/Precautions: Hypersensitivity, prolong use or application to large area (risk for salicylism). Pregnancy(C). Avoid in broken skin; impaired peripheral circulation; not suitable for application to anogenital region, face, large areas; patients with diabetes at risk of neuropathic ulcers, significant peripheral neuropathy. Avoid contact with eyes.

Dosage schedule: *Common and plantar warts:* Apply daily, treatment may need to be continued for up to 3 months

Adverse effects: Local irritation, salicylism on excessive application or treatment of large areas

Patient information: Advice patient to apply carefully to wart and to protect surrounding skin. External use only

16.17 Depigmenting agents

AZELAIC ACID

Dosage form and strength: *Cream:* 20%, *Gel:* 15%,

Indications: Melasma, acne, palliative treatment for lentigo maligna and

malignant melanoma. Avoid contact with eyes.

Dosage schedule: Apply a thin layer into affected areas twice a day

Adverse effects: Relatively safe, though mildly irritant, burning/stinging/tingling sensation, dry skin.

Patient information: Cleanse affected area with mild soap or soapless cleansing and make dry before application. Inform to your doctor if facial swelling, eye swelling, worsening of asthma, dyspnea.

CAPSAICIN

Dosage form and strength: *Cream:* 0.025%, 0.035%, 0.075% and 0.1%; *Gel:* 0.025%

Indications: Post-herpetic neuralgia, musculoskeletal pain, diabetic neuropathy, glossodynia, nodular prurigo, nostalgia paraesthetica, pruritus ani, pruritus caused by pityriasis rubra pilaris, psoriasis, PUVA itch and uraemic pruritus.

Contraindications/Precautions: Hypersensitivity. Pregnancy (B), Lactation not known. Use caution in patients with history of uncontrolled HTN or cerebrovascular accidents. If used topically on the tongue or smooth skin, such as the lips, capsaicin application results in a form of burning pain, whose intensity directly relates to the extent of capsaicin-induced increase of the temperature and blood flow. Do not apply to face and scalp to avoid exposure to eyes or mucous membrane.

Dosage schedule: For musculoskeletal pain: Apply to affected area TID or QID for 3-4 consecutive weeks and evaluate efficacy; efficacy decrease if less than 3 application per day.

Adverse effects: Transient increased pain at application site (dissipates with continuous use), irritation, burning, application site erythema, swelling, pruritus, nausea

Patient information: For external use only. Do not use in broken skin. Treated area may be sensitive to heat for several days. (E.g. hot water, direct sunlight, exercise)

HYDROQUINONE

Dosage form and strength: *Gel, Cream:* 2% and 4%

Indications: Used as a depigmenting agent both in clinical and cosmetic contexts. Melasma, post inflammatory hyperpigmentation.

Contraindications/Precautions: Hypersensitivity, sunburn, use as depilatory drug. Exogenous ochronosis occurs mostly in black skin. Do not apply near eyes, to cut, abraded or sunburned skin, after shaving or using a depilatory agent; or over miliria rubra

Dosage schedule: Local application on pigmented area twice a day or at night.

Adverse effects: Mild skin irritation and sensitization (burning, stinging), dermatitis, dryness, erythema, inflammatory reaction

Patient information: Avoid unnecessary exposure to sunlight.

PSORALENS

Dosage form and strength: *Cream:* 0.1%; *Tablets:* 10 mg

Indications: Vitiligo, psoriasis, cutaneous T cell lymphoma, atopic dermatitis,

lichen planus, urticaria pigmentosa,

Contraindications/Precautions: Immediately before treatments avoid any perfumes, aftershave, deodorants or other cosmetics and toiletries as they may make your skin even more sensitive to the ultra violet light. Ensure your skin is clean and dry by having a plain shower before your treatment. Avoid any other form of artificial ultra violet treatment or relaxation e.g. solarium or sun bed. Avoid sun bathing whilst receiving treatment.

Dosage schedule: Local application at least 30 minutes before UVA or sun exposure usually before 10 am and after 2 pm, because of more UVB exposure during those periods. Oral psoralen used at a dose of 0.5-0.7 mg/kg twice a week, should be taken 2 hours before sun exposure and patient should use black sunglasses on sun exposure. The total amount of UVA reaching the skin at any one time varies widely depending on the season, time of the day, latitude, and conditions of the atmosphere

Adverse effects: Irritation, redness, itching, blistering, nausea

Patient information: Eye protection is very important. UV400 standard eye protection must be worn for 24 hours from time of taking your Psoralen tablets. If eye protection is not worn, permanent damage to your eyes may occur i.e. cataract formation. Be mindful that sunlight, daylight, neon light without diffusers and even light through a window can cause the above to happen, therefore sunglasses should be worn when indoors. Skin and lip protection. Do not expose skin and lips to sunlight or sun lamps for 24 hours after taking the tablets, as you will be more sensitive to sunlight during this period. Avoid sitting near a window as UVA can pass through glass. In sunny conditions use a sun block/high SPF sunscreen, SPF25 or greater, on all light exposed areas of the skin following your treatment.

If your face is unaffected by your skin condition and/or your face is protected during treatment then apply a sun block / high SPF sunscreen after taking the Psoralen tablets. Please make sure all areas of skin are covered e.g. by wearing long sleeved clothing, gloves, enclosed shoes and a wide brimmed hat to protect your skin and head on treatment days. There is a very real risk of burning from the sun, due to your skin being sensitive to the sun's rays.

Section II - Chapter 17

Drugs used in Ophthalmic Disorders

17.1 Antibacterial

Chloramphenicol
Ciprofloxacin
Gentamicin
Levofloxacin
Moxifloxacin
Neomycin
Ofloxacin
Polymyxin B
Tetracycline

17.2 Antiviral

Acyclovir
Ganciclovir
Idoxuridine

17.3 Antifungal

Fluconazole
Natamycin

17.4 Anti-inflammatory

Betamethasone
Dexamethasone
Diclofenac
Fluorometholone
Flurbiprofen
Hydrocortisone
Indomethacin
Ketorolac
Prednisolone

17.5 Antihistamine/Mast cell stabilizers

Ketotifen
Olopatadine
Sodium chromoglycate

17.6 Anti-glaucoma drugs

Acetazolamide
Bimatoprost
Brimonidine
Dorzolamide
Latanoprost
Mannitol
Pilocarpine
Timolol

Travoprost

17.7 Mydriatics

Atropine
Cyclopentolate
Homatropine
Phenylephrine
Tropicamide

17.8 Miscellaneous

Acetylcysteine
Bevacizumab
Bupivacaine
Carbomer
Cyclosporine
Fluorescein sodium
Hypromellose
Liquid paraffin
Polyvinyl alcohol
Sodium chloride
Triamcinolone

17.1 Antibacterial**CHLORAMPHENICOL**

Dosage form and strength: *Eye drops:* 0.5 %, *Eye ointment:* 1%

Indications: Superficial bacterial infection (broad spectrum antibiotics)

Contraindication/Precautions: Hypersensitivity, pregnancy (C), breastfeeding (avoid unless essential, theoretical risk of bone marrow toxicity)

Dosage schedule: *Bacterial conjunctival infection:* Eye drop: 1 drop 4-6 times a day for 5 to 7 days; Eye ointment: apply twice daily. To be applied at night (if eye drops used during the day)

Adverse effects: Transient stinging

CIPROFLOXACIN

Dosage form and strength: *Eye drops:* 0.3%; *Eye ointment:* 0.3%

Indications: Superficial bacterial infections, corneal ulcer

Contraindication/Precautions: Hypersensitivity; concurrent tizanidine administration. Pregnancy category C; avoid wearing contact lens

Dosage schedule:

- *Superficial bacterial eye infection:* Eye drop: Apply 1 drop 4-6 times a day for maximum duration of 5-7 days; Eye ointment: Apply 1.25 cm 3 times a day for 2 days then apply 1.25 cm twice daily for 5 days

- *Corneal ulcer:* Eye drop: given 2 hourly until ulcer heals and titrated according to responses

Adverse effects: Corneal deposits (reversible after completion of treatment), ocular discomfort, ocular hyperemia, taste disturbance, contact dermatitis

Drug and food interactions: Not to be given with tizanidine (α_2 agonist)

GENTAMICIN

Dosage form and strength: *Eye drops:* 0.3%

Indication: Bacterial eye infection

Contraindication/Precautions: Hypersensitivity

Dosage schedule: *Bacterial conjunctival infection:* Apply 1 drop 4-6 times a day, reduce frequency as infection is controlled and continue for 48 hrs after healing; Fortified gentamicin can be used for corneal ulcer

Adverse effects: Transient irritation, burning, itching. Sometimes may result in overgrowth of non-susceptible organism including fungi

LEVOFLOXACIN

Dosage form and strength: *Eye drop:* 0.5%

Dosage schedule: *Bacterial corneal ulcer:* apply every 2 hours for first 2 days (to be applied 8 times a day), then apply 4 times a day for 3 days. Titrated according to response

Adverse effects: Dry eye, corneal deposits, contact dermatitis

MOXIFLOXACIN

Dosage schedule: Same as ofloxacin

NEOMYCIN

Dosage form and strength: *Eye ointment:* eye drops in combination with

steroids and antibiotics

Indication: Superficial infection of eye

Contraindication/Precautions: Hypersensitivity

Adverse effects: Contact conjunctivitis, burning, rash and urticaria

Patient information: Neomycin eye drops should be protected from light

OFLOXACIN

Dosage form and strength: *Eye drop:* 0.3%

Dosage schedule: *Bacterial conjunctivitis/corneal ulcer:* Apply every 2-4 hours for first 2 days then reduce to 4 times a day for maximum 10 days.

POLYMYXIN B

Dosage form and strength: *Eye ointment:* containing polymyxin B sulfate (190,000 units) and bacitracin zinc (500 units/gm)

Indication: Superficial infection of eye, effective for pseudomonas aeruginosa infection for conjunctival and cornea; not given systemically, prophylaxis of infection in ocular surgery

Contraindication/Precautions: Same as neomycin

Dosage schedule: Same as ciprofloxacin

Adverse effects: Irritation and contact dermatitis

TETRACYCLINE

Dosage form and strength: *Eye ointment:* 1%; *Tablet/capsule:* 250 mg or 500 mg

Indications: Superficial bacterial infection of eye, chlamydial infection of eye, trachoma, chemical injury, blepharitis

Contraindication/Precautions: Hypersensitivity. Pregnancy cat (D), lactation, less than 12 years children. Elderly, Topical use may result in overgrowth of non-susceptible organism like fungi, hepatic and renal impairment, SLE

Dosage schedule: Given once or twice a day

Drug and food interaction: With topical corticosteroid, may mask clinical signs of bacterial, fungal or viral infection or may suppress hypersensitivity reactions to antibiotics or any ingredients in formulation

17.2 Antiviral

ACYCLOVIR

Dosage form and strength: *Eye ointment:* 3%, *Tablet:* 400 mg and 800 mg

Indications: Herpes simplex epithelial keratitis and herpes zoster ophthalmicus associated keratitis

Dosage schedule: Ointment to apply 5 times a day for 2 weeks to 3 weeks

Adverse effects: Local burning and stinging, blepharitis, superficial punctate keratitis

Patients information: Can be used in immunocompromised

GANCICLOVIR

Dosage form and strength: *Eye gel:* 0.15%; *Injection:* 500 mg

Indications: Herpes simplex epithelial keratitis, Herpes zoster ophthalmicus, CMV retinitis

Dosage schedule:

- *Herpes simplex virus*: 5 times a day until complete corneal re-epithelization, then 3 times daily for 7 days (usual duration is 21 days);
- *CMV retinitis*: IV 5 mg/kg IV infusion over 1 hour q12 hly for 14-21 days, then maintenance with 1000 mg 3 times a day

Adverse effects: Local irritation and visual disturbance

Patient information: Use with caution in pregnancy and lactation

IDOXURIDINE

Dosage form and strength: *Eye ointment*: 0.5%; *Eye drop*: 0.1%

Indications: HSV keratitis, CMV, varicella zoster

Contraindication/Precautions: Hypersensitivity, do not give steroid with it locally. Use with caution in pregnancy and lactation.

Dosage schedule: 1 drop every hour during day and every 2 hrs at night until the lesions does not stain with fluorescence. Usual duration of treatment is 21 days (for ophthalmic solution). For ointment: q4hrly during day and once before bedtime.

Adverse effects: Local irritation, edema of eyelids, photophobia, superficial punctate keratitis, corneal filaments

17.3 Antifungal**FLUCONAZOLE**

Dosage form and strength: *Eye drop*: 0.3%

Indications: Keratomycosis (fungal keratitis); miconazole can be administered as subconjunctival and intra-vitreous injection for fungal endophthalmitis

Contraindication/Precautions: Hypersensitivity

Dosage schedule: 1 drop instilled on affected eye every 2-4 hours according to severity of infection

Adverse effects: Conjunctival hyperemia and irritation

NATAMYCIN

Dosage form and strength: *Eye drop*: 5%

Indications: All keratitis especially fusarium solani keratitis, aspergillus

Contraindication/Precautions: Hypersensitivity

Dosage schedule: Start with 1 drop instilled in affected eye every 1-2 hours one day 1, reduce the dose to 1 drop in affected eye every 3-4 hourly for 2-3 weeks

Adverse effects: Conjunctival hyperemia and irritation

17.4 Anti-inflammatory**BETAMETHASONE**

Dosage form and strength: *Eye drops*: 0.1%

Indications: Local treatment of severe ocular inflammation, intraocular inflammation, uveitis, endophthalmitis, for post-operative inflammation

Contraindication/Precautions: Same as glucocorticosteroids; acute untreated purulent bacterial, viral and fungal infections. Should be protected from light and stored at temperature <25°C. Patient receiving prolonged therapy, intra-ocular pressure should be checked frequently.

Dosage schedule:

- *Eye drop:* child/adult: apply every 1-2 hour until controlled then decrease frequency;
- *Eye ointment:* child/adult: apply 2-4 times a day alternately apply at night when used in combination with eye drops

Adverse effects: Adrenal suppression following prolonged use in neonates, corneal thinning, scleral thinning, blurred vision, posterior capsular cataract, glaucoma, secondary infection

DEXAMETHASONE

See betamethasone

DICLOFENAC

Dosage form and strength: *Eye drops:* 0.1%

Indications: Inhibits intra-operative miosis during cataract surgery, post-operative inflammation in eye surgery, Seasonal allergic conjunctivitis, mild ocular surface inflammation

Contraindication/Precautions: Hypersensitivity reaction to NSAIDS, HIV keratitis (dendritic). Use with caution in pregnancy, lactation and children. should be protected from light and stored at temperature < 25)

Dosage schedule: For post-op. inflammation: 1 drop 4 times a day for 1-2 weeks

Adverse effects: Ocular irritation, burning, tearing, conjunctival hyperemia, superficial punctate keratitis, retardation of re-epithelialization

FLUOROMETHOLONE

Dosage form and strength: *Eye drops:* 1%

Indications: Local treatment of inflammation (short term)

Dosage schedule: Child/adult: apply 1 drop 2 to 6 hours according to severity of inflammation

Adverse effects: Adrenal suppression following prolonged use in neonates, corneal thinning, scleral thinning

FLURBIPROFEN

Dosage form and strength: *Eye drops:* 0.03%

Indications: Ocular surface inflammation, inhibition of intra-operative miosis during surgery

Contraindication/Precautions: Hypersensitivity reaction to NSAIDS, HSV keratitis (dendritic). Contraindicated in pregnancy; use with caution in lactation and can be used in children

Dosage schedule:

- *Before surgery:* 1 drop every 30 min for 4 times before surgery (max 4 drops).
- *For ocular inflammation control:* 1 drop 4 times a day for 2-4 weeks

Adverse effects: Same as diclofenac like ocular irritation, conjunctival hyperemia, superficial punctate keratitis, etc.

HYDROCORTISONE

Dosage form and strength: *Eye drops:* 1%

Indications: See under betamethasone

Contraindication/Precautions: See under betamethasone

Dosage schedule: Apply thin ribbon of ointment to conjunctival sac every 3-4 hours depending on the severity

Adverse effects: See under betamethasone

INDOMETHACIN

Dosage form and strength: *Tablets:* 25 mg; *Sustained release tablets:* 75 mg

Indications: Cystoid macular degeneration, anterior uveitis, vernal conjunctivitis, prevention of intra-op miosis, episcleritis, scleritis, gastritis, gastric ulcer

Dosage schedule: 25 mg TDS or SR 75 mg OD for 7-10 days

Adverse drug reactions: Corneal changes and deposits, ocular irritation, conjunctival hyperemia, superficial punctate keratitis

KETOROLAC

Dosage form and strength: *Eye drops:* 0.5%; *Tablet:* 10 mg; *Injectable solution:* 15-30 mg/ml

Indications: Superficial ocular surface inflammation, moderate to severe pain, ocular itching associated with seasonal allergic conjunctivitis, prophylaxis and decrease of postoperative ocular inflammation, cystic macular edema

Contraindication/Precautions: Children, lactation, hypersensitivity to aspirin or other NSAIDs, asthma, hypovolemia or dehydration, history of peptic ulcer or coagulation disorders, nasal polyps, angioedema, bronchospasm, labor, moderate to severe renal impairment, cerebrovascular bleeding. Elderly, weight < 50 kg, hepatic dysfunction, heart failure, predisposition to reduced blood volume or renal blood flow, mild renal impairment, monitor renal function closely

Dosage schedule:

• **Ophthalmic (eye drops):**

- *Ocular surface inflammation:* Adult: Instill 1 drop of 0.5% solution 4 times daily into affected eye for 7-10 days
- *Prophylaxis and reduction of postoperative ocular inflammation:* Adult: Instill 1 drop of 0.5% solution into appropriate eye(s) 4 times daily. Continue for 2 weeks
- *Cystoid macular edema:* Adult: Instill 1-2 drops of 0.5% solution into appropriate eye(s) every 6-8 hours and continue for 3-4 weeks
- *Pain and photophobia after incisional refractive surgery:* Adult: Instill 1 drop of 0.5% solution 4 times daily into operative eye for up to 3 days after surgery;

• **Oral:**

- *Moderate to severe pain:* Adult: 10 mg every 4-6 hourly maximum 40 mg/day, maximum duration: 7 days; Elderly: 10 mg every 6-8 hourly; maximum duration: 7 days;

• **Parenteral:**

- *Moderate to severe pain:* Adult: 60 mg single dose intramuscular injection or 30 mg SD intravenous injection. Alternately, 30 mg every 6 hourly IM or IV up to maximum 120 mg daily; half the doses if weight < 50 kg, maximum duration: 2 days. Change to oral therapy as soon as possible; Elderly: 30 mg single dose IM or 15 mg single dose IV. Alternately, 15 mg every 6 hourly

IM or IV up to maximum 60 mg daily

Adverse effects: Gastrointestinal ulcer, bleeding and perforation, drowsiness, rash, bronchospasm, psychosis, dry mouth, fever, bradycardia, chest pain, dizziness, headache, sweating, edema, pallor, liver function changes, transient stinging and local irritation (eye)

PREDNISOLONE

Dosage form and strength: *Eye drops:* 1%

Indication: Anti-inflammatory agent for external as well as intra ocular inflammation, post-operative inflammation.

Contraindication/Precautions: Lactation, old age, children, pregnancy Cat. C, causes less pituitary-adrenal suppression when in single dose in morning or alternate day treatment is given, Potassium, blood glucose, urine glucose should be checked periodically in long term therapy patients, check adrenal function periodically for H-P-A axis suppression, monitor glucose levels, patient's weight and BP

Dosage schedule: 1 drop every 1-2 hour until inflammation is controlled then taper the dose

Adverse effects: Adrenal suppression following prolonged use in neonates, corneal thinning, scleral thinning

17.5 Antihistamines

KETOTIFEN

Dosage form and strength: *Eye drops:* 0.025%

Indications: Allergic conjunctivitis

Contraindication/Precautions: Hypersensitivity, children less than 3 years. Pregnancy C

Dosage schedule: 2 times daily

Adverse effects: Common side effects- punctuate corneal epithelial erosions, transient burning, uncommon side effects- headache, photophobia, dry eyes, subconjunctival hemorrhage.

OLOPATADINE

Dosage form and strength: *Eye drops:* 0.1% and 0.2%

Indications: Allergic conjunctivitis, vernal keratoconjunctivitis

Contraindication/Precautions: Hypersensitivity, children less than 3 years. Pregnancy (C)

Dosage schedule: 2 times (0.1%) daily for maximum 4 months, 0.2% given once daily only

Adverse effects: Ocular-local irritation, hyperemia, non-ocular- headache, rhinitis

SODIUM CHROMOGLYCATE

Dosage form and strength: *Eye drops:* 2% or 4%

Indication: Allergic conjunctivitis, allergic keratoconjunctivitis

Contraindication/Precautions: Hypersensitivity

Precaution: Do not exceed frequency of administration

Dosage schedule: 4 times daily (2%) and 2 times daily (4%)

Adverse effects: Transient burning

17.6 Anti-glaucoma

ACETAZOLAMIDE

Dosage form and strength: *Tablets:* 250 mg; *Injection:* 500 mg

Indication: Open-angle glaucoma, angle-closure glaucoma (preoperatively if surgery delayed)

Contraindication/Precautions: Hypersensitivity to sulfonamide, Stevens Johnson syndrome, severe renal, hepatic disease, electrolyte imbalance, hyperchloremic acidosis, Addison's disease, adrenocortical deficiency, long-term use in non-congestive angle-closure glaucoma. Pregnancy cat C, breast-feeding, hypercalciuria, respiratory acidosis, pulmonary obstruction, emphysema and COPD

Dosage schedule: *Acute attack of angle closure glaucoma:* Adult: PO/IV-500 mg stat followed by 250mg TID or QID

Adverse effects: Seizures, confusion, cholestatic jaundice, metabolic acidosis

Drug and food interaction: Increases action of Amphetamines, Phenytoin, procainamide, quinidine, anticholinergic; Increases toxicity of salicylate and cyclosporine; causes cardiac toxicity if hypokalemia develops with arsenic trioxide, cardiac glycoside, levo methadyl

BIMATOPROST

Dosage form and strength: *Eye drop:* 0.01% or 0.03%

Indication: Open angle glaucoma or ocular HTN, Hypotrichosis of eyelashes

Contraindication/Precautions: Hypersensitivity, children <16 years. Aphakia and pseudoaphakia patients with torn posterior lens capsule, pt. with known risk factors for macular edema, active intraocular inflammation (E.g. uveitis), Pregnancy cat C, lactation

Dosage schedule: 1 drop in affected eye OD evening

Adverse effects: Ocular – Dryness, burning, foreign body sensation, pain, irritation, visual disturbance, increased iris pigmentation, blepharitis, pigmentation of periocular skin, cataract, eyelash darkening, eye discharge, tearing, photophobia, superficial punctuate keratitis, allergic conjunctivitis, conjunctival edema, hypertrichosis, macular edema.

BRIMONIDINE

Dosage form and strength: *Eye drop:* 0.1%, 0.15% and 0.2%

Indications: IOP lowering drug with increase in optic nerve head perfusion in normo tension glaucoma and low tension glaucoma.

Contraindication/Precautions: Known hypersensitivity, severe cardiovascular disease. Special precaution in case of hypertensive patients, coronary and cerebral insufficiency, hepatic and renal impairment; Pregnancy, lactation; safety not established in children. In patients using contact lenses, they should wait for 15 mins after instilling brimonidine eye drops before putting on lenses

Dosage schedule: 1 drop twice daily

Adverse effects: Ocular side effects: conjunctival blending, eyelid retraction, discomfort, burning, itching and dryness of eye. Occasionally, causes ocular allergy leading to blepharoconjunctivitis. Systemic side effects: dry mouth, dry nose, may cause headache, chest heaviness, fatigue and lethargy

DORZOLAMIDE**Dosage form and strength:** *Eye drops:* 2%**Indication:** Elevated intraocular pressure and ocular hypertension and open-angle glaucoma**Contraindication/Precautions:** Hypersensitivity to sulfonamides, hepatic, renal disease, angle-closure glaucoma, electrolyte disturbance. Notify immediately if vision change occurs or if condition worsens**Dosage schedule:** Instill 1 drop of a 2% solution into the affected eye TDS**Adverse effects:** Headache, blurred vision, tearing, allergy, burning/stinging, photophobia, corneal epithelial toxicity**Drug and food interaction:** Increased effects of carbonic anhydrase inhibitors, salicylate**LATANOPROST****Dosage form and strength:** *Eye drops:* 0.005%**Indication:** Open angle glaucoma, ocular hypertension and who don't respond to other IOP lowering agents**Contraindication/Precautions:** Hypersensitivity, eye infection, renal/hepatic function impairment, angle closure glaucoma, children, Pregnancy cat. C, lactating mother and aphakia, intra ocular inflammation**Dosage schedule:** Instill 1 drop in each affected eye (conjunctival sac) every night**Adverse effects:** Ocular- conjunctival hyperemia, iris color change (brown pigmentation), ocular pruritis, xerophthalmia, visual disturbance, irritation, burning, foreign body sensation, blepharitis, pain, cataract and superficial punctuate keratitis; Non-ocular- rash**MANNITOL****Dosage form and strength:** 20% infusion**Indications:** Reduce elevated IOP**Contraindication/Precautions:** Anuria, severe renal disease, pulmonary edema, intracranial bleeding, heart failure, dehydration**Precautions:** Pregnancy (C); use with caution in lactation and age > 65 years, CCF, Hypertension**Dosage schedule:** 1-2 g/kg or 5ml/kg IV infused over 30-60 minutes can be given 4 times/day**Adverse effects:** Renal impairment, dehydration, pulmonary edema, heart failure, hyponatremia, hemodilution and headache**PILOCARPINE****Dosage form and strength:** *Eye drops:* 1%, 2% and 4%**Indications:** Acute-angle-closure glaucoma, open angle glaucoma**Contraindication/Precautions:** Avoid in patients with nuclear and subcapsular cataract neovascular and uveitis glaucoma, history of asthma and retinal detachment, iritis, uveitis and infection of anterior segment. Use with caution in pregnancy and lactation**Dosage schedule:** 1 drop 4 times a day**Adverse effects:** *Local side effects:* accommodative spasm, miosis, follicular conjunctivitis, band keratopathy, allergic blepharokeratopathy, retinal detachment. *Systemic side effects (minimized by punctal occlusion):*

headache, nausea and vomiting, salivation, bronchial spasm and muscular weakness

TIMOLOL

Dosage form and strength: *Eye drops:* 0.25% and 0.5%

Indication: Open angle glaucoma, angle closure glaucoma, prophylactic treatment for lowering the IOP after cataract surgery

Contraindication/Precautions: Hypersensitivity; bronchial asthma, COPD; caution in patients with DM, thyroid disorders, respiratory disease and diminished myocardial contractility, not recommended in children and safety not established in pregnancy

Dosage schedule: 1 drop twice daily

Adverse drug reaction: Allergic reactions (itching), conjunctivitis, keratitis, bradycardia, heart block cardiac failure

TRAVOPROST

Dosage form and strength: *Eye drop:* 0.004%

Indications: Reduction of elevated IOP in patients with open angle glaucoma or ocular HTN

Contraindication/Precautions: Hypersensitivity, ocular inflammation

Adverse drug effects: Ocular: hyperemia, conjunctival hyperemia, decreased visual acuity, eye discomfort, foreign body sensation, pain, pruritus, abnormal vision, blepharitis, blurred vision, cataract, corneal staining, dry eyes, photophobia, keratitis, sub-conjunctival hemorrhage and tearing, lid margin crusting. Non-ocular: allergy, angina pectoris, anxiety, arthritis back pain, bradycardia, bronchitis, cold/flu syndrome, depression, dyspepsia, GI disorder, headache, hypercholesterolemia, HTN as well as hypotension

17.7 Mydriatics

ATROPINE

Dosage form and strength: *Eye drops:* 1%, *Eye ointment:* 1%

Indication: Cycloplegic refraction in children, cyclospasm, neovascular glaucoma

Contraindication/Precautions: Angle closure glaucoma, hypersensitivity

Dosage schedule: 1 drop up to 3 times daily

Adverse effects: Local irritation, raised IOP, dermatitis, systemic effects-flushing, dryness of skin, blurred vision

CYCLOPHENOLATE

Dosage form and strength: *Eye drops:* 1%

Indication: Same as atropine

Contraindication/Precautions: Same as atropine

Dosage schedule: 1 drop in every 5-10 minutes, not to exceed maximum 3 times for cycloplegic refraction

Adverse effects: Same as atropine

HOMATROPINE

Dosage form and strength: *Eye drops:* 1% and 2%

Indication: Same as atropine

Contraindication/Precautions: Same as atropine

Dosage schedule: 1 drop twice to thrice daily

PHENYLEPHRINE

Dosage form and strength: *Eye drops:* 2.5% - 10%

Indication: Uveitis to prevent posterior synechia, mydriatics

Contraindication/Precautions: Angle closure glaucoma. Hypertension, cardiac disorders, diabetes mellitus, children and elderly

Adverse effects: Burning eye pain, blurred vision, allergic conjunctivitis or dermatitis and systemic sympathomimetic effects

TROPICAMIDE

Dosage form and strength: *Eye drops:* 1%

Indication: Refraction procedure, mydriasis for fundus evaluation, corneal ulcer, uveitis

Contraindication/Precautions: Angle closure glaucoma. Store at 8-15°C

Dosage schedule: 1 drop every 5-10 minutes three times for fundus evaluation; 1 drop three times for therapeutic purpose

Adverse effects: Increased IOP, burning, photophobia, allergic reactions and systemic effects

17.8 Miscellaneous

ACETYL CYSTEINE

Dosage form and strength: *Eye drops:* 5%

Indication: Dry eye, usually used together with hypromellose which soothes and lubricates the surface of eye, dry eye

Dosage schedule: Instill 1 drop 3-4 times a day and as required

Adverse effects: Temporary blurring of vision

BEVACIZUMAB

Dosage form and strength: *Injection:* 25 mg/ml

Indications: Choroidal neovascularization in age-related macular degeneration, macular edema secondary to central retinal vein occlusion, diabetic macular edema

Contraindication/Precautions: Ocular and peri-ocular infection, signs of irreversible ischemic visual function loss in patients with retinal vein occlusion, diabetic patients with HbA_{1c}>12%, history of strokes and TIA, proliferative diabetic retinopathy, retinal detachment or macular hole (discontinue if primary retinal detachment), uncontrolled hypertension

Dosage schedule: 1.25 mg by intra-vitreous injection repeated after 4-6 weeks.

Adverse effects: Transient rise in IOP, acute intra-ocular inflammation (sterile endophthalmitis), bacterial endophthalmitis, iridocyclitis, conjunctivitis, superficial punctate keratitis, cataract, retinal disorders

BUPIVACAINE

Dosage form and strength: *Injectable solution:* 0.25%, 0.5% and 0.75%

Indications: Local anaesthesia

Contraindication/Precautions: Hypersensitivity, history of malignant hyperthermia, hepatic impairment

Dosage schedule: 0.5% infiltrated

CARBOMER

Dosage form and strength: *Eye drops:* 0.2%; *Eye gel:* 0.35%

Indication: Dry eyes including keratoconjunctivitis, unstable tear film

Dosage schedule: Apply 3-4 times a day or when required

Patient information: Remove contact lens before use, don't touch the tip of the vial

CYCLOSPORINE

Dosage form and strength: *Ophthalmic emulsion:* 0.05%

Indication: Corneal melting associated with auto immune disease, prevention of graft rejection, keratoconjunctivitis (Vernal and HSV stromal keratitis), corneal graft rejection, dry eye, ocular surface disorder

Contraindication/Precautions: Hypersensitivity

Dosage schedule: Keratoconjunctivitis: 1 drop two times a day approximately 12 hours apart in each eye may be used with artificial tears; allow 15 minutes interval between products

Adverse effects: Ocular burning, conjunctival hyperemia, discharge, peripheral, eye pain, pruritus, foreign body sensation

FLUORESCEIN SODIUM

Dosage form and strength: *Eye drops:* 1%, 2% and 4%

Indication: Diagnostic staining, ophthalmic angiography

Contraindication/Precautions: Protect from light

HYPROMELLOSE

Dosage form and strength: *Eye drops:* 0.3%

Indication: Dry eye, moisten hardened contact lens

Contraindication/Precautions: Hypersensitivity. The product contains Benzalkonium chloride (which discolors soft contact lens), so shouldn't be used with soft contact lenses

Dosage schedule: Put 1 drop 3-4 times a day as required. May be needed to be used more frequently eg hourly

Adverse effects: Eye irritation, blurred vision, stickiness of eye lashes

Patient information: Remove contact lens prior to application and wait at least 15 min before reinserting, if irritation of eye persists or headache, eye pain, vision change occurs, discontinue and consult a physician

LIQUID PARAFFIN

Dosage form and strength: *Eye ointment:* 0.12 Fl oz

Indications: Dry eyes, particularly used at night as ointment, can be used in recurrent epithelial erosion- stays for longer period of time

Contraindication/Precautions: Hypersensitivity. Shouldn't be used while wearing contact lens. If other eye drops are being used, then apply them first then wait for at least 5 minutes before applying eye ointment

Dosage schedule: Usually applied at bed time

Adverse effects: Irritation, burning, stinging of eye, temporary blurring of vision after application

POLYVINYL ALCOHOL

Dosage form and strength: *Eye drops:* 1.4%

Indication: Tear deficiency (increase persistence of tear film and useful when ocular surface mucin decreased)

Contraindication/Precautions: with concomitant droxidopa or MAOI or furazolidone in last 14 days

Dosage schedule: Child/adult- apply as required

Adverse effects: See under hypromellose

SODIUM CHLORIDE

Dosage form and strength: *Eye drops:* 5%

Indication: short term relief of corneal edema, can be used as comfort drops by contact lens users to facilitate lens removal, tear deficiency, bullous keratopathy

Dosage schedule: Apply as required

Adverse effects: Eye discomfort, burning, redness, temporary blurred vision

Contraindication/Precautions: Hypersensitivity

Patient information: Remove contact lens; do not touch the tip of the vial

TRIAMCINOLONE

Dosage form and strength: *Injectable suspension:* 4 mg/0.05 ml or 4 mg/0.1 ml

Indication: Sympathetic ophthalmia, temporal arteritis, uveitis and ocular inflammatory conditions unresponsive to ophthalmic corticosteroids, hemangioma, chalazion, macular edema

Contraindication/Precautions: Hypersensitivity, not for intravenous administration. Prolonged use may produce posterior subcapsular cataracts, glaucoma with possible damage to optic nerves and may increase risk of secondary infections due to fungi or viruses and other opportunistic infections. Endophthalmitis: proper aseptic techniques is the must while administering triamcinolone acetonide, Caution advised in lactation, distributed in breast milk, Pregnancy category (D)

Adverse effects: Abnormal sensation in eye, anterior chamber cells, cataract, conjunctival hemorrhage, exophthalmos, eye irritation, eye pain, eye pruritus, foreign body sensation in eyes, glaucoma, increased intraocular pressure, injection site hemorrhage, increase in lacrimation, vitreous detachment, vitreous floaters, secondary intraocular infection.

Section II - Chapter 18

Drugs used in Ear, Nose and Throat Disorders

18.1 Drugs used in ear disorders

18.1.1 Local medications

18.1.1.1 Antibacterial

Chloramphenicol
Ciprofloxacin
Gentamicin
Ofloxacin

18.1.1.2 Antifungals

Clotrimazole

18.1.1.3 Mixed topical

Chloramphenicol with Dexamethasone
Ciprofloxacin with Hydrocortisone
Neomycin with Polymixin with Hydrocortisone
Tobramycin with Dexamethasone

18.1.1.4 Steroids

Betamethasone
Dexamethasone
Prednisolone

18.1.1.5 Wax softener (cerumenolytic)

Almond oil
Sodium bicarbonate

18.1.1.6 Others

Ichthammol in glycerin (IG) pack

18.1.2 Systemic medications

18.1.2.1 Antibacterial

Amoxicillin
Amoxicillin + clavulanic acid
Azithromycin
Cefixime
Ceftazidime
Ceftriaxone
Chloramphenicol
Ciprofloxacin
Clarithromycin
Flucloxacillin
Gentamicin
Piperacillin + Tazobactam

18.1.2.2 Anti-vertigo

18.1.2.2.1 Acute stage

Diazepam
Prochlorperazine

18.1.2.2.2 Chronic stage

Betahistine
Cinnarizine

18.1.2.3 Steroids

Prednisolone
Dexamethasone
Methylprednisolone

18.2 Drugs used in nose disorders**18.2.1 Local medications****18.2.1.1 Antibiotic ointment**

Mupirocin

18.2.1.2 Anticholinergics

Ipratopium bromide

18.2.1.3 Chemical cautery

Chromic acid
Silver nitrate

18.2.1.4 Local anaesthetic

Lidocaine

18.2.1.5 Mast cell stabilizers

Sodium cromoglycate

18.2.1.6 Mixed topical

Neomycin with Betamethasone

18.2.1.7 Nasal decongestants

Oxymetazoline
Xylometazoline

18.2.1.8 Steroids

Beclomethasone
Betamethasone
Fluticasone
Mometasone

18.2.1.9 Others

Glucose in glycerine

18.2.2 Systemic medications**18.2.2.1 Antibiotics**

Amoxicillin + Clavulanic acid
Dapsone
Doxycycline
Flucloxacillin
Rifampicin
Ampicillin
Co-trimoxazole

18.2.2.2 Antihistamines

Cetirizine
Desloratadine
Ebastine
Fexofenadine
Levocetirizine
Loratadine

18.2.2.3. Oral corticosteroids**18.2.2.4 Systemic antifungals**

Amphoterecin B

18.2.2.5 Others

Tranexamic acid

Turpentine oil

18.3 Drugs used in throat disorders

18.3.1 Local medications

Amphotericin B

Benzalkonium chloride (0.2%) + Choline salicylates (9%)

Chlorhexidine

Chlorhexidine + Clotrimazole + Lidocaine + Metronidazole

Clotrimazole

Fluticasone

Hydrocortisone

Hydrogen Peroxide

Lidocaine

Mometasone

Povidone iodine

18.3.2 Systemic medications

18.3.2.1 Antibacterials

Amoxicillin

Amoxicillin + Clavulanic acid

Azithromycin

Benzyl penicillin

Cefdinir

Cefuroxime axetil

Ceftriaxone

Clarithromycin

Clindamycin

Diphtheria antitoxin

Erythromycin

Levofloxacin

Penicillin V

18.3.2.2 Antivirals

Acyclovir

Valacyclovir

18.3.2.3 Antifungal

Fluconazole

Itraconazole

Ketoconazole

18.3.2.4 Others

Acetaminophen

Dexamethasone

Pantoprazole

Prednisolone

18.1 Drugs used in ear disorders

18.1.1 Local medications

18.1.1.1 Antibacterial: see under antibacterial in section: drugs used in infection

CHLORAMPHENICOL

Dosage form and strength: Solution (ear drop): 5%

Indications: Bacterial infection in otitis externa

Contraindication/Precautions: Avoid prolonged use

Dosage schedule: Intra-aural: 2–3 drops in affected ear, 2–3 times a day

Adverse effects: Rash, headache

Also see under section 17.1 in Drugs acting on eyes, Chapter 17

CIPROFLOXACIN

Dosage form and strength: Solution (eye/ear drops): 0.3%

Indications: Bacterial infection in otitis externa

Dosage schedule: Intra-aural: 2–3 drops in affected ear, 2 times a day for 7 days

Adverse effects: Local sensitivity

Also see under section 17.1 in Drugs acting on eyes, Chapter 17

GENTAMICIN

Dosage form and strength: Solution (ear drop): 0.3%

Indications: Chronic suppurative otitis media with perforated tympanic membranes

Contraindications/Precautions: Patent grommet, perforated tympanic membrane. Avoid prolonged use

Dosage schedule: Intra aural: 2–3 drops in the affected ear 4–5 times a day (including a dose at bedtime)

Adverse effects: Local sensitivity

Also see under section 17.1 in Drugs acting on eyes, Chapter 17

OFLOXACIN

Dosage form and strength: Solution (ear drop): 0.3%

Indications: Chronic suppurative otitis media with perforated tympanic membranes, otitis externa

Contraindications/Precautions: Hypersensitivity.

Dosage schedule: CSOM with perforated tympanic membranes intra aural: 10 drops 2 times a day in affected ear for 14 days otitis externa: 10 drops 2 times a day in the affected ear for 7 days

Adverse effects: Local sensitivity, taste perversion, pruritus, dizziness, vertigo

Also see under section 17.1 in Drugs acting on eyes, Chapter 17

18.1.1.2. Antifungals

CLOTRIMAZOLE

Dosage form and strength: 10 mg/1 ml

Indications: Fungal infection in otitis externa

Dosage schedule: Intraaural: 2-3 drops in the affected ear 2-3 times a day continue for at least 14 days after disappearance of infection

Adverse effects: Local irritation, local sensitivity

Also see under drugs used in infection

18.1.1.3. Mixed topical

The properties listed below are those particular to the combination only.

CHLORAMPHENICOL with DEXAMETHASONE

Dosage form and strength: *Suspension:* Chloramphenicol 1%, Dexamethasone 0.1%

Indications: Chronic suppurative otitis media

Dosage schedule: Intraaural: 2-3 drops in the affected ear 2-3 times a day for 7-10 days.

Also see under section in drugs used in infection

CIPROFLOXACIN with HYDROCORTISONE

Dosage form and strength: *Suspension:* ciprofloxacin 0.2%, Hydrocortisone 1%

Indications: Chronic suppurative otitis media

Dosage schedule: Intraaural: 2-3 drops in the affected ear 2-3 times a day for 7-10 days.

Also see under section in drugs used in infection

NEOMYCIN with POLYMYXIN with HYDROCORTISONE

Dosage form and strength: Dexamethasone 1 mg/g, Neomycin sulfate: 3500 unit/g, Polymyxin B sulfate 6000 unit/g

Indications: Chronic suppurative otitis media

Dosage schedule: Intraaural: 2-3 drops in the affected ear 2-3 times a day for 7-10 days.

Also see under section in drugs used in infection

TOBRAMYCIN with DEXAMETHASONE

Dosage form and strength: Dexamethasone 1 mg/ml, Tobramycin 3 mg/ml

Indications: Chronic suppurative otitis media

Dosage schedule: Intraaural: 2-3 drops in the affected ear, 2-3 times a day for 7-10 days.

Also see under section in drugs used in infection

18.1.1.4 Steroids

BETAMETHASONE: Also see under section 17.4. Anti-inflammatory, Drugs acting on eyes, Chapter 17

Dosage form and strength: *Solution (ear/nasal drops):* 0.1%

Indications: Eczematous inflammation in otitis externa

Contraindications/Precautions: Untreated infection. Avoid prolonged use.

Dosage schedule: Intra-aural: 2-3 drops in the affected ear 2-3 times a day, reduce frequency when relief attained

DEXAMETHASONE

Dosage form and strength: *Solution:* 0.1%

Indications: Eczematous inflammation in otitis externa

Contraindications/Precautions: Untreated infection. Avoid prolonged use

Dosage schedule: Intra-aural: 2-3 drops in the affected ear 2-3 times a day, reduce frequency when relief attained

Also see under section 17.4. Anti-inflammatory, Drugs acting on eyes, Chapter 17

PREDNISOLONE: Also see under section 17.4. Anti-inflammatory, Drugs acting on eyes, Chapter 17

Dosage form and strength: *Solution (drops):* 1%

Indications: Eczematous inflammation in otitis externa, adenoid hypertrophy

Dosage schedule: Intra-aural: 2-3 drops in the affected ear 2-3 times a day, reduce frequency when relief attained

18.1.1.6. Wax Softeners (*ceruminolytic*)

ALMOND OIL

Dosage form and strength: 1 ml of almond oil

Indications: Soften dry or hardened ear wax and for ear wax removal

Contraindication/Precautions: CSOM, perforation of tympanic membrane. Allow drops to warm to room temperature before use.

Dosage schedule: Intraaural: Use 3-4 drops twice daily for 3-5 days. The patient should lie with the affected ear up for 5-10 minutes after the oil has been introduced into the ear

SODIUM BICARBONATE

Dosage form and strength: *Solution (drop):* 50 mg/ml (5% ear drop)

Indications: Soften dry or hardened ear wax and for ear wax removal

Dosage schedule: Intraaural: Use 3-4 drops twice daily for 3-5 days. Allow the solution to remain in the ear for 5-10 minutes.

Adverse effects: Dryness of the ear canal

18.1.1.6. Others

ICHTHAMMOL IN GLYCERINE PACK

Dosage form and strength: 10 % Ichthammol in glycerin pack

Indications: Acute otitis externa, diffuse otitis externa

Contraindication/Precautions: allergic to glycerin and topical medicine, for external use only, use cautiously in pregnancy. Don't use in broken skin. Store below 25°C.

Dosage schedule: Intraaural: soaked thin ribbon gauze is to be placed for 24-48 hrs.

18.1.2 Systemic medications

18.1.2.1 Antibacterial

AMOXICILLIN

Indications: Otitis media, sinusitis

Dosage schedule: Oral, Child (1–11 months): 125 mg 3 times a day; increased if necessary up to 30 mg/kg 3 times a day. Child (1–4 years): 250 mg 3 times a day; increased if necessary up to 30 mg/kg 3 times a day. Child (5–11 years): 500 mg 3 times a day; increased if necessary up to 30 mg/kg 3 times a day (max. Per dose 1 g). 12 years and above: 500 mg 3 times a day; increased if necessary up to 1 g 3 times a day, use increased dose in severe infections

AMOXICILLIN with CLAVULANIC ACID

See under drugs used in infections

AZITHROMYCIN

Indications: Otitis media, sinusitis (beta lactamase producing strains of H. influenza and M catarrhalis).

Dosage schedule: Oral, adult: 2000 mg (2 extended release tablet) 2 times a day for 10 days

CEFIXIME

See under drugs used in infections

CEFTAZIDIME

Dosage form and strength: Powder: 250 mg, 500 mg, 1 gm to be reconstituted

Indications: Perichondritis

Dosage schedule: Intravenous, adult: 1–2 gm in 2 divided doses in a day (along with aminoglycosides), for 6–8 weeks.

CEFTRIAZONE

CHLORAMPHENICOL

CIPROFLOXACIN

CLARITHROMYCIN

FLUCLOXACILLIN

GENTAMICIN

PIERACILLIN/TAZOBACTAM

See under drugs used in infections

18.1.2.2. Anti-vertigo

18.1.2.2.1 Acute stage

DIAZEPAM

Dosage form and strength: Solution: 5 mg/ml

Indications: Acute vertigo not controlled with other conventional anti vertigo drugs.

Contraindications/Precautions: See under section 7.1 Anticonvulsants

Dosage schedule: Intravenous, adult: 5-10 mg (as needed), maximum dose 30 mg.

Also see under section 7.1 Anticonvulsants, Drugs Acting on Central Nervous System, Chapter 7

PROCHLORPERAZINE

Dosage form and strength: *Tablet:* 5 mg

Indications: Acute vertigo

Dosage schedule: Oral: 5 mg during acute phase, can be given 3 times a day, usually not recommended for more than a week.

Also see under section 1.4 Antiemetic in Drugs Acting on Gastrointestinal System, Chapter 1

18.1.2.2.2 Chronic stage

BETAHISTINE

Dosage form: *Tablet:* 8 mg.

Indications: Ménière's disease.

Contraindications/Precautions: Pheochromocytoma. Use with caution asthma, history peptic ulcer. Not recommended in children. Pregnancy: avoid, unless clearly necessary. In lactation and elderly, use with caution.

Dosage schedule: Oral, adult: Initially 16 mg 3 times daily, preferably with food; maintenance 24- 48 mg daily.

Adverse effects: Gastrointestinal disturbances, headache, pruritus, rashes.

CINNARIZINE

Dosage form: *Tablet:* 25 mg, 75 mg.

Indications: Relief of symptoms of vestibular disorders, such as vertigo, tinnitus, nausea, and vomiting in Ménière's disease, motion sickness

Contraindications/Precautions: Avoid in acute porphyria, neonate, pregnancy, severe liver disease (increased risk of coma). Use with caution renal impairment, epilepsy, glaucoma (in children), Parkinson's disease (in adults), prostatic hypertrophy (in adults), pyloroduodenal obstruction, susceptibility to angle closure glaucoma (in adults), urinary retention.

Dosage schedule:

- *Relief of symptoms of vestibular disorders in Ménière's disease:* oral, 12 years and above: 25 mg 3 times a day, up to 5-7 days or unless indicated.
- *Motion sickness:* oral, child (5-11 years): Initially 15 mg, dose to be taken 2 hours before travel, then 7.5 mg every 8 hours if required, dose to be taken during journey. 12 years and above: Initially 30 mg, dose to be taken 2 hours before travel, then 15 mg every 8 hours if required, dose to be taken during journey.

Adverse effects: Drowsiness, although paradoxical stimulation (especially with high doses in children), anaphylaxis, angioedema, angle-closure glaucoma, arrhythmias, blood disorders, bronchospasm, confusion, convulsions, depression, dizziness, extrapyramidal effects, hypersensitivity reactions, hypotension, lichen planus, liver dysfunction, lupus-like skin reactions, palpitation, photosensitivity reactions, rashes, sleep disturbances,

sweating, tremor, weight gain, antimuscarinic effects, blurred vision, dry mouth, gastro-intestinal disturbances, headache, psychomotor impairment, urinary retention. Children and elderly are more susceptible to side effects.

18.1.2.3. Steroids

DEXAMETHASONE

Dosage form and strength: *Solution:* 4 mg/ 1 ml

Indications: Sudden sensorineural hearing loss

Dosage schedule: Intratympanic: 0.5 ml

Also see under section 11.1 Adrenal hormones and synthetic substituents in Drugs used in Endocrine diseases, Chapter 11

METHYLPREDNISOLONE

Dosage form and strength: *Solution:* 4 mg/ 1 ml, 2 mg/ 1ml

Indications: Vestibular neuronitis, sudden sensorineural hearing loss

Dosage schedule:

- *Vestibular neuronitis:* oral: 1 mg/kg/day in 2 divided doses for 5 days then taper.
- *Sudden sensorineural hearing loss:* intravenous, adult: 500 mg every 12 hourly for 3 days then oral: 1 mg/kg/day in 2 divided doses for 5 days then taper.

Also see under section 11.1 Adrenal hormones and synthetic substituents in Drugs used in Endocrine diseases, Chapter 11

PREDNISOLONE

Dosage form and strength: *Tablets:* 5 mg, 10 mg, 20 mg

Indications: Bell's palsy, sudden sensorineural hearing loss, Ramsay-Hunt syndrome, vestibular neuronitis

Dosage schedule:

- *Bell's palsy:* oral, adult: 1 mg/kg/day for 5 days to 3 weeks depending on the patients progression then taper in every 5 days.
- *Sudden sensorineural hearing loss:* oral, adult: 1 mg/kg/day for 10-15 days.
- *Ramsay-Hunt syndrome:* oral, adult: 1 mg/kg for 14 days, followed by a declining dose of 5 mg/ day in every 5 days

Also see under section 11.1 Adrenal hormones and synthetic substituents in Drugs used in Endocrine diseases, Chapter 11

18.2 Drugs used in nose disorders

18.2.1 Local medications

18.2.1.1. Antibiotic

MUPIROCIN

Dosage form and strength: *Ointment:* 20 mg/gram

Indications: For eradication of nasal carriage of staphylococci, including methicillin-resistant *Staphylococcus aureus* (MRSA)

Dosage schedule: intranasal: 2–3 times a day for 5 days; a sample should be

taken 2 days after treatment to confirm eradication. Course may be repeated if sample remains to be positive

18.2.1.2 Anti-cholinergics

IPRATOPIMUM BROMIDE

Dosage form and strength: *Metered spray:* 21 mcg/ dose (puffs)

Indication: Intrinsic rhinitis

Contraindications/Precautions: Avoid spraying near eyes, bladder outflow obstruction, cystic fibrosis, prostatic hyperplasia (in adults), risk of glaucoma (in children), susceptibility to angle-closure glaucoma (in adults)

Dosage schedule: Intranasal, >12yrs of age: 2 spray, 2–3 times a day, dose to be sprayed into each nostril

Adverse effects: Epistaxis, nasal dryness, nasal irritation, headache, nausea, pharyngitis (in children), headache, nausea, burning/stinging sensation, pain pruritis, rashes.

Also see under Ipratropium Bromide, in section- 6.1.1. in Drugs used in respiratory system, Chapter 6

18.2.1.3 Chemical cautery

CHROMIC ACID

Dosage form and strength: *Solution:* 40%

Indications: Epistaxis, cauterization of granulation tissue.

Dosage schedule: Local application: as required.

SILVER NITRATE

Dosage form and strength: *Solution:* 10%, 25%, 50%

Indications: Epistaxis, cauterization of granulation tissues.

Dosage schedule: Local application: as required.

18.2.1.4 Local anaesthetic

LIDOCAINE

Dosage form and strength: *Solution:* 4%; *Gel:* 4%; *Spray:* 10%.

Indication: Local anesthesia

Dosage schedule: Local application: adult: apply as required, then rub sparingly and gently on affected areas.

See under Local anesthetics in section 8.2, Drugs used in anesthesia and critical care Chapter 8

18.2.1.5 Mast cell stabilizer

SODIUM CROMOGLYCATE

Dosage form and strength: *Solution:* 2%

Indication: Prophylaxis of allergic rhinitis

Dosage schedule: Intranasal drops: 2-3 drops 2-4 times a day, to be administered into each nostril

Adverse effects: Local irritation and transient bronchospasm

Also see under section 7.1.5. Mast cell stabilizers in Drugs used in respiratory system, Chapter 6

18.2.1.6 Mixed topical

The properties listed below are those particular to the combination only.

NEOMYCIN WITH BETAMETHASONE

Dosage form and strength: *Solution (drop):* Neomycin sulfate: 5 mg/ 1 mL, Betamethasone sodium phosphate: 1 mg/ 1 mL

Indication: Nasal infection

Dosage schedule: Intranasal: 2–3 drops into each nostril 2–3 times a day.

18.2.1.7 Nasal decongestants

OXYMETAZOLINE

Dosage form and strength: *Solution:* 0.05%, 0.025%

Indications: Acute rhinitis

Contraindications/Precautions: Hyperthyroidism, heart disease/hypertension, diabetes, pregnancy, lactation, elderly, children <3 months of age, glaucoma, dysuria

Dosage schedule:

- *Intranasal drop, adult (0.05%):* 2–3 drops into each nostril 2–3 times daily or when required, maximum duration 7 days.
- *Intranasal drop, child >3 months (0.025%):* 1–2 drops into each nostril twice daily maximum duration 7 days.

Adverse effects: Local burning, sneezing, dryness of mouth; prolonged use-rebound congestion, insomnia, headache, nausea, dizziness, palpitations, high BP, tachycardia, arrhythmias

Drug and food interaction: Monoamine oxidase inhibitors

XYLOMETAZOLINE

Dosage form and strength: *Solution:* 0.1%, 0.05%

Indication: Nasal congestion

Contraindications/Precautions: Avoid in hyperthyroidism, heart disease, hypertension, diabetes. Use with caution in pregnancy, lactation, elderly, children, glaucoma, urinary difficulty

Dosage schedule:

- *Intranasal drop, adult (0.1%):* 1–2 drop in each nostril, 1–2 times a day for maximum duration of 7 days.
- *Intranasal drop, children >6 years of age (0.1%):* 2–3 drops in each nostril, 2–3 times a day as required, for maximum duration of 7 days

Adverse effects: Local burning, sneezing, dryness of mouth; prolonged use-rebound congestion, insomnia, headache, nausea, dizziness, palpitations, high BP, tachycardia, arrhythmias

Drug and food interaction: MAO inhibitors

18.2.1.8 Steroids

BECLOMETHASONE

Dosage form and strength: *Aerosol:* 50 mcg/puff

Indication: symptomatic management of allergic rhinitis

Dosage schedule: intranasal: 1- 2 spray 1-2 times a day until the symptoms subside.

Also see under Section 6.1.3.1. Inhaled corticosteroids in Drugs used in respiratory system, Chapter 6

BETAMETHASONE

Dosage form and strength: *Aerosol:* 0.1%

Indication: Symptomatic management of allergic rhinitis

Dosage schedule: Intranasal: 1-2 spray, 1-2 times a day until the symptoms subside

Also see under Section 11.1 Adrenal hormones and synthetic substituents in Drugs used in Endocrine diseases, Chapter 11

FLUTICASONE

Dosage form and strength: *Aerosol:* 50 mcg/puff

Indication: symptomatic management of allergic rhinitis

Dosage schedule: intranasal: 1-2 spray, 1-2 times a day until the symptoms subside

Also see under Fluticasone in section 16.5 Inflammatory Skin Infections in Drugs used in skin conditions, Chapter 16

MOMETASONE

Dosage form and strength: *Aerosol:* 50 mcg/puff

Indication: symptomatic management of allergic rhinitis

Dosage schedule: intranasal: 1-2 spray, 1-2 times a day until the symptoms subside

Also see under Mometasone in section 16.5 Inflammatory Skin Infections in Drugs used in skin conditions, Chapter 16

18.2.1.1 Others

GLUCOSE IN GLYCERINE

Dosage form and strength: *Solution:* 25%

Indications: Atrophic rhinitis

Dosage schedule: Cotton swab dipped in glucose 25% in glycerine and apply in bilateral nasal cavity for 1 month twice daily, when improved continue once daily dosing for life or until the underlying cause is treated.

18.2.2. Systemic medications

18.2.2.1 Antibiotics

The following antibiotics are commonly used in infections of nose. See under Drugs used in infections (Chapter 10).

AMOXICILLIN + CLAVULANIC ACID

Also see under drugs used in infection

DAPSONE

Also see under drugs used in infection

Indication: nasal leprosy and preventing recurrence of rhinosporidiosis

DOXYCYCLINE**FLUCLOXACILLIN****RIFAMPICIN**

See under drugs used in infections

AMPICILLIN

Indication: Rhinoscleroma

Also see under drugs used in infections

CO-TRIMOXAZOLE

Indication: Rhinoscleroma

Also see under drugs used in infections

18.2.2.2 Antihistamines**CETIRIZINE**

Dosage form and strength: *Tablet:* 10 mg; *Syrup:* 5 mg/5ml

Indication: Symptomatic treatment of any allergic condition related to ENT, urticaria, chronic idiopathic urticaria

Dosage schedule: Oral, child (2-5 years): 2.5 mg twice daily. Child (6-11 years): 5 mg twice daily. 12 years and above: 10 mg once daily

Contraindications/Precautions: Avoid in acute porphyrias and pregnancy. Use with caution in epilepsy. Renal impairment: In adults, use half normal dose if eGFR 30- 50 mL/minute/1.73 m². Use half normal dose and reduce dose frequency to alternate days if eGFR 10- 30 mL/minute/1.73 m².

Adverse effects: Antimuscarinic effects, blurred vision, dry mouth, gastrointestinal disturbances, headache, psychomotor impairment, urinary retention, anaphylaxis, angioedema, angle-closure glaucoma (in adults), arrhythmias, blood disorders, bronchospasm, confusion, convulsions, depression, dizziness, extrapyramidal effects, hypersensitivity reactions, hypotension, liver dysfunction, palpitation, photosensitivity reactions, rashes, sleep disturbances, tremor, drowsiness. Children and the elderly are more susceptible to side effects.

DESLORATADINE

Dosage form and strength: *Tablet:* 5 mg

Indications: see under Cetirizine

Contraindication/Precautions: Contraindicated if history of hypersensitivity to loratadine. Use with caution in acute porphyrias, epilepsy, severe renal impairment. Pregnancy: avoid

Dosage schedule: Oral, child (1-5 years): 1.25 mg once daily; child (6-11 years): 2.5 mg once daily, 12 years and above: 5 mg once daily

Adverse effects: See under cetirizine

EBASTINE

Dosage form and strength: *Tablet:* 10 mg, 20 mg

Indication: See under Cetirizine

Dosage schedule: Oral, adult: 10-20 mg once daily.

Adverse effects: See under Cetirizine

FEXOFENADINE

Dosage form and strength: *Tablet:* 30 mg, 120 mg, 180 mg

Indication: Symptomatic relief of seasonal allergic rhinitis, symptomatic relief of chronic idiopathic urticarial

Contraindication/Precautions: Use with caution in epilepsy

Dosage schedule:

- *Symptomatic relief of seasonal allergic rhinitis:* oral, Child (6- 11 years): 30 mg twice daily, 12 years and above: 120 mg once daily.
- *Symptomatic relief of chronic idiopathic urticarial:* oral, 12 years and above: 180 mg once daily

Adverse effects: see under Cetirizine

LEVOCETIRIZINE

Dosage form and strength: *Tablet:* 5 mg

Indications: See under Cetirizine

Dosage schedule: Oral, 6 years and above: 5 mg once daily

Contraindication/Precautions: Avoid in acute porphyria, pregnancy. Use with cautions: epilepsy. Renal impairment: in adults 5 mg on alternate days

Adverse events: See under Cetirizine.

LORATADINE

Dosage form and strength: *Tablet:* 5 mg, 10 mg.

Indication: see under Cetirizine.

Contraindication/Precautions: Avoid in acute porphyria, epilepsy. Reduce dose frequency to alternate days in severe hepatic impairment

Dosage schedule: Oral, child (2-11 years and body weight \leq 30 kg): 5 mg once daily. Oral, child (2-11 years and body weight $>$ 30 kg): 10 mg once daily. Oral, \geq 12 years: 10 mg once daily

Adverse effects: See under Cetirizine.

18.2.2.4 Oral corticosteroids

18.2.2.4 Systemic antifungals

AMPHOTERICIN B

Indication: Invasive fungal rhinosinusitis

Dosage schedule: As in systemic fungal infection

Also see under Amphotericin B, in Drugs Used in Infections Chapter 10

18.2.2.5 Others

TRANEXAMIC ACID**Dosage form and strength:** *Tablet:* 500 mg**Indication:** Epistaxis**Dosage schedule:** *Epistaxis:* 1000-1500 mg every 8-12 hours for 10 days
Also see under tranexamic acid, Drugs Used In Blood, Chapter 3**TURPENTINE OIL****Dosage form and strength:** *Solution:* 10%**Indication:** Nasal myiasis**Dosage schedule:** Intranasal: 2-3 drops, 2-3 times a day as required.**18.3 Drugs used in throat disorders****18.3.1 Local medications****AMPHOTERICIN B**

See under Antifungals in drugs used in infection

BENZALKONIUM CHLORIDE + CHOLINE SALICYLATE**Dosage form and strength:** *Ointment:* Benzalkonium chloride 0.2%, Choline salicylate 9%**Indications:** Aphthous ulcer, oral ulcers**Contraindications/Precautions:** Hypersensitivity reactions**Dosage schedule:** local application, three times a day for 5 to 10 days**CHLORHEXIDINE****Dosage form and strength:** *Mouthwash:* 0.2%**Indications:** Aphthous ulcer, acute tonsillitis, acute oropharyngitis, tonsillar keratosis, gingivitis**Contraindications/Precautions:** Hypersensitivity reactions. Do not use in patients who cannot gargle, do not swallow the solution**Dosage schedule:** Gingivitis: oral rinse: 15mL two times a day**CHLORHEXIDINE + LIDOCAINE + METRONIDAZOLE****Dosage form and strength:** *Ointment:* Chlorhexidine 1% (w/w), Lidocaine 2% (w/w), Metronidazole 1% (w/w)**Indications:** Oral cavity laceration, aphthous ulcer, oral ulcers with high risk of infection (sutured wound)**Contraindications/Precautions:** Hypersensitivity reaction**Dosage schedule:** Oral cavity lesion, local application, three times a day for 5-7 days**CLOTRIMAZOLE**

See under drugs used in infections

FLUTICASONE**HYDROCORTISONE**

See under drugs used in endocrinal disorder

HYDROGEN PEROXIDE (H₂O₂)**Dosage form and strength:** *Solution:* 3%**Indications:** Hemostasis in tonsillectomy, remove unhealthy slough from wounds**Contraindications/Precautions:** Should not be used in healthy tissue, avoid exposure to eye**Dosage schedule:**

- *Hemostasis in tonsillectomy:* mixed with povidone iodine (ratio 1:2) and diluted in water and applied on the wound or ringed for lesion on the oral mucosa;
- *Oral gargle:* diluted with water (10 mL in 1L of water), used 3-4 times a day.
- *Unhealthy wound:* diluted in povidone iodine (4-5 drops in 10mL 10% povidone iodine), used for dressing of wound

Adverse effects: Erythema, stinging, edema, pruritis, vesiculation**LIDOCAINE**

See under drugs used in anesthesia

MOMETASONE

See under drugs used in endocrine disorders

NYSTATIN**Dosage form and strength:** *Suspension:* 1,00,000 units/mL**Indications:** Oropharyngeal candidiasis**Dosage schedule:** *Oropharyngeal candidiasis:* adult and children, swish and swallow, 4-6 mL, 5 times a day for 7 days minimum or 2 days after symptoms improve, infant, 1-2 mL, local application using cotton swab or finger, 4 times daily**Adverse effects:** Irritation, sensitization (rash, urticaria, contact dermatitis)
Also see under drugs used in infections**POVIDONE IODINE****Dosage form and strength:** *Gargle:* 1%, 2%. *Solution:* 10%**Indications:** Oral ulcer, wound dressing**Contraindications/Precautions:** Hypersensitivity, burn skin, renal impairment, thyroid disorders, cautious in children, do not swallow**Dosage schedule:**

- *Oral ulcer:* gargle, dilute with water and 3-4 times a day;
- *Wound dressing:* (10%)

Adverse effects: Hyperthyroidism, irritation, pruritis, rashes**18.3.2 Systemic medications****18.3.2.1 Antibacterials****AMOXICILLIN****AMOXICILLIN + CLAVULANIC ACID****AZITHROMYCIN****BENZYL PENICILLIN**

See under drugs used in infections

CEFDINIR

Dosage form and strength: *Capsule:* 300 mg, *Oral suspension:* 125 mg/5mL, 250 mg/5mL

Indications: Acute tonsillitis, acute oropharyngitis

Contraindications/Precautions: Hypersensitivity, skin rashes

Dosage schedule: *Tonsillitis and pharyngitis:* adult, 600 mg oral, once a day for 10 days or 300 mg oral, twice a day for 10 days; child, 14 mg/kg PO once daily for 10 days

Adverse effects: Urtricularia, skin rash

CEFUROXIME AXETIL

CEFTRIAZONE

CLARITHROMYCIN

CLINDAMYCIN

See under drugs used in infections

DIPHThERIA ANTITOXIN

See under drugs used in immunology

ERYTHROMYCIN

LEVOFLOXACIN

See under drugs used in infections

PENICILLIN V

Dosage form and strength: *Tablet:* 250 mg, 500 mg; *Oral suspension:* 125 mg/5mL, 250 mg/5mL

Indications: Tonsillitis and pharyngitis, quinsy (with metronidazole)

Contraindications/Precautions: Hypersensitivity reaction, renal impairment

Dosage schedule: *Tonsillitis and pharyngitis (penicillin susceptible):* adult, 500 mg oral, two times a day for 10 days or 250 mg oral, four times a day for 10 days; child, 25-50 mg/kg/day divided every 6 hours for 10 days

Adverse effects: Diarrhea, nausea, vomiting

18.3.2.2. Antivirals

ACICLOVIR/ACYCLOVIR

See under drugs used in infections

VALACYCLOVIR

Dosage form and strength: *Tablet:* 500 mg, 1 gm

Indications: Herpes labialis

Contraindications/Precautions: Hypersensitivity reaction, acute renal failure

Dosage schedule: *Herpes labialis:* oral, 2 grams, two times a day for one day

18.3.2.3 Antifungal

FLUCONAZOLE ITRACONAZOLE KETOCONAZOLE

See under drugs used in infection

18.3.2.4 Others

ACETAMINOPHEN (PARACETAMOL)

Dosage form and strength: See under musculo-skeletal system

Indications: Acute laryngitis, acute tonsillitis, acute oropharyngitis, quinsy

Contraindications/Precautions: See under musculo-skeletal system

Dosage schedule: See under musculo-skeletal system

Adverse effects: See under musculo-skeletal system

DEXAMETHASONE

Dosage form and strength: See under drugs used in endocrinal disorders

Indications: Oral submucous fibrosis, stridor, upper respiratory tract edema, facial nerve palsy

Contraindications/Precautions: See under drugs used in endocrinal disorders

Dosage schedule:

• *Oral sub mucous fibrosis:* intraleison, 4 mg (1 ml) with hyalase (1500 IU in 1 ml), injected biweekly for 8-10 weeks

• *Facial nerve palsy:* 400 mg, IV, three times a day for 2-3 days

Adverse effects: See under drugs used in endocrinal disorders

PANTOPRAZOLE

Dosage form and strength: *Tablet:* 40 mg

Indications: Laryngopharyngeal reflux

Dosage schedule: *Laryngopharyngeal reflux:* oral, 40 mg, two times a day for 6 weeks with/without domperidone

PREDNISOLONE

Indications: Facial nerve palsy

See under drugs used in endocrine disorders and drugs used in ear disorder

Section II - Chapter 19

Drugs used in Dental Disorders

- 19.1 Drugs for dental emergencies*
- 19.2 Prophylactic drugs during dental procedures*
- 19.3 Common antimicrobials used in dentistry*
- 19.4 Desensitizing agents*
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- 19.6 Host modulating agents*
- 19.7 Local drug delivery agents*
- 19.8 Analgesics used in dentistry*
- 19.9 Local anesthetics used in dentistry*
- 19.10 General anesthesia for dental procedures*
- 19.11 Topical and systemic steroids for dental purpose*
- 19.12 Hemostatic agents*
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- 19.14 Dentifrices*
- 19.15 Salivary substitutes and anti-sialogogues*
- 19.16 Miscellaneous*

19.1 Drugs for dental emergencies

ADRENALINE/EPINEPHRINE

Dosage form and strength: Prefilled syringes of 0.3-0.5 ml of 1: 1000 solution IM injection, 1 ml ampoules For children: 0.01 mg/kg

Indications: Anaphylaxis; As a vasoconstrictor for haemostasis

Dosage schedule: Administer as soon as patient undergoes anaphylactic shock (0.3 mg IM up to a dose of 0.5 mg per dose). The injection may be repeated every 5-10 minutes as necessary for a total of 3 doses.

Instruction and warning: Always give adrenaline auto-injector first, then asthma reliever if someone with known asthma and allergy to food, insects or medication has sudden breathing difficulty. Inject adrenaline IM or SC into anterolateral aspect of the thigh, through clothing if necessary. Do not administer repeated injection at the same site, as the resulting vasoconstriction may cause tissue necrosis. Do not use if the solution is colored or cloudy, or if it contains particulate matter.

Patient's information: People who have had a severe allergic or anaphylactic reaction in the past are advised to carry an auto-injection device containing adrenaline with them at all times.

SALBUTAMOL/ALBUTEROL

Dosage form and strength: Nebulizer, Inhaler 100 µg/puff

Indications: Relief of bronchospasm in adults & children 6 yrs of age and older with reversible obstructive airway disease during dental procedures.

Dosage schedule: 1-2 puffs per dose

Instruction and warning: Albuterol may cause paradoxical bronchospasm, which may be life threatening. If it occurs, should be discontinued immediately.

ASPIRIN

Dosage form and strength: Tablet: 75 mg non-enteric coated chewed and swallowed. Chewable tablet: one to four 81 mg chewed and swallowe

Indications: Suspected myocardial infarction (MI) during dental treatment.

Dosage schedule: Administer as soon as the MI attack occurs.

GLUCAGON

Dosage form and strength: Children (<20 kg): 0.5 mg IM, IV or SC

Adults and children (>20 kg): 1 mg IM, IV or SC

If weight is unknown, children 6 years of age & older: 1 mL

If weight unknown & children < 6yrs: 0.5 mL

Indications: Treatment of hypoglycemic shock during dental procedures

Precautions: Glucagon should be used to treat hypoglycemia only if the person is unable to eat, is unconscious or having seizure.

Glucagon should not be administered to hypoglycemic patients who are experiencing starvation, adrenal insufficiency or are suffering from chronic hypoglycemia. For these patients, if conscious, oral glucose is more effective. If the patient is not conscious, IV glucose should be given

Instruction and warning: Hypoglycemia should be treated as quickly as possible. Having low blood sugar for too long can cause seizure, coma,

or death. Once glucagon is administered, blood glucose measurements should be obtained until the patient is no longer experiencing hypoglycemic symptoms

GLYCERYL TRINITRATE (GTN)

Dosage form and strength: Sublingual tablet 0.5 mg; Spray 0.4 mg; Injection 1 mg/ml

Indications: Relief of chest pain associated with angina pectoris encountered during dental treatment

Dosage schedule: When angina starts, one sublingual tablet or 1-2 spray should be placed under the tongue & if symptoms do not resolve, may be repeated at 5 minutes interval for a total of 3 doses

If symptoms have not resolved after a total of 3 doses, patient should seek prompt medical attention

Instruction and warning: GTN must be placed under the tongue (administered sublingually) & retained in the mouth until dissolved or discarded (a local burning or tingling sensation may occur); Inability to relieve chest pain after 3 doses indicates acute MI - should be rushed to emergency department if possible

MIDAZOLAM

Dosage form and strength: Injectable solution 5 mg/mL IV; Adults : 10 mg; Pediatric: 1 to 5 years: 5 mg, 5 to 10 years: 7.5 mg, > 10years: 10mg

Indications: Status tonic-clonic seizures in patients undergoing dental treatment

Precautions: Do not give midazolam by rapid intravenous injection to neonates, as it can result in low blood pressure and seizures

Instruction and warning: During emergency administration for seizures, use as buccal (oromucosal) injection on the side of the mouth between the cheek and the gum

DIPHENHYDRAMINE

Dosage form and strength: Injectable solution 50mg/ml; Tablets: 25mg, 50mg

Indications: Allergic reactions to any material or medication used during dental procedures.; As an alternative anesthetic agent in cases of local "caine" anesthetic allergies.

Dosage schedule 25 – 50mg PO 6 to 8 hourly; not to exceed 300mg per day; 10-50mg (no more than 100mg) IV/IM 4 to 6 hourly; not to exceed 400mg per day

ANAPHYLACTIC REACTION MANAGEMENT

Anaphylaxis is any acute-onset illness with typical skin features (urticarial rash or erythema/flushing, and/or angioedema), with involvement of respiratory and/or cardiovascular and/or persistent severe gastrointestinal symptoms.

Anaphylaxis management protocol:

1. Remove allergen (if still present).
2. Call for assistance

3. Lay patient flat. Do not allow them to stand or walk. If breathing is difficult, allow them to sit.
4. Give INTRAMUSCULAR INJECTION (IMI) OF ADRENALINE (epinephrine) without delay using an adrenaline autoinjector if available OR adrenaline ampoules and syringe.
5. Give oxygen (if available).
6. Call ambulance to transport patient if not already in a hospital setting. Administer intravenous saline (20mL/kg) if hypotensive.
7. If required at any time, initiate cardiopulmonary resuscitation.

19.2 Prophylactic drugs during dental procedures

Antibiotic prophylaxis is indicated in patients with:

- Valve replacement
- Cavernous thrombosis
- Uncontrolled diabetes
- Mitral valve prolapse
- Dialysis patients
- Rheumatic heart disease with valve defects
- Previous history of endocarditis
- Congenital malformations

Endocarditis prophylaxis is recommended during the following procedures:

- Dental extractions
- Periodontal procedures including surgery, scaling and root planing, probing and recall maintenance
- Dental implant placement and reimplantation of avulsed teeth
- Endodontic (root canal) instrumentation or surgery beyond the apex
- Subgingival placement of antibiotic fibers or strips
- Initial placement of orthodontic bands but not brackets
- Intraligamentary local anesthetic injections
- Prophylactic cleaning of teeth or implants where bleeding is anticipated

Endocarditis prophylaxis is not recommended for the following procedures:

- Restorative dentistry (operative and prosthodontics) with or without retraction cord
- Local anesthetic injections (non- intraligamentary)
- Intracanal endodontic treatment, post placement and build-up
- Placement of rubber dams
- Postoperative suture removal
- Placement of removable prosthodontics or orthodontic appliances
- Oral impressions
- Fluoride treatments
- Oral radiographs
- Orthodontic appliance adjustment
- Shedding of primary teeth

Antibiotic prophylaxis for dental procedure maybe supplemented with chlorhexidine gluconate gel 1% or chlorhexidine gluconate mouthwash 0.2% used 5 mins before procedure. Usually prophylaxis is continued 2 days after the procedure.

Prophylactic regimen for dental procedures

- Regimen: Single dose 30 to 60 min before the procedure

Situation	Agent	Adults	Children
Standard general prophylaxis	Amoxicillin	2 g	50 mg/kg
Unable to take oral medications	Ampicillin or Cefazolin or Ceftriaxone	2 g IM or IV 1 g IM or IV	50 mg/kg IM or IV 50 mg/kg IM or IV
Allergic to penicillin or ampicillin – oral	Cephalexin or Clindamycin or Azithromycin or Clarithromycin	2 g 600 mg 500 mg	50 mg/kg 20 mg/kg 15 mg/kg
Allergic to penicillin or ampicillin and unable to take oral medication	Cefazolin or Ceftriaxone or Clindamycin	1 g IM or IV 600 mg IM or IV	50 mg/kg IM or IV 20 mg/kg IM or IV

19.3 Common antimicrobials used in dentistry

{For details Refer to General Section}

19.3.1 Antibacterial agents

AMOXICILLIN

Dose form and Strength: Oral preparations- Dispersible tablets, syrup, and capsules

125 mg, 250 mg, 500 mg; Adults: 250-500mg, three times a day; Children: 20-40 mg/kg/day in three divided doses; Suspension- 125 mg per 5 mL, 250 mg per 5 mL

Indications: Oro-dental infections, actinomycosis, acute maxillary sinusitis; Also used as a prophylactic drug.

Contraindications: Cannot be used in patients who are allergic to β -lactam antibiotics (e.g., penicillins and cephalosporins); Care to be taken in patients with chronic renal dysfunction.

AMOXICILLIN + CLAVULANIC ACID

Dose form and Strength: Oral preparations - Tablets, 30 ml syrup and suspension;

Tablets (for adults): Amoxicillin 250mg + Clavulanic acid 125mg; Amoxicillin 500mg + Clavulanic acid 125mg; Amoxicillin 500mg + Clavulanic acid 500mg; Tablets (for children): Amoxicillin 125mg + Clavulanic acid 31.25mg; Syrup (30ml): Amoxicillin 125mg + Clavulanic acid 31.25mg per 5ml; Amoxicillin 250mg + Clavulanic acid 125mg per 5ml

AZITHROMYCIN

Adult dose: 500 mg OD Tablets (For detail refer to)

Children: Refer to paediatric section

CLINDAMYCIN: (Refer to ... for detail)

Adult dose: 150-300 mg 6 hourly

Children: 3-6mg/kg 6 hourly

OFLOXACIN

200-400 mg once daily

TETRACYCLINE

Dose form and strength: Oral preparations- Capsules and tablets 250mg and 500mg

Adults: 1gm daily in 2-4 divided doses (maximum of 2gm/day)

Children: 20-40 mg/kg/day in 2-4 divided doses

Indications: Aphthous Ulcers; Periodontal diseases

Contraindications: Hypersensitivity to tetracycline; Renal failure, Systemic Lupus Erythematosus; Pregnant women and nursing mothers; Children less than 8 years of age

Adverse effects:

- Taking the medicine during pregnancy may affect the tooth and bone development in the unborn baby due to the affinity of tetracycline for calcium and gets deposited as tetracycline calcium orthophosphated complex. Deposits of these antibiotics in teeth causes yellow discoloration. Taking the medicine during last half of pregnancy can cause permanent tooth discoloration later in the child's life.
- Diarrhea, nausea, vomiting, light sensitive rashes, Benign Intracranial hypertension, Pancreatitis, Pseudomembranous colitis.
- The critical period for tetracycline-related discoloration in the primary dentition is 4 months in utero to 3 months postpartum for maxillary and mandibular incisors and 5 months utero to 9 months postpartum for maxillary and mandibular canines
- The sensitive period for tetracycline-induced discoloration in the permanent maxillary and mandibular incisors and canines is 3 to 5 months postpartum to about the seventh year of the child's life. The maxillary lateral incisors are an exception because they begin to calcify at 10 to 12 months postpartum.

DOXYCYCLINE

Dose form and strength: Oral preparations- Capsules and tablets 50mg and 100mg; Adults: First day- 100 mg 2 times/day followed by 100mg one per day; Children: 5 mg/kg/day in 2 divided doses

19.3.2 Antiprotozoal**METRONIDAZOLE**

Dose form and strength: Oral preparations: Tablets: 200mg, 400mg; Suspension: 100mg/5ml suspension, 200mg/5ml suspension.; Parenteral

preparations: 500mg/100ml IV infusions; Adults: 400mg three times a day; Children: 30-50mg per kg weight per day in divided doses

Indications: Anaerobic infections (first choice of drug); Ulcerative gingivitis

Contraindications: Has mutagenic potential therefore not to be used in the first trimester of pregnancy. Neurological diseases, chronic alcoholism and blood dyscrasias.

Patient's Information: Discontinue consumption of alcoholic beverages or products containing propylene glycol while taking Metronidazole tablets and for at least three days afterward because abdominal cramps, nausea, vomiting, headaches, and flushing may occur

TINIDAZOLE

2 g OD day one followed by 1 gm OD or 500mg BD

ORNIDAZOLE

1 g in 2 divided doses (500 mg BD)

19.3.3 Antifungal drugs

There are few local factors that make the oral tissues susceptible to Candida infection. These factors include acid saliva, xerostomia, night use of prosthetic dentures, tobacco, carbohydrate rich diets and patients that receive radiotherapy and chemotherapy in maxillofacial structures and also associated with the use of broad spectrum antibiotics, corticosteroids, anticancer/immunosuppressant drugs, emergence of AIDS.

• **Generic name:**

- Polyenes (nystatin and amphotericin B)
- Azoles which are classified into: imidazoles(clotrimazole, econazole, fenticonazole, isoconazole, ketoconazole, miconazole, sulconazole, tioconazole); and triazoles (fluconazole, itraconazole)

NYSTATIN

Dosage form and strength: Oral - 5, 00,000 unit tablets TDS; **Topical** - 100,000 unit/gm cream and ointments. It is available currently for topical use in creams, ointment, suppositories, lotion, suspension, vaginal tablets, and oral pastille.

Indications: Oral candidiasis (Oral thrush); Denture stomatitis (chronic atrophic candidiasis): 0.2% chlorhexidine solution with Mycostatin tablet dissolves in it forming gel used mainly in such patients.; Candidial Angular cheilitis

Contraindication: Hypersensitivity to nystatin

Dosage schedule: Thrush is treated by holding 5 ml of nystatin suspension (for infants- 2 ml) in oral cavity for several minutes 4 times daily before swallowing.

Alternative treatment is to retain vaginal tablet in the mouth until it dissolves, at least 4 times a day. Nystatin oral pastille (200,000 units) dissolved slowly in the mouth 5 times a day—can be mixed with glycerin.

Mycostatin creams and ointments (1 lack units) may be used in candidiasis with angular cheilitis, stomatitis.

Mycostatin oral rinse - 1 teaspoon of nystatin oral suspension (100,000unit/cc) mixed with $\frac{1}{4}$ cup of water is used as oral rinse for 3-4 times a day for 7-10 day.

AMPHOTERICIN-B

Dosage form and strength: Topical: 3% ointment, suspension, drops, cream, and lotion

Indications: Oral candidiasis (Oral thrush); Acute atrophic candidiasis (antibiotic stomatitis); Denture sour mouth (chronic atrophic candidiasis) ; Chronic hyperplastic candidiasis (candidal leukoplakia)

Adverse effect: Its toxicity can cause impairment of renal and hepatocellular function, anemia, mental and neurological changes, renal toxicity. Chills, fever, vomiting and headache.

Dosage schedule: It is applied 2-3 times a day. In denture wearing patient, amphotericin B ointment applied to fitting surface of denture before it use.

CLOTRIMAZOLE

Dosage form and strength: Topically: 1% Gel, cream, lotion, solution.; **Oral:** 100 mg, 200 mg, 500 mg tab.

Indications: Candidiasis

Contraindications: Hypersensitivity to imidazole; 1st trimester of pregnancy.

Dosage schedule: For oropharyngeal candidiasis, 10 mg lozenge of clotrimazole is allowed to dissolve in the mouth 3-4 times a day, or the lotion/gel is applied/ swirled in the mouth for as long as possible.

KETOCONAZOLE (KTZ)

Dosage form and strength: Topical Solution: 1%; Cream: 1%, 2%; Oropharyngeal lozenge: 10mg

Indications: Mucocutaneous candidiasis ; Oropharyngeal candidiasis (thrush)

Contraindications: Pregnancy; Azole antifungals hypersensitivity

Dosage schedule: For fungal infections: Adults—At first, 200 milligrams (mg) once a day.; **Children 2 years of age and older**—Dose is based on body weight and must be determined. The dose is usually 3.3 to 6.6 milligrams (mg) per kilogram (kg) of body weight per day.; **Children younger than 2 years of age**—Use and dose must be determined by your doctor.

19.3.4 Antiviral drugs

ACYCLOVIR

Dosage form and strength: Topical – Cream 5%, ointment, mucoadhesive buccal tablet; Capsules (200mg, 400mg, 500mg, 800mg)

Indications: To treat cold sores around the mouth (caused by Herpes Simplex), oral lesions related to chicken pox & shingles (caused by Varicella Zoster)

Dosage schedule: Should be administered within first 72 hours in a dosage of 200 mg 5times a day for 10 days.; As a prophylactic measure for recurrent herpes infection – 400 mg twice a day for 10 days; 800 mg 5times a day for a week or Valacyclovir 1000mg or Famciclovir 500mg 3 times a day for a week

for oral lesions of Herpes Zoster

Adverse effects: Stinging and burning sensation after each application; Mouth pain while using an acyclovir buccal tablet

Instruction and warning: Take this medicine by mouth with or without food, usually 2 to 5 times a day as directed by your doctor; Treatment with acyclovir should be started as soon as possible after the first appearance of symptoms. (such as tingling, burning, blisters)

Patient's information: Take acyclovir for the entire length of time prescribed by your doctor; Seek medical advice as soon as lesion appears

VALACYCLOVIR

1000 mg TDS

FAMCICLOVIR

250-500 mg TDS

19.3.5 Topical antimicrobials

POVIDONE IODINE

Povidine iodine is a rapidly acting broad spectrum, microbicidal agent for topical application in the treatment and prevention of infection.

Dose form and strength: 1% used as oral antiseptic (betadine mouthwash), preprocedural mouthrinse in patients with varying degree of oral hygiene Irrigation with or without normal saline after routine extraction

Precautions: In patients sensitive to iodine as it may cause iodine sensitivity In pregnant and lactating mothers

METRONIDAZOLE GEL

Indications: Early stage gingivitis and mild form of periodontitis; Membranous and hyperplastic candidiasis; Angular cheilitis; Median rhomboid glossitis

BISPYRIDINAMINES

A new class of topical antimicrobial agents as inhibitors of dental plaque. Octenidine which belongs to this class of chemicals exhibits a broad spectrum of antimicrobial efficacy against gram positive and negative bacteria and fungi. Its efficacy is not affected by interfering substances like blood, mucus. It shows greater effectiveness as an inhibitor to plaque forming enzymes of *Streptococcus mutans* than chlorhexidine (Bailey et al 1984).

CLOTRIMAZOLE

Used in Oral candidiasis, Post radiotherapy, prolonged corticosteroid usage and other immunocompromised status

19.4 Desensitizing agents

Dentinal hypersensitivity is one of the most common symptom with which patients present to the dental clinic. Such patients should be examined carefully to reach an accurate & definitive diagnosis.

Dentin hypersensitivity is characterized by short, sharp pain arising from

exposed dentin in response to stimuli typically thermal, evaporative, tactile, osmotic or chemical and which cannot be ascribed to any other form of dental defect or pathology.

Dentin desensitizing agents refers to those substances which reduce or eliminate dentin hypersensitivity mainly by two mechanisms:

1) Occluding the dentinal tubules or 2) Blocking the pulpal sensory nerves.

Dental desensitizing agents are used both in office and home. In-office agents are used to desensitize exposed root surfaces, in tooth preparation as well as before and after tooth bleaching. Available in various viscosities, they may be delivered via pre-filled syringe, single use droppers or bottle droppers. Home desensitizing agents are also available which have higher pH than their in-office counterparts for patient safety and because they will be used frequently.

POTASSIUM NITRATE

Generic name: Potassium nitrate

Dosage form and strength: 5% W/W Gel; Dentifrice; Mouthwash

Indications: Dentinal hypersensitivity

Contraindications: Hypersensitivity to any component of the drug

Precautions: If allergic to any component of the drug, inform your doctor; Pre-existing diseases should be ruled out for any side effects

Adverse effects: Vertigo, Headache, Hypotension, Convulsions, Cyanosis, GI disturbance, Collapse, Flushing of the skin, Irregular pulse, Methemoglobinemia

Instruction and warning: Use cautiously in case of pregnancy or lactation Do not use more than the recommended dose or use longer than 4 weeks without consulting with your doctor

Patient's information: If in case of any allergic reactions, stop the drug immediately & report immediately to the doctor.

GLUTARALDEHYDE

Generic name: Glutaraldehyde

Dosage form and strength: 5% Gel or Solution

Indications: Provides symptomatic relief from dentinal hypersensitivity; As a disinfectant

Contraindications: Hypersensitivity to glutaraldehyde

Precautions: Should not be given to neonates; Not used if hypersensitive to glutaraldehyde or any component of the formulation; Wearing respirators and protective clothing should be mandatory when handling glutaraldehyde

Adverse effects: Headache, nausea, rashes, nasal & throat symptoms, brownish discolouration of skin; Further complications : rhinitis, dermatitis, asthma, eye irritation

Instructions and warning: Blot dry and apply with a cotton pellet or applicator tip by rubbing the preparation for 30 seconds and dry thoroughly (except if you are using a wet or moist adhesive protocol); Avoid contact with soft tissue as it can cause irritation.

Patient's information: If glutaraldehyde contacts eyes, pulp, skin or mucous membrane, rinse immediately with copious amount of water and seek medical attention.; If ingested, do not induce vomiting and direct the patient

to drink large quantities of water

SILVER NITRATE

Generic name: Silver nitrate

Dosage form and strength: 0.5% topical solution/dentifrice form

Indications: As a desensitizing agent; Caries control/arresting carious lesion; Also used to heal oral ulcers (silver nitrate swabs); As an astringent/hemostatic agent; As a disinfectant

Contraindications: Pregnancy

Precautions: Patients and staff are advised to wear eye protective equipments and mouth masks; History of any pre-existing medical conditions

Dosage schedule: Apply a cotton applicator dipped in solution on the affected area 2-3 times/week for 2-3 weeks

Adverse effects: Dark, purple or brown staining of the skin; Irritation of the skin; Burns; Long term exposure: eye damage, argyria (>1gm silver nitrate accumulated in body; a permanent cosmetic condition in which the skin and internal organs turn a blue-gray color)

Drug and food interactions: Silver nitrate reacts rapidly with dissolved chloride to precipitate highly insoluble silver chloride, which results in a fatal electrolyte imbalance; Increased risk of methemoglobinemia if used in combination with sodium nitrite/Prilocaine/lidocaine; The effect of papain/urea topical is reduced when silver nitrate is applied to the same site; Antibiotics may diminish the therapeutic effect of silver nitrate, so avoid combination

Instructions and warning: Recommended dosage of the solution should be used; Do not ingest solution; Keep away from children

Patient's information: In case of any reactive lesions/irritations, discontinue usage of the product and report immediately to your doctor

SODIUM FLUORIDE

Generic name: Sodium fluoride

Dosage form and strength: 2% Solution or Gel; 0.188-0.254% with available F ion concentration of 650ppm in dentifrice form *SP; Rinse 0.05-0.2%; Varnish 5-6%

Indications: For preventing caries; In cases of dentinal hypersensitivity

Contraindications: In children who are unable to expectorate the content; In children younger than 6 months old

Precautions: Do not use sodium fluoride if allergic to any ingredient in the solution; Do not use if your drinking water has a fluoride content > 0.6ppm.; Pre-existing medical conditions should be mentioned to your doctor.; Supervised use in children.

Dosage schedule: Four-visit procedure at intervals of approximately one week for in-office treatment.

Adverse effects: Rashes, Itching, Difficulty in breathing, Tightness in the chest, Swelling of the mouth, face, lips, tongue

Drug and food interactions: Do not take antacid that has aluminum, calcium, magnesium for several hours after you take sodium fluoride.

Instructions and warning: No more than 2gm of gel per tray or approximately 40% of tray capacity should be dispensed per use.; Not for systemic use, do

not swallow.

Do not exceed the dose recommended by your dentist. Notify your dentist if your teeth become spotted or stained.

Patient's information: If you are pregnant and currently using sodium fluoride, inform your doctor and discuss about the risks to your baby.; Overdose is suspected if symptoms such as diarrhea, extreme thirst, increased drooling, muscle weakness, nausea, paleness of the skin, seizures, shaking, vomiting, etc. are seen, which should be reported to your doctor immediately. Give calcium orally and induce vomiting, if necessary. In patients with depressed gag reflex, induced vomiting is contraindicated and endotracheal intubation should be performed before gastric lavage.

Routine monitoring and electrolyte administration should be done.

CASEIN PHOSPHOPEPTIDE-AMORPHOUS CALCIUM PHOSPHATE (CPP-ACP)

Dosage form and strength: Topical cream (35ml tubes); Sugar free chewing gum (1.2%); Mouthwashes (2% or 4%); Dentifrices (2% w/w); CPP-ACP spray; Also added in various restorative materials such as GIC, noneugenol cements

Indications: anticariogenic, anti-erosive efficiency; Reduces dentine hypersensitivity.

Contraindications: As CPP-ACP is a milk product, it cannot be given to patients having intolerance to milk.

Precautions:

Dosage schedule: Topical cream - It can be applied directly with clean finger onto the teeth, smeared over all surfaces, and left in place to slowly dissolve over night.

Adverse effects: The presence of CPP-ACP on the dentine surface may compromise the bonding effectiveness of the etch-and-rinse adhesive system
Patient's information: It's best to apply in the evening after cleaning the teeth and before going to bed, since the reduced saliva flow during sleep helps to maximize the benefit. ; It is applied for 2-3 minutes and then any excess should be spat out leaving just a thin coating on the teeth.

19.5 Anti-plaque chemotherapeutic agents

Chemicals used for supragingival plaque control include antibiotics (penicillin, vancomycin), enzymes (mucinase, protease), quaternary ammonium compounds (cetylpyridinium chloride, benzethonium chloride), bisbiguanides (chlorhexidine, alexidine), metallic salts (copper, tin), herbal extracts (sanguinarine), fluorides (strontium fluoride), oxygenating agents (hydrogen peroxide), phenolic compounds (thymol, menthol) and other antiseptics (Iodine, Triclosan).

CHLORHEXIDINE (Bisbiguanides)

Generic Name: Chlorhexidine gluconate

Dosage Form and Strength: Mouthwash (0.12% or 0.2%); Gel (1%); Sprays (0.2%); Varnishes; Periochip (2.5 mg of chlorhexidine gluconate)

Indications: Used as an adjunct to mechanical oral hygiene in initial periodontal therapy; During postsurgical period; In gingival enlargements;

Patients wearing fixed orthodontic appliances or intermaxillary fixation; For handicapped patients whose plaque control and gingival status are often very poor; In drug induced gingival overgrowth for controlling accumulation of plaque; In medically compromised patients who suffer from recurrent generalized oral infections; Prophylactic rinse in prevention of post extraction bacteremia, dry socket and to reduce the bacterial content of aerosol sprays during ultrasonic scaling

Contraindications: Not usually indicated for patients under 18 years and children due to fear of swallowing.; Allergic to Chlorhexidine; Categorized under Category B and C for pregnant women

Precautions: For patients having coexisting gingivitis and periodontitis, the presence or absence of gingival inflammation following treatment with Chlorhexidine gluconate oral rinse should not be used as a major indicator of underlying periodontitis.

Chlorhexidine gluconate oral rinse can cause staining of oral surfaces, such as tooth surfaces, restorations, and the dorsum of the tongue. Not all patients will experience a visually significant increase in tooth staining. Stain resulting from use of Chlorhexidine gluconate oral rinse does not adversely affect health of the gingiva or other oral tissues. Stain can be removed from most tooth surfaces by conventional professional prophylactic techniques. Additional time may be required to complete the prophylaxis.

Some patients may experience an alteration in taste perception while undergoing treatment with Chlorhexidine gluconate oral rinse.

Dosage Schedule: Rinse with 10ml of 0.2% chlorhexidine mouthwash twice daily for 2 weeks

Adverse Effects: Extrinsic i.e. brown staining of the teeth, tongue and silicate and resin restorations Painful, desquamative lesions on the oral mucosa may be associated with burning sensation Impaired taste sensation Dryness and soreness of mucosa

Periochip may cause headache, toothache and upper airway infections

Instructions and Warnings: Rinse your mouth twice daily after 30 minutes of brushing teeth; Swish the medicine in mouth for at least 30 seconds, and then spit it out. Do not swallow.; Do not add water to the rinse; Avoid eating and drinking right after using the chlorhexidine rinse.; Overdose would only occur if the medicine is swallowed. Symptoms include nausea, stomach pain or the appearance of being drunk.; Calculus deposits should be removed by a dental prophylaxis at intervals not greater than six months

Patient's Information: Get emergency medical help if you have hives, skin rashes, wheezing, difficulty in breathing, cold sweat and feeling of lightheadedness.

LISTERINE (ESSENTIAL OILS)

Listerine is over the counter phenol precipitate that contains thymol, eucalyptol, menthol, methyl salicylate, benzoic acid and sodium benzoate.

Dosage Form: Mouthwash; Strips

Indications: It helps prevent and reduce plaque, gingivitis, halitosis and reduces microorganisms between teeth; Listerine strips are used as a breath freshener.

Contraindications: Lactating mothers; Hypersensitivity; Neonates;

Pregnancy; Renal calculi; Seizures ; Patients under treatment for alcoholism

Adverse effects:

Diarrhea, nausea, vomiting, stomach upset, irritation to gastric mucosa, rashes,

cardiac arrhythmias, central nervous system depression, acidosis, cyanosis, pulmonary edema, respiratory failure, myocardial damage, circulatory failure, sweating, metabolic acidosis, local edema, ataxia, abdominal pain, drowsiness, contact dermatitis, involuntary eye movements, sleep disorder, coma, irregular heart rhythms, vertigo.

Precautions: Consult with doctor for precautions; Pregnant and lactating mothers

Dosage Schedule: Use it twice a day after 30 minutes of brushing the teeth; 20 ml of the solution is enough which is equal to $\frac{3}{4}$ of a capful

Patient's information: Before using it, inform the doctor about current list of medications, over the counter products, allergies, pre existing diseases, current health conditions like pregnancy, upcoming surgeries etc. Take as directed by the doctor or follow the directions printed on the product insert. Dosage is based on the condition.

Avoid interaction with alcohol. Listerine contains 26.9% alcohol making it more potent than various alcoholic beverages because of which it is not uncommon for addicts to consume large quantities which might be carcinogenic. Don't dilute the product. It is ready to use. Rinse around the mouth for 30 seconds, then spit out.

Refrain from eating and drinking for half an hour post rinsing

TRICLOSAN (ANTISEPTIC)

It is a bisphenol antiseptic which has recently been included in mouth rinse and toothpaste.

Dose form and strength: 0.3% in toothpaste

Indications: Maintenance of oral hygiene since it prevents plaque formation along with zinc citrate or copolymer Gantrez (methoxyethylene and maleic acid) to enhance its retention within the oral cavity.

Contraindications: Hypersensitivity to the drug

Adverse Effects: (Seen with its addition in toothpaste)

The hormonal effects impacts the entire endocrine system from vital organ growth and responds to the release of essential chemicals in the body making this an endocrine disrupter. It can lead to the development of allergies especially with children and their young developing immune system. Hay fever, asthma and seasonal allergy symptoms are a large concern.

Instructions and Warnings: The using guidelines depend upon the product containing the triclosan.

Patient's Information: When triclosan degrades, it turns into dioxin which is a carcinogen which has been linked to different types of cancer. When combined with chlorinated toxic tap water, it was found to form chloroform which is another carcinogen.

19.6 Host modulating agents

Refers to those agents used in Host Modulation Therapy (HMT).

HMT is a recent concept that aims to reduce tissue destruction & stabilize or even regenerate the periodontium by modifying or down regulating destructive aspects of the host response & up regulating procedure or regenerative responses.

These agents can be:

- Given systemically or locally
- Given in adjunct to conventional treatment
- Is a means of treating the host side of host-bacterial interaction

Agents used in HMT :

1. Antiproteinases (tetracycline – SDD)
2. Anti-inflammatory agents (NSAIDS such as salicylates (e.g. aspirin), Indomethacin, Propionic acid derivatives (e.g. ibuprofen, flurbiprofen, naproxen)
3. Bone sparing drugs (anti-resorptive agents such as bisphosphonates)
4. Others : Enamel matrix protein, Growth factors, Bone morphogenetic protein
5. Newer agents: Nitrous Oxide synthase inhibitors, Recombinant human interleukin-11, Omega -3 fatty acid, TNF-alpha antagonists (e.g. Infliximab)

SUBANTIMICROBIAL DOSE OF DOXYCYCLINE (SDD / Periostat)

[The most potent tetracycline in the inhibition of collagenolytic activities]

Dosage form and strength: Tablet - 20mg (doxycycline hyclate)

Indications: As an adjunct to scaling & root planning in the treatment of chronic periodontitis & aggressive periodontitis; May also be benefit in cases that are refractory to treatment, as well as in patients with risk factors such as smoking or diabetes, in whom treatment response might be limited; As an adjunct to periodontal surgery

Contraindications: Any patient with history of allergy or hypersensitivity to tetracyclines; Should not be given to pregnant or lactating women; Children < 12 yrs as due to high potential for discoloration of developing dentition

Precautions: Should not be used as a stand-alone therapy

Dosage schedule: 20mg, taken twice a day for 3 months (maximum of 9 months)

Adverse effects: 20mg dose is usually well tolerated by the body

Drug and food interactions: Efficacy of oral contraceptive pills may be reduced when used with tetracyclines

Instruction and warning: SDD should be prescribed to coincide with the first episode of SRP and is prescribed for 3 month, up to a maximum of 9 months of continuous dosing; Modification of any risk factors such as smoking, diabetes, faulty restorations , poor oral hygiene, should also be addressed; After initial periodontal treatment, patient should be enrolled into an intensive periodontal maintenance program, during which the need for further prescription of SDD can be assessed.

Patient's information: Patient's compliance with the maintenance regimen & oral hygiene instruction is very important; As efficacy of oral contraceptive pills is reduced by tetracycline, alternative birth control measures should be discussed.

ENAMEL MATRIX DERIVATIVES (Emdogain)

Dosage form and strength: Resorbable, implantable material available in Gel form (in syringe of 0.7ml or 0.3ml)

Indications: Promotes the re-growth of hard and soft tissues lost due to periodontal disease; To stimulate regeneration of lost bone, PDL & cementum, restoring the complete periodontal apparatus; To improve soft tissue healing

Contraindications: Patient hypersensitivity to any component of emdogain

Precautions: If you use other drugs or over the counter products at the same time, the effects of the gel may change. This may increase your risk for side-effects or cause your drug not to work properly.

Adverse effects: Increased bowel movements, nausea, thirst, bloating, cramps, and reduced appetite.

Drug Interactions: Emdogain gel may interact with the following drugs and products: Alendronate, Ciprofloxacin, Demeclocycline, Levodopa

Patient's information: Before using this drug, inform your doctor about your current list of medications, over the counter products (e.g. vitamins, herbal supplements, etc.), allergies, pre-existing diseases, and current health conditions (e.g. pregnancy, upcoming surgery, etc.). Some health conditions may make you more susceptible to the side-effects of the drug. Take as directed by your doctor or follow the direction printed on the product insert. Dosage is based on your condition. Tell your doctor if your condition persists or worsens.

19.7 Local drug delivery agents

Anti microbial agents can be administered systemically or locally. In the periodontal context, locally delivered drugs are applied directly to reduce the number of bacteria present in the diseased periodontal pocket. Some periodontal pathogens are able to invade the periodontal tissues, thereby making mechanical therapy alone sometimes ineffective. Thus, the local administration of anti-microbial agents directly into the pocket has the following advantages:

- Higher concentration of drug localized to a specific area
- Less systemic side-effects
- Drug release can be designed depending on the carrier

The local antimicrobials delivery systems are as follows:

Antimicrobial agent	Amount	Delivery system
Minocycline HCl	1 mg	Biodegradable powder in gel form
Doxycycline Hyclate	42.5 mg	Polymer
Tetracycline HCl	12.7 mg	Non-resorbable fiber
Chlorhexidine gluconate	2.5 mg	Matrix
Metronidazole benzoate	250 mg	Gel

MINOCYCLINE HYDROCHLORIDE

Dosage form and strength: 121 unit dose of 1mg cartridges of microsphere powder
2% w/w gel

Indications: As an adjunct during dental scaling & root planing to reduce

pocket depth in adults with periodontitis

Contraindications: Allergy to any tetracycline antibiotic; Periodontal pockets associated with abscess formation; Renal failure; Patient under 12 years of age; Should not be used in children, pregnant or nursing women during the tooth development phase, as it can cause permanent discoloration of the teeth

Precautions: Liver or renal disease; Use with caution in pregnant women or nursing mothers

Dosage schedule:

Powder form: Cartridges used in a single visit and up to 3 treatments, at 3-month intervals

Gel form: Applied 3-4 times with an interval of 14 days. Procedure repeated, if necessary, after 6 months.

Adverse effects: Swelling of the eyes, mouth and possibly hands, feet and throat, breathing difficulties, rash, hives (raised, often itchy, red patches on the skin), itching at the site of application.

Instruction and warning: The drug should always be professionally applied.

Powder form: Does not require local anesthesia. Professional sub-gingival administration is accomplished by inserting the unit-dose cartridge to the base of the periodontal pocket and then pressing the thumb ring in the handle mechanism to expel the powder while gradually withdrawing the tip from the base of the pocket. The handle mechanism should be sterilized between patients.

Gel form: use the applicator supplied with the product to fill each periodontal pocket until it overflows. Then wipe the applicator with an antiseptic before using it to treat another tooth but the same applicator can be used for treating several teeth. Always allow the applicator to reach room temperature 15 minutes before use and must not remove it from the aluminum pouch until immediately before use.

Patient's information:

Powder form: Patients should avoid chewing hard, crunchy, or sticky food from the treated site for 1 week, as well as avoid touching treated areas.

They should also postpone the use of interproximal cleaning devices around the treated sites for 10 days.; Some mild to moderate sensitivity is expected during the first week after SRP and administration of the agent, and should notify the dentist promptly if pain, swelling, or other problems occur.

Gel form: Do not brush or floss your teeth, use mouthwash, eat or drink for at least 2 hours after the agent has been applied.

DOXYCYCLINE HYCLATE

Dosage form and strength: 10% gel form (syringe system with two different tubes)

Indications: Subgingival placement for the treatment of periodontitis.

Contraindications: Not recommended in infants and children younger than 8 years of age; Pregnancy

Precautions: Inform your doctor if any history of hypersensitivity to doxycycline.

Nursing mothers

Dosage schedule: Apply a second treatment with this product after 4

months.

Adverse effects:

Less common: High blood pressure, looseness of tooth, tooth or gum pain (severe or continuing)

More common: Common cold-like symptoms, gum discomfort, pain, or soreness, headache, pressure sensitivity of the tooth, toothache

Instruction and warning: The gel is placed into the infected tooth pocket. It becomes wax-like when it comes in contact with saliva. Doxycycline is then slowly released from the hardened gel over the next 7 days.

Patient's information: Always inform your doctor if any history of other systemic diseases. After this medication is placed in your tooth pocket(s), do not brush or floss around the treated teeth for 7 days. Avoid using the treated teeth to chew, and do not eat hard, crunchy, or chewy foods for at least 7 days. It is very important that your dentist check your progress while you are receiving this medicine. Do not miss any dental appointments. Your dentist may prescribe a dental rinse to be used during the time you should avoid brushing and flossing. Follow your dentist's directions carefully.

Do not worry if you see bits of this product come out of the treated tooth pockets. This product is harmless if swallowed.

TETRACYCLINE HYDROCHLORIDE

Dosage form and strength: Powder for Suspension; Implant

Indications: Tetracycline periodontal fibers are used as an adjunct to scaling and root planing for reduction of periodontal pocket depth and bleeding on probing in patients with adult periodontitis.

Contraindications: Hypersensitivity to tetracycline

Precautions: Children and geriatric patients; Pregnant and nursing mothers

Adverse effects:

Rare: Gum redness, swelling, and pain in the areas of treatment, tongue pain and redness

More common: Discomfort in the area where the fibers have been placed, redness in the area where the fibers were removed

Instruction and warning: Remove the tetracycline periodontal fibers after ten days. Do not miss any dental appointments.

Patient's information: Do not chew hard, crusty, or sticky foods, or chewing gum.

Do not brush or floss near any treated areas, but continue to clean the other teeth.

Do not probe or pick at the fibers with your tongue, toothpicks, or fingers. If the fibers become loose or fall out before your next dental visit, contact your dentist right away

Check with your dentist right away if you have pain or swelling or other problems in the treated areas.

CHLORHEXIDINE GLUCONATE

Dosage form and strength: 2.5mg chip (**Periochip**)

Indications: Periochip is indicated as an adjunct to scaling and root planing procedures for reduction of pocket depth in patients with adult periodontitis.

Contraindications: Periochip should not be used in any patient who has a

known sensitivity to chlorhexidine.

Precautions: Use with caution In patients with acutely abscessed periodontal pocket

Periochip should be used in a pregnant woman only if clearly needed.

Dosage schedule: Treatment is recommended to be administered once every three months in pockets with PD remaining 5 mm or greater.

Adverse effects: Tooth/tongue staining, increased tartar, mouth/throat irritation, dry mouth, and change in taste of food/drinks

Instruction and warning: The periodontal pocket should be isolated and the surrounding area dried prior to chip insertion. The Periochip should be grasped using forceps (such that the rounded end points away from the forceps) and inserted into the periodontal pocket to its maximum depth. If necessary, the Periochip can be further maneuvered into position using the tips of the forceps or a flat instrument. The Periochip does not need to be removed since it biodegrades completely.

Up to 8 chips may be inserted in a single visit. If dislodgement occurs 7 days or more after placement, the dentist should consider the subject to have received a full course of treatment. If dislodgement occurs within 48 hours after placement, a new Periochip should be inserted. If dislodgement occurs more than 48 hours after placement, the dentist should not replace the Periochip, but reevaluate the patient at 3 months and insert a new Periochip if the pocket depth has not been reduced to less than 5 mm.

Patient's information: Patients should avoid dental floss at the site of Periochip insertion for 10 days after placement, because flossing might dislodge the chip.

Notify the dentist promptly if the Periochip dislodges. Mild to moderate sensitivity is normal during the first week after placement of Periochip, they should notify the dentist promptly if pain, swelling, or other problems occur.

METRONIDAZOLE BENZOATE

Dosage form and strength: 25% gel

Indications: An adjunct to conventional therapy in the treatment of chronic periodontal disease in adults

Contraindications: Hypersensitivity to metronidazole

Precautions: Alcohol consumption; Should not be given during first trimester of pregnancy unless it is considered essential.

Dosage schedule: Two 25% gel applications at a one week interval

Adverse effects: Bitter taste, temporary local tenderness, headache

Instruction and warning: It is supplied in viscous consistency to the pocket; Use each applicator on one patient during one session of treatment only; If just part of the gel is used, the remainder should be discarded.

19.8 Analgesics used in dentistry

For indications, contraindications, adverse effects, drug interactions and other details see general section.

ACETAMINOPHEN AND NSAIDs

Indications: Mild to moderate nociceptive pain

Dosage form and schedule:**For adults:**

Drugs	Dose (mg)	Frequency	Daily maximum (mg)
Acetaminophen	500-1000	q4-6h	4000
Ibuprofen	400	q4-6h	2400
Naproxen	250-500	q8-12h	1375
COX-2 inhibitor (Celecoxib)	100-200	q12h	400
Etoricoxib	90-120	24h	
Piroxicam	20	24h	
Ketorolac	10	q4-6h	40
Mephenamic acid	500	q8h	
Diclofenac	50	q8h	

For children:

Drugs	Dose (mg)	Frequency	Daily maximum (mg)
Acetaminophen • Tablets • Oral suspension	10-15 mg/kg 160 mg/5ml	q4-6h q4-6h	65 mg/kg Not more than 5 times a day
Ibuprofen Tablets • 2-12yrs • Over 12 yrs Oral suspension • 1-4 years • 4-7 years • 7-12 years	10 mg/kg 200-400 mg 100 mg/5ml 5ml 7.5ml 10ml	q6-8h q4h q8h q8h q8h	1200 mg 60 ml
Diclofenac	1 mg/kg		

OPIATE AND COMBINATION OF OPIATE-NSAIDs**Indications:** For moderate to severe nociceptive pain**Dosage form and schedule:**

Opiate analgesic medications		
Drugs	Dose (mg)	Frequency
Oxycodone	5-30	q4h
Codeine sulfate	15-60	q4-6h
Tramadol	50-100	q4-6h
Hydromorphone	8	q3-4h
meperidine	50-150	q3-4h

Combination of NSAID-opiate medications		
Drugs	Dose (mg)	Frequency
Acetaminophen +codeine	300 + 30	q4-6h
Acetaminophen + hydrocodone	500 + 5	q4-6h

Ibuprofen + hydrocodone	200 + 7.5	q4-6h
Acetaminophen + oxycodone	(325+ 2.5) / (500+7.5)	• 2 tabs q4-6h

TOPICAL ANALGESICS

Drug	Form	Dose	Frequency	Indications
Lidocaine	Topical patch Topical gel Solution	2.5-5% 2%	Apply upto 12h/d Apply q3-4h 10cc q4-6h (rinse & expectorate)	Mucosal pain Superficial facial pain
Diphenhydramine	Solution	12.5mg/5cc	10cc q4-6h (rinse & expectorate)	Mucosal pain
Benzocaine	Topical gel	10%, 15%, 20%	Apply qd	Mucosal pain Superficial facial pain
Dexamethasone	Solution	0.5mg/5cc	10cc, q4- 6h (rinse & expectorate)	Mucosal pain
Capsaicin	Topical cream	0.025%, 0.075%	Apply tid/qid	Stomatodynia Superficial neuropathic facial pain
Doxepin	Topical cream	5% cream	Apply q3-4h	Superficial neuropathic facial pain

ADJUVANT ANALGESICS:**ANTICONVULSANT AND ANTIDEPRESSANT****Anticonvulsant medications for chronic facial pain.**

Indications: Cranial neuralgias; Traumatic neuropathy; Neuropathic pain of undetermined origin

Dosage form and schedule:

Drugs	Form	Dose (mg)	Frequency
Carbamazepine	Tablets Suspension	200-600 250mg/5ml; dose as needed 100-1200mg	BID. Slow escalation TID
Gabapentin	Tablets Solution	300-1200 mg 250mg/5ml; dose as needed 300-1200mg	TID TID
Pregabalin	Tablets	100mg	BID. Slow escalation
Lamotrigine	Tablets	50-200mg	BID. Slow escalation
Oxcarbazepine	Tablets	300-600 mg	BID. Slow escalation
Topiramate	Tablets	50-100mg	BID. Slow escalation

Antidepressant and anxiolytic medications for chronic orofacial pain

Indications: Adjuvant for cranial neuralgias; Primary for generalized neuropathic pain; Stomatodynia (burning mouth)

Dosage form and schedule:

Drugs	Form	Dose (mg)	Frequency
Amitriptyline	Tablets	10-100 mg	Qhs
Nortriptyline	Tablets	10-75 mg	Qhs
Imipramine	Tablets	10-50 mg	Qhs
Clonazepam	Tablets	0.5-4 mg	qhs
	Tansmucosal wafer	0.25mg	q6s
Doxepin	Tablets	10-50 mg	qhs
	Topical	5% cream	q3-4h
Duloxetine	Tablets	30-60 mg	QD

Muscle relaxant medications for chronic orofacial pain**Indications:** Myofacial pain with muscle tension component**Dosage form and schedule:**

Drugs	Form	Dose (mg)	Frequency
Baclofen	Tablets	10-20 mg	Bid
Cyclobenzaprine	Tablets	5-10 mg	TID
Tizanidine	Tablets	2-8 mg	Q6-8h prn
Carisoprodol	Tablets	350 mg	TID-QID
Metaxalone	Tablets	800 mg	TID/QID

19.9 Local anesthetics used in dentistry

Anesthesia is administered prior to a procedure to help dull pain or sedate a nervous or anxious patient.

Local Anesthesia is defined as loss of sensation (without loss of consciousness) in a circumscribed area of the body caused by the depression of excitation in nerve endings or an inhibition of conduction process in peripheral nerves.

Role of LA:

- Decrease intra-operative and post-operative pain
- Decrease amount of general anesthesia used in the operation theatre
- Increase patient's co-operation
- Diagnostic testing/examination

Commonly used local anesthetics in dental practice are:

- Lidocaine (also called Xylocaine or Lignocaine)
- Procaine (also known as Novocaine)
- Articaine (also called Septocaine or Ubistesin)
- Bupivacaine (a long-acting anesthetic)
- Mepivacaine

A combination of these may be used depending on the situation. Single dose cartridge of any local anesthetic solution contains 1.7 mL solution.

VASOCONSTRICTORS

Most anesthetic agents come in **two forms**:

1. With vasoconstrictor (Epinephrine/Levonordefrin/Nor-epinephrine)
 2. Without vasoconstrictor
- Vasoconstrictors allow the agent to last longer and also control bleeding

in the tissue during procedures.

- The most commonly used dose of epinephrine as a vasoconstrictor is:
 - 1:50,000 – Used mostly for additional hemostasis (minimum volume should be used); not used in increased-risk patients.
 - 1:100,000 – Ideally used for most dental procedures; hemostasis.
 - 1:200,000 – Used more in ASA-3, ASA-4 and elderly patients; hemostasis.

Maximum Epinephrine Dosage:

- ASA I patients: 0.2 mg or 200µg per appointment.
- ASA III or IV patients: 0.04 or 40µg per appointment.

Epinephrine concentration	Healthy adult patient		Adult patient with significant cardiovascular disease	
	Dose	Cartridges	Dose	Cartridges
1:50,000	0.2 mg	5.5	0.04 mg	1.1
1:100,000	0.2 mg	11.1*	0.04 mg	2.2
1:200,000	0.2 mg	22.2	0.04 mg	4.4

*Actual maximum volume is limited by the dosage of the local anesthetic

Relative/absolute contraindications of vasoconstrictors:

The vasoconstrictor-containing anesthetic agents are used **precautiously(pc)** or are **contraindicated(¢)** in the following cases:

- Diabetes (**pc**)
- Corticosteroid-dependent asthma (**pc**)
- Hyperthyroidism (**¢**)
- History of congestive heart failure; patients taking digitalis glycosides, such as Digoxin (**pc**)
- History of cerebrovascular accidents (atherosclerosis, hypertensive vascular disease, myocardial infarction, etc.) (**pc**)
- Patients taking medications including:
 - Tricyclic antidepressants (Epinephrine (**pc**); Nor-epinephrine (**¢**); Levonordefrin (**¢**))
 - Cocaine (**¢**)
 - Anti-psychotic or other α adreno-receptor blockers (**pc**)
 - Adrenergic neuronal blockers (**pc**)

Calculation of maximum dosage and number of cartridges (Single drug)

- **Patient 1:** 22 years old, healthy, female, 50 kg
Local anesthetic: Lidocaine HCl + Epinephrine 1:100,000
 Lidocaine 2% = 36 mg/cartridge
 Lidocaine: 7 mg/kg = 350 mg (MRD)
 Number of cartridges: $350/36 =$ approximately 9 and $\frac{3}{4}$
- **Patient 2:** 40 years old, healthy, male, 90 kg
Local anesthetic: Articaine HCl + Epinephrine 1:200,000
 Articaine 4% = 72 mg/cartridge

Articaine: $7 \text{ mg/kg} = 630 \text{ mg (MRD)}$
 Number of cartridges: $630/72 = \text{approximately } 9.0$

- **Patient 3:** 6 years old, healthy, male, 20kg
Local anesthetic: Mepivacaine HCl + No vasoconstrictor
 Mepivacaine 3% = 54 mg/cartridge
 Mepivacaine 3%: $6.6 \text{ mg/kg} = 132 \text{ mg (MRD)}$
 Number of cartridges: $130/54 = \text{approximately } 2.5$

Calculation of maximum dosage and number of cartridges (Multiple drugs)

- **Patient 1:** 45 kg female, healthy
Local anesthetic: Mepivacaine 2% + Levonordefrin 1:20,000
 Mepivacaine 2% = 36 mg/cartridge
 Mepivacaine: $6.6 \text{ mg/kg} = 297 \text{ mg (MRD)}$
 Patient receives 2 cartridges = 72 mg, but anesthesia is inadequate.
 Doctor wishes to change to articaine 4% + epinephrine 1:100,000.

How much Articaine can this patient receive?

Articaine 2% = 72 mg/cartridge
 Articaine: $7.0 \text{ mg/kg} = 315 \text{ mg (MRD)}$
 Total dose of both local anesthetic should not exceed the lower of the two calculated doses, or 297 mg.
 Patient has received 72 mg (lidocaine), thus can still receive 225 mg of articaine.
 Therefore, $225 \text{ mg}/72 \text{ mg per cartridge} = \text{approximately } 3.0$ cartridges of articaine 4% + epinephrine 1:100,000.
 MRD=Maximum Recommended Dose

Calculation of number of cartridges to be given

- **Patient 1:** 45 kg male, healthy
Local anesthetic: Lidocaine 2%, 1 cartridge = 3 ml
 $100\% = 1000 \text{ mg/ml}$; $1\% = 10 \text{ mg/ml}$; $2\% = 20 \text{ mg/ml}$
 $\therefore 1 \text{ ml} = 20 \text{ mg}$
 $\therefore 3 \text{ ml} = 3 \times 20 = 60 \text{ mg in 1 cartridge}$
MRD = 7mg/kg (with vasoconstrictor)

Maximum number of cartridges = (Body weight x MRD) / Cartridge volume

= $(45 \text{ kg} \times 7 \text{ mg/kg}) / 60 \text{ mg}$
 = 5.25 cartridges
 = ~ 6 cartridges

COCAINE

Generic Name: Cocaine Hydrochloride

Dose Form and Strength: Available in concentrations ranging from 2% to 10%; It is used extensively via topical application. Concentration of cocaine should not exceed 4% for the topical application on oral mucous membrane

Time of onset and duration:

Onset of Topical anesthesia: 1 minute

Duration of action: 2 hours

Indications: Used as a local anesthetic prior to surgical procedures involving the oral, laryngeal, or nasal cavities.

Contraindications: Patients with a known history of hypersensitivity to the drug or to components of topical solution.

Precautions: Use with caution during pregnancy and in nursing mothers. It should be used with caution in patients with severely traumatized mucosa and sepsis in the region of the proposed application.

Instructions and warning: The medication can be poured, sprayed, or applied with a cotton swab directly to the area. This effect will make swallowing difficult and increase the risk of choking or swallowing the wrong way. Do not eat for 1 hour after this product is used or until the mouth/throat is no longer numb. Be careful not to accidentally bite the tongue or mouth. Injection of cocaine is contraindicated because of the ready availability of more effective and much less toxic local anesthetics

Patient information: Before the procedure, inform the doctor if allergic to cocaine, or to other ester-type anesthetics, or if any other allergies or if you have any existing medical history. This drug may make you dizzy. Do not drive, use machinery, or do any activity that requires alertness until you are sure you can perform. Rarely abnormal drug-seeking behavior or addiction is possible with this medication therefore use exactly as prescribed. Do not use more of this medication, use it more frequently, or use for a longer period of time than prescribed.

BENZOCAINE

Dosage form: Aerosols; Gel; Gel patch; Ointment; Solution

Time of onset and duration:

Indications: Benzocaine topical is used to reduce the pain or discomfort caused by minor skin irritations, sore throat, sunburn and many other sources of minor pain on a surface of the body. It is also used to numb the skin surfaces inside the mouth to lessen the pain of inserting medical instruments.

Contraindications: Known allergy or hypersensitivity to benzocaine; History of methemoglobinemia; Infants

Precautions: Any type of inherited enzyme deficiency, heart diseases, a breathing disorder such as asthma, bronchitis or emphysema Do not apply other medications to the same affected areas treated with benzocaine topical, unless absolutely necessary

Adverse Effects: Benzocaine topical used in the mouth or throat may cause life-threatening condition due to methemoglobinemia causing respiratory distress and cyanosis. Intravenous methylene blue is the specific therapy for this condition. Signs and symptoms may occur within minutes or up to 2 hours after using benzocaine topical in the mouth or throat. It may include: Headache, tired feeling, confusion, Fast heart rate, Feeling light-headed or short of breath, Pale, blue, or gray appearance of the skin, lips, or fingernails. Contact dermatitis and/or hypersensitivity to benzocaine can cause burning, stinging, pruritis, tenderness, erythema, rash, urticarial and edema.

Serious side effects are: Headache, weakness, dizziness, breathing

problems, fast heart rate, and gray or bluish colored skin, Severe burning, stinging, or sensitivity where the medicine is applied; Swelling, warmth or redness, oozing, blistering or any other signs of infection.

Less serious side effects includes: Mild stinging, burning, or itching where the medicine is applied; Skin tenderness or redness, or Dry white flakes where the medicine was applied.

Patient's information: Inform your doctor of any existing medical conditions; Avoid eating within 1 hour after using it on the gums or inside the mouth. Avoid getting it in the eyes. Avoid swallowing the gel, liquid, or ointment while applying it to the gums or the inside of the mouth. The throat spray or oral lozenge may be swallowed gradually during use

TETRACAINE

Dose Form and Strength: Injection: 0.15% concentration; Topical: 2% concentration

Maximum recommended dose: 20mg when used for topical application which represents 1ml of a 2% solution.

Time of onset and duration:

Onset of topical anesthesia: slow

Duration of action: 45 mins

Indications: To achieve anesthesia of any part of the body, where applied. Tetracaine in a 3% concentration, with the vasoconstrictor oxymetazocaine, has been shown to provide pulpal anesthesia of maxillary teeth when administered by aerosol spray into a patients nares.

Contraindications: It should not be used if allergic to tetracaine or similar numbing medicines such as lidocaine, benzocaine or Prilocaine. Do not use it in large skin areas or deep puncture wounds. Avoid using it on skin that is raw or blistered, such as a severe burn or abrasion.

Precautions: Rapidly absorbed through mucous membrane. Use should be limited to small areas to avoid rapid absorption. In pregnant and breast-feeding women

Adverse Effects: Commonly seen: Mild stinging, burning, or itching where the medicine is applied Skin tenderness or redness. Numbness in places where the medicine is accidentally applied **Rare but serious:** Nervousness, dizziness, blurred vision; Drowsiness, feeling like you might pass out; Breathing problems; Fast or slow heart rate ; Weak pulse, fainting, slow breathing (breathing may stop).

Instruction and warning: Do not use in larger or smaller amounts or for longer than recommended. To treat minor skin conditions, apply a thin layer of tetracaine topical to the affected area up to 4 times per day. Overdose symptoms may include uneven heartbeats, seizures, coma, slowed breathing, or respiratory failure.

Patient's information: Inform your doctor of any existing medical conditions, or if you are taking any other medication. Inform if pregnant or plan to become pregnant while using this medicine. Tell the doctor if breast feeding a baby as well. Rinse with water if this medicine gets in the eyes as it can cause severe eye irritation.

NOVOCAIN**Generic Name:** Procaine**Dosage form and strength:** Effective dental concentration- 2% to 4%; Topical Anesthetic action – Not in clinically acceptable concentrations**Maximum recommended dose:** For peripheral nerve block - 1000mg**Time of onset and duration: Onset:** 6 to 10 minutes**Pulpal anesthesia duration (2% plain procaine):** No action**Soft tissue anesthesia duration (2% plain procaine):** 15 to 30 minutes**Indications:** Production of local or regional analgesia and anesthesia by local infiltration and peripheral nerve block techniques.**Contraindications:** Patients with known hypersensitivity to procaine, other components of Novocain solution, drugs of a similar chemical configuration, or para-aminobenzoic acid or its derivatives. Procaine with epinephrine or other vasopressors should not be used concomitantly with ergot-type oxytocic drugs, because a severe persistent hypertension may occur.**Precautions:** The safety and effectiveness of local anesthetics depend on proper dosage, correct technique, adequate precautions, and readiness for emergencies. Resuscitative equipment, oxygen, and other resuscitative drugs should be available for immediate use. Used with caution in patients with known allergies and sensitivities.

Contains acetone sodium bisulfite, a sulfite that may cause allergic-type reactions including anaphylactic symptoms and life-threatening or less severe asthmatic episodes in asthmatic people. Patients with severe hepatic disease Solutions of Procaine containing a vasoconstrictor should be used with extreme caution in patients receiving monoamine oxidase inhibitors (MAOI) or antidepressants of the triptyline or imipramine types, because severe prolonged hypertension or disturbances of cardiac rhythm may occur.

Adverse Effects: An allergic reaction (difficulty in breathing, closing of the throat, swelling of the lips, tongue or face, hives); Chest pain or slow or irregular heart beats. Dizziness or drowsiness; Anxiety or restlessness; Nausea or vomiting; Seizures. Other less serious side effects such as numbness, tingling, or minor pain at or around the injection site are more likely to occur**Instructions and Warnings:** Injections should be made slowly, with frequent aspirations before and during the injection to avoid intravascular injection.**Patient's Information:** When appropriate, patients should be informed, in advance, that they may experience temporary loss of sensation and motor activity following proper administration of regional anesthesia.**CHLORPROCAINE****Generic Name:****Dosage form and strength:** Maximum single recommended doses: Without epinephrine -11 mg/kg, not to exceed a maximum total dose of 800 mg; With epinephrine (1:200,000) -14 mg/kg, not to exceed a maximum total dose of 1000 mg**Time of onset and duration:****Indications:** Production of local anesthesia by infiltration, peripheral and central nerve block.

Contraindications: In patients hypersensitive (allergic) to drugs of the PABA ester group

Precautions: Consideration should be given to employing a chlorprocaine solution that contains epinephrine for the test dose because circulatory changes characteristic of epinephrine may also serve as a warning sign of unintended intravascular injection. An intravascular injection is still possible even if aspirations for blood are negative.

Chlorprocaine Hydrochloride Injection contains sodium metabisulfite, a sulfite that may cause allergic-type reactions including anaphylactic symptoms and life-threatening or less severe asthmatic episodes in asthmatic patients. Similar to ester local anesthesia as procaine

Adverse Effects: Restlessness, anxiety, dizziness, tinnitus, blurred vision or tremors may occur, possibly proceeding to convulsions. High plasma levels and related depression of the myocardium, hypotension, bradycardia, ventricular arrhythmias and, possibly, cardiac arrest. Allergic-type reactions are rare and may occur as a result of sensitivity to the local anesthetic. These reactions are characterized by signs such as urticaria, pruritis, erythema, angioneurotic edema (including laryngeal edema), tachycardia, sneezing, nausea, vomiting, dizziness, syncope, excessive sweating, elevated temperature, and possibly, anaphylactoid-type symptomatology (including severe hypotension).

Instructions and Warnings: Mixtures of local anesthetics are sometimes employed to compensate for the slower onset of one drug and the shorter duration of action of the second drug

Patient's information: When appropriate, patients should be informed in advance that they may experience temporary loss of sensation

PROPOXYCAINE HCl

Dosage form and Strength: Effective dental concentration – 0.4%; Topical Anesthetic – Not in clinically acceptable concentrations

Time of onset and duration: **Onset:** 2 to 3 minutes. Combines with procaine to provide more rapid onset and longer-lasting anesthesia. It is not used as a sole agent due to its higher toxicity.

Indications: Propoxycaine combined with procaine in solution provides more rapid onset and a more profound and longer-lasting anesthesia than that obtained with procaine alone

Contraindications: Not used as a sole agent because of its higher toxicity (7 to 8 times that of procaine)

(Warnings, precautions, instructions resemble to procaine since it is used along with it)

PROCAINE HCl + PROPOXYCAINE HCl

Time of onset and duration:

Onset: 2-3 minutes

Pulpal anesthesia: 40 minutes

Soft tissue anesthesia: 2-3 hours

Indications: The combination was useful when the amides were absolutely contraindicated, in cases of documented allergies or when several amide local anesthetics failed to provide clinically adequate anesthesia

Dosage form and strength: Available only in dental cartridge form. A dose of 0.4% propoxycaïne + 2% procaine with 1:20,000 levonordefrin (Unites States) or with 1:30,000 norepinephrine (Canada) provided approximately 40 minutes of pulpal anesthesia and 2 to 3 hours of soft tissue anesthesia.

Maximum recommended dose: 3.0mg/lb or 6.6 mg/kg of body weight for the adult patient; 3.0mg/lb for children (upto maximum of 5 cartridges)

LIDOCAINE

Generic name: Lidocaine hydrochloride

Dosage form and strength: Injection - Ampoule; Flip-top vial; Multiple-dose flip-top vial; Spray solution (5%); 7 mg/kg (3.2 mg/lb) of body weight with epinephrine;

not exceeding the maximum total dose of 500mg; 4.5 mg/kg (2 mg per lb) of body weight without epinephrine; not exceeding the maximum total dose of 300mg

Time of onset and duration: **Onset:** Less than 2 minutes **Pulpal anesthesia duration:** 60 minutes; **Soft tissue anesthesia duration:** 2 1/2 hours; **Onset:** 2-4 minutes; **Pulpal anesthesia duration:** 90 minutes; **Soft tissue anesthesia duration:** 3 to 3 1/4 hours

Indications: For production of local or regional anesthesia during dental procedures such as teeth extractions, control of odontogenic pains and surgical procedures.

Contraindications: In patients with a known history of hypersensitivity to local anesthetics of the amide type

Precautions:

Lidocaine with vasoconstrictor in patients with peripheral vascular disease and those with hypertension may exhibit exaggerated vasoconstrictor response. Ischemic injury or necrosis may result. Use solution without vasoconstrictor in such cases.

Preparations **containing a vasoconstrictor** should be used with caution in patients during or following the administration of potent general anesthetic agents, since cardiac arrhythmias may occur under such conditions.

Should be used with caution in patients with hepatic disease and impaired cardiovascular function.

Use with caution in pregnant women and nursing mothers.

Adverse effects: Commonly seen: nausea, dizziness, numbness in places where the medicine is accidentally applied, or bruising, redness, itching, or swelling where the medication was injected **Rarely seen (more serious):** drowsiness, mental/mood changes, ringing in the ears, dizziness, vision changes, tremors, numbness, headache or backache

Dosage schedule:

For routine dental procedures, lidocaine and epinephrine 1:100,000 injection is preferred. However, when greater depth and a more pronounced hemostasis are required, a 1:50,000 epinephrine concentration should be used. In oral infiltration and / or mandibular block, initial dosages of 1.0 - 5.0 mL (1/2 to 2.5 cartridges) of Lidocaine and Epinephrine Injections are usually effective. **In children under 10 years of age,** it is rarely necessary to administer more than one-half cartridge (0.9-1.0 mL or 18-20 mg of lidocaine)

per procedure to achieve local anesthesia for a procedure involving a single tooth. In maxillary infiltration, this amount will often suffice to the treatment of two or even three teeth. In the mandibular block, however, satisfactory anesthesia can be achieved with this amount of drug.

Drug and food interactions: May interact with monoamine oxidase inhibitors (MAOIs), antidepressants, phenothiazines, butyrophenones, vasopressor drugs, ergot-type oxytocic drugs, or drugs that can cause drowsiness such as medicine for sleep, sedatives, tranquilizers, anti-anxiety drugs, narcotics, psychiatric medicines, anti-seizure drugs, muscle relaxants, or antihistamines.

Instruction and warning: Lidocaine is more potent than procaine, with toxicity more in lidocaine compared to procaine. Use of lidocaine anesthetic should be restricted to clinicians who are well-versed in the diagnosis and management of dose-related toxicity and other emergencies that may arise from the usage of the anesthetic agent.

Patient's information: Patients should be informed in advance that they may experience temporary loss of sensation and motor activity in the anesthetized nerve area.

MEPIVACAINE

Generic name: Mepivacaine hydrochloride

Dosage form and strength: Injection; Solution; Maximum recommended dose of 6.6 mg/kg (3 mg/lb) of body weight, not to exceed 400mg.

Time of onset and duration: Onset: 1.5-2 minute

Pulpal anesthesia: 60 minutes duration

Soft tissue anesthesia: 3-5 hours duration

Indications: Production of local anesthesia for dental procedures by infiltration or nerve block in adults and pediatric patients.

Contraindications: In patients with a known hypersensitivity to amide type local anesthetics.

Precautions: Mepivacaine should be used with caution in patients with a history of severe disturbances of cardiac rhythm or heart block. Injections should always be made slowly with aspiration to avoid intravascular injection. Use with caution in patients with liver disease, kidney disease, high or low blood pressure, asthma, cardiovascular disease or thyroid disorder. Use with caution in pregnant women and nursing mothers.

Adverse effects: Commonly seen: nausea, vomiting, nervousness, dizziness or drowsiness **More serious effects:** weak or shallow breathing, feeling like you might pass out, sweating, anxiety, confusion, blurred vision, ringing in your ears, numbness or tingling around your mouth, slow heart rate, weak pulse, metallic taste in your mouth, tremors, muscle twitching, or seizure (convulsions).

Drug and food interactions: Mepivacaine with vasopressor should not be used concomitantly with ergot-type oxytocic drugs, because a severe persistent hypertension may occur. Mepivacaine with vasoconstrictor should be used with extreme caution in patients receiving monoamine oxidase inhibitors (MAOI) or antidepressants of the triptyline or imipramine types, because severe prolonged hypertension may result.

Instruction and warning: Potency of mepivacaine equals that of lidocaine. Toxicity, compared to lidocaine, is almost equivalent, or slightly less. Resuscitative equipment and emergency drugs should be immediately available in case of any potent adverse reaction.

Treatment of a patient with toxic manifestations consists of assuring and maintaining a patent airway and supporting ventilation (respiration) as required.

In case of convulsions, small increments of anticonvulsive agents may be given intravenously.

Cardiovascular depression may require circulatory assistance with intravenous fluids and/or vasopressor.

Allergic reactions should be managed by administration of antihistamines.

Patient's information:

The patient should be cautioned against loss of sensation and possibility of biting trauma should the patient attempt to eat or chew gum prior to return of sensation.

PRILOCAINE

Generic name: Prilocaine

Dosage form and strength: Injectable solution (cartridge for dental use); Gel form: 4%, 4% with epinephrine 1:200,000

Time of onset and duration:

Onset: 2-4 minutes

Pupal anesthesia duration: 60-90 minutes

Soft tissue anesthesia duration: 3-8 hours

Pulpal anesthesia duration: 40-60 minutes

Soft tissue anesthesia duration: 2-4 hours

Indications: Local anesthesia in dentistry by nerve block or infiltration techniques.

Contraindications: Congenital or idiopathic methemoglobinemia; Hypersensitivity to prilocaine, amide-type local anesthetics, sulfites, parabens

Precautions: Have resuscitative equipment, oxygen, and standard protocol for management of malignant hyperthermia available, G6PD deficiency, Severe shock, Heart block, Hepatic disease, Impaired cardiovascular function, Head and neck block. Monitor cardiovascular and respiratory vital signs.

Adverse effects: CNS depression (drowsiness, unconsciousness, respiratory arrest, nausea, chills etc); Cardiovascular effects (eg, bradycardia, hypotension, cardiovascular collapse); Anxiety, restlessness, nervousness, disorientation, confusion, dizziness, tremors, twitching, blurred vision, seizures, edema, anaphylactoid reactions, status asthmaticus

Drug and food interactions: Risk of methemoglobinemia with sulfonamides, acetaminophen, aniline dyes, benzocaine, chloroquine, dapsone, naphthalene, nitrates and nitrites; Concurrent administration of vasopressor drugs and ergot-type oxytocic drugs may cause severe, persistent hypertension or cerebrovascular accidents.

Instruction and warning: Administration of > 600mg to adults causes non-acute 15% methemoglobinemia via formation of O-toluidine metabolite.

ASPIRATION PRIOR TO INJECTION IS RECOMMENDED, since it reduces the possibility of intravascular injection, thereby keeping the incidence of side effects and anesthetic failure to a minimum.

NOTE: Parenteral drug products should be inspected visually for particulate matter and discoloration prior to administration whenever the solution and container permit. Solutions that are discolored and/or contain particulate matter should not be used.

Patient's information: The patient should be informed of the possibility of temporary loss of sensation and muscle function following infiltration or nerve block injections.

The patient should be advised to exert caution to avoid inadvertent trauma to the lips, tongue, cheek mucosa, or soft palate when these structures are anesthetized. The ingestion of food should therefore be postponed until normal function returns. The patient should be advised to consult the dentist if anesthesia persists, or if a rash develops.

ARTICAINE

Generic name: Articaine

Dosage form and strength: Injectable solution 4% with epinephrine 1:100,000 or 1:200,000

Time of onset and duration:

Onset: 1-2 minutes

Pulpal anesthesia duration: 60-75 minutes

Soft tissue anesthesia duration: 3-6 hours

Pulpal anesthesia duration: 45-60 minutes

Soft tissue anesthesia duration: 2-5 hours

Indications: Local, infiltrative or conductive anesthesia in dental procedures

Contraindications: Hypersensitivity to amide-type local anesthetics, sulfites

Precautions: If allergic to any type of numbing medicine.; To make sure articaine and epinephrine is safe for the patient, rule out any history of heart rhythm disorder; low or high blood pressure; asthma or a sulfite allergy; or a history of seizures.

Resuscitative equipment, oxygen, and other resuscitative drugs should be available for immediate use.

Dosage schedule:

Procedure	Volume (mL)	Total dose of articaine HCl (mg)
Infiltration	0.5 - 2.5	20 - 100
Nerve block	0.5 - 3.4	20 - 136
Oral surgery	1.0 - 5.1	40 - 204

Adverse effects: Facial edema, headache, paresthesia, sleepiness, nausea, vomiting, infection; Tongue pain or swelling, red or swollen gums; mild swelling in your face; headache; or numbness and tingling.

Drug and food interactions: The administration of local anesthetic solutions containing epinephrine to patients receiving monoamine oxidase inhibitors, nonselective beta-adrenergic antagonists, or tricyclic antidepressants may produce severe, prolonged hypertension. Phenothiazines and butyrophenones may reduce or reverse the pressor effect of epinephrine.

Concurrent use of these agents should be avoided

Instruction and warning: Dental practitioners who employ local anesthetic agents including Articaine HCl and Epinephrine should be well versed in diagnosis and management of emergencies that may arise from their use. ; To avoid intravascular injection, aspiration should be performed before Articaine HCl and Epinephrine is injected. The needle must be repositioned until no return of blood can be elicited by aspiration. Note, however, that the absence of blood in the syringe does not guarantee that intravascular injection has been avoided.; Careful and constant monitoring of cardiovascular and respiratory (adequacy of ventilation) vital signs and the patient's state of consciousness should be performed after each local anesthetic injection of Articaine HCl and Epinephrine.

Patient's information: This medication can cause numbness for an extended period of time. Avoid eating, chewing gum, or drinking hot liquids until the feeling in your mouth has returned completely. Chewing while your mouth is numb could result in a bite injury to your tongue, lips, or inside of your cheek.; To make sure articaine and epinephrine is safe for you, tell your doctor if you have: a heart rhythm disorder; low or high blood pressure; asthma or a sulfite allergy; or a history of seizures.

BUPIVACAINE

Generic name: Bupivacaine hydrochloride

Dosage form and strength:

Injection

Solution

400 mg/day maximum dosage

Time of onset and duration:

Onset: 6-10 minutes

Pulpal anesthesia duration: more than 90 minutes

Indications: Production of local anesthesia for dental procedures by infiltration or nerve block in adults.; For pain control in long duration dental procedures.; For relief of acute severe dental pain until definitive treatment is provided

Contraindications: In patients with a known hypersensitivity to amide type local anesthetics.

Precautions: Use with caution in patients with history of anemia, kidney or liver disease, bleeding or blood clotting disorder, syphilis, polio, a brain or spinal cord tumor, numbness or tingling, chronic back pain, headache caused by surgery, low or high blood pressure, abnormal curvature of the spine, or arthritis. Use with caution in pregnant women and nursing mothers. Not usually indicated in pediatric and mentally-disabled patients, since dental appointments are usually of short duration.

Adverse effects:

Commonly seen: nausea, vomiting, chills or shivering, headache, or back pain.

Serious effects: feeling anxious, restless, confused, or like you might pass out, problems with speech or vision, ringing in the ears, metallic taste, numbness or tingling around your mouth, or tremors, convulsions, weak or

shallow breathing, fast heart rate, gasping, feeling unusually hot, slow heart rate, weak pulse, urinating less than usual or not at all.

Drug and food interactions: Drugs that affect the action of bupivacaine : Blood thinner such as warfarin (Coumadin); Ergot medicine such as ergotamine, dihydroergotamine;

Antidepressants such as amitriptyline, doxepin; MAO inhibitor such as furazolidone, isocarboxazid; Phenothiazine such as chlorpromazine, prochlorperazine, promethazine

Instruction and warning: Four times more potent and four times less toxic than lidocaine and mepivacaine. Use of anesthetic should be restricted to clinicians who are well-versed in the diagnosis and management of dose-related toxicity and other emergencies that may arise from the usage of the anesthetic agent.

Patient's information: Inform your doctor if you are pregnant or is a lactating mother

Avoid eating, chewing gum, or drinking a hot beverage until your mouth is no longer numb.

DIPHENHYDRAMINE

Generic name: Diphenhydramine hydrochloride

Dosage form and strength: Vial containing 50 mg/mL diphenhydramine for parenteral injection

Dosage dispense: Draw up entire contents of vial containing 50 mg/mL diphenhydramine into the syringe. This should measure to a volume of 1 mL. Dilute the contents of the syringe with 4 mL of 0.9% Sodium Chloride to yield a final volume of 5 mL.

Clearly label the contents of the syringe with the medication label as “**Diphenhydramine 1% (10 mg/mL).**”

Administer via injection a total of **2 mL of 1% DPH.**

Depending on the location and depth of the wound, the amount of 1% DPH necessary to induce local anesthesia may vary, and can range from 1 mL to 10 mL.

Indications: In cases of hypersensitivity to any of the “-caine” anesthetic agents.

Allergic reactions to any materials or medications used during dental procedures.

Contraindications: Hypersensitivity to diphenhydramine.

Adverse effects: Greater perception of pain at injection site relative to 1% Lidocaine.

Risk of local tissue necrosis at the site of injection.

19.10 General anesthesia for dental procedures

General anesthetics are drugs which produce reversible loss of all sensation and consciousness.

Generic name:

Inhalational form	Intravenous form
Nitrous oxide	Thiopentone sodium
Ether	Propofol
Halothane	Ketamine
Isoflurane	Fentanyl
	Etomidate

Indications: Patients unable to cooperate with a certain physical, mental or medically compromising disability. Patients who have sustained extensive orofacial or dental trauma & require extensive surgical procedures. Patients with dental restorative or surgical needs for whom local anesthesia is ineffective because of acute infections, anatomic variation or allergy. Extremely uncooperative, fearful, anxious. Physically resistant child or adolescent with substantial dental needs Patients requiring immediate comprehensive oral and dental needs.

Failure of sedation.

Contraindications: Presence of respiratory obstruction; cardiovascular instability; severe asthma or bronchospastic disease; porphyria

Sedation**Terms coined by ADA:**

Status	Responsiveness	Airway	Ventilation	Cardiovascular
Minimal sedation	Normal to verbal stimulation	Maintained	Normal	Normal
Moderate sedation	Purposeful to verbal or light tactile stimulation	Maintained	Adequate	Maintained
Deep sedation	Purposeful to repeated or painful stimulation	May need intervention	May need intervention	Usually maintained

Commonly used sedatives:

Routes of administration	Agents
Inhalation	Nitrous oxide, desflurane, sevoflurane
Oral	Hydroxyzine, promethazine, chloral hydrate, meperidine, diazepam, triazolam, chlorpromazine
Intramuscular	Ketamine, Midazolam
Intravenous	Midazolam, Propofol

Conscious Sedation

It is a minimally depressed level of consciousness that retains the patient's ability to maintain an airway independently and respond appropriately to physical stimulation and verbal command.

Nitrous oxide/oxygen is usually the technique of choice for conscious sedation especially in pediatric patients.

Dosage form and strength: Nitrous oxide/oxygen gas: 30-40% N₂O {Do not exceed 50% of N₂O}

Indications: Patients who cannot cooperate or understand for definitive treatment; patients lacking cooperation because of lack of psychological or emotional maturity; patients with dental care requirements but are fearful and anxious; patients whose gag reflex interferes with the procedure.

Contraindications: Chronic obstructive pulmonary disorder, pregnancy (first trimester), myasthenia, epilepsy, bleeding disorder; unaccompanied; prolonged surgery, inadequate personnel

Precautions: Review of patient's medical history; use of appropriate dose of N_2O/O_2

Maintain appropriate flow rate of the gas.

Adverse effects: Nausea and vomiting (in 0.5%); diffusion hypoxia can occur as a result of rapid release of N_2O from blood stream into the alveoli, thereby diluting the concentration of oxygen.

Instructions and warnings: The practitioner must be trained in the use of such agents and techniques; take informed consent from the patients and parents; select appropriate sized nasal hood; maintain a flow rate of 5-6L/min; the dose of N_2O should not exceed 50%; introduction of 100% oxygen for 1-2 minutes after the titration of N_2O in 10% intervals.

Patient information: Patients should eat normally on the day of their appointment avoiding alcoholic drinks; routine medication should be taken as normal; children must be accompanied to their appointments by a responsible parent or guardian who is able to give consent, or a responsible adult if written consent has already been obtained for the course of treatment. Adults should be accompanied to their first appointment by a responsible adult escort but may be permitted to attend subsequent appointments unaccompanied at the discretion of the treating dentist; unaccompanied adult patients who have received nitrous oxide/oxygen inhalation sedation must adopt caution before driving, operating machinery or signing legal documents and may be asked to remain in the clinic for up to 30 minutes after treatment is complete; sensible clothing is advised, avoiding tight sleeves and high-heeled shoes; patients who are trying to conceive or who are pregnant must inform their dentist in advance of their appointment.

19.11 Topical and systemic steroids for dental purpose

Corticosteroids are immunosuppressive and anti-inflammatory drugs very widely administered to treat pathological process in medical and dental practice. Topically used in non-infections, ulcerative diseases in oral cavity, inhibit the inflammatory reaction, redness and edema whereas systemic use is in third molar extraction, pre-prosthetic surgery, reconstructive oral surgery, orthognatic surgery.

Generic name:

- Dexamethasone
- Methylprednisolone
- Hydrocortisone
- Triamcinolone
- Flucinonide
- Clobetasol

TRIAMCINOLONE ACETONIDE

(a medium potency corticosteroid)

Form: Dental paste Usual dosage:1,2 Adolescents and adults: Apply paste to ulcers 3 times/day, after meals and at bedtime, not to exceed 7 day course.

DEXAMETHASONE

(a high potency corticosteroid; not FDA-approved for oral application)

Form: Elixir, solution (contains alcohol) Usual dosage:1,2 Adolescents and adults: Rinse with 5 mL 4 times/day for 2 minutes and expectorate; not to exceed 7 day course.

Dosage form and strength: Topically used as 0.025%, 0.05%, 0.1% or 0.2% Cream, Ointment, Lotion, Solution, Spray and Gel; Orally as tablets, suspension. Other routes can be intramuscular and intravenous; Intralesional form

Indications: As prophylactic drugs; Mucosal ulceration and inflammation; Odontogenic pain; Facial pain; Medical emergencies in dental practice; In orthodontic tooth movement

Contraindications: Primary bacterial infection; Hypersensitivity; Peptic ulcer; Diabetes mellitus; Hypertension; Osteoporosis; Psychosis; Epilepsy; Congestive heart failure; Renal failure.

Dosage schedule:

Mucosal ulceration and inflammation: Use of hydrocortisone hemisuccinate (as pellets of 2.5 mg) and triamcinolone acetonide (in an adhesive paste containing 0.1% of the steroid). High potency topical steroid preparation such as fluocinonide, betamethasone or clobetasol placed directly on the lesions shortens healing time and reduces the size of lesion. The gel can be carefully applied directly to the lesion after meals and at bedtime 2-3 times a day or mixed with an adhesive such as orabase prior to application.

Moderate lesions are treated by intralesional injections as in oral lichen planus with 10-20 mg in the form of bi-weekly injections, or even 3-4 times a week in more severe cases can be used for the treatment of erosions.

Larger lesions can be treated by placing a gauze sponge containing the topical steroid on the ulcer and leaving it in place for 15-30 min to allow for longer contact of the medication.

Systemic prednisone therapy should be started at 0.5 to 1.0 mg/kg a day as a single dose in patients and should be tapered after 1-2 week.

Facial pain: Immunocompetent patients without specific contraindications are prescribed prednisone at 1 mg/kg/d (maximum 80 mg) for the first week, which is tapered over the second week. (Ramsey 2000)

Endodontic pain: Corticosteroid can be used as a dressing agent for deep cavities and exposed pulp tissue in order to control the inflammatory pulp response and reduce postoperative pain. Intra canal placement of 2.5% steroid solution (triamcinolone) results in significant reduction of incidence of postoperative pain in vital tooth. (however no significant results are seen in necrotic pulp)

Oral submucous fibrosis: Intralesional injection: Triamcinolone Intralesional -3mg/ml-2-3ml/day.

Medical emergencies: In anaphylaxis shock, prednisone 1 mg/kg up to 50

mg orally or hydrocortisone 1.5-3 mg/kg intravenously specific in patients with airway involvement and bronchospasm is used.

19.12 Hemostatic agents

GELFOAM

Gelfoam is a porous, pliable sponge made from dried and sterilized porcine skin gelatin.

Available form: Size 4 (2 x 2 cm) envelopes of 2 sponges

Mechanism of Action: Gelfoam's mode of action is not completely understood, but unlike collagen, it is believed to be related to formation of a mechanical matrix that facilitates clotting rather than affecting the blood-clotting mechanism. This agent can retain in its interstices 45 times its weight in blood. Gelfoam liquefies in one week and is completely resorbed in 4 to 6 weeks.

Indications: Commonly employed agents for the control of minor bleeding in oral and dental surgery

Contraindications: Gelfoam should not be used in closure of skin incisions because they may interfere with the healing of skin edges.; Patients with known allergies to porcine collagen.

Adverse Effects: Giant cell granuloma and hematoma formation, foreign body reactions, excessive fibrosis, toxic shock syndrome, fever, and failure of absorption.

Precautions: Use of Gelfoam Dental Sponges is not recommended in presence of frank infection. If signs of infection or abscess develop in an area where GELFOAM has been placed, reoperation may be necessary to remove infected material and allow drainage.

By absorbing fluid, Gelfoam may expand and impinge on neighboring structures. Therefore, when placed into cavities or closed tissue spaces, minimal preliminary compression is advised and care should be exercised to avoid over packing.

Positioning of the patient resulting in negative peripheral venous pressure during a procedure has been reported to be a contributing factor resulting in life-threatening thromboembolic events

Instructions and warning: When used dry, Gelfoam, cut to desired size, are rolled between the fingers and lightly compressed to the approximate diameter of the cavity or socket to be filled. Following insertion of the rolled pack, light finger pressure should be applied for one or two minutes; When used moistened, Gelfoam, cut to desired size, is immersed in the solution of sodium chloride. The piece is then removed from the solution, squeezed thoroughly to remove air bubbles present in the meshes, and replaced in the solution where it will swell to its original size. It is then taken from the solution, blotted on sterile gauze to remove excess fluid, and placed in the cavity or wound

BONE WAX

Bone wax is a sterile mixture of beeswax, paraffin, and isopropyl palmitate (a softening agent). It is opaque and has a waxy color.

Available form: Available sterile in individual foil envelopes, each containing 2.5 g, and packaged in an individually sealed overwrap packet.

Mechanism of Action: Bone Wax achieves local hemostasis of bone by acting as a mechanical (tamponade) barrier. It does not act biochemically and is nonabsorbable.

Indications: It is useful when bleeding is from a visualized local vascular channel within bone, commonly referred to as a “bone bleeder,” at the surgical site. This occurs commonly during the extraction of mandibular third molars, and if not adequately addressed during surgery can be a reason for postoperative bleeding.

Contraindications: Procedures where rapid osseous regeneration and fusion are desired.

Adverse Effects: Mild inflammatory reactions have been reported in tissues adjacent to the site of Bone Wax implantation ; May enhance an existing infection

Precautions: Use Bone Wax sparingly. Remove excess Bone Wax from the operative site. ; Open the package just prior to use to minimize the possibility of contamination and excessive drying.

Instructions and Warnings: Use bone wax immediately after removal from the package. Using aseptic procedure, warm Bone Wax to desired consistency by manipulation with the fingers or by immersion of the unopened foil packet in a warm sterile solution. Apply the softened Bone Wax to the bone edges as indicated by surgical circumstances and the preference of the surgeon.

Do not subject Bone Wax to excessive heat. Bone Wax may inhibit osteogenesis and may act as a physical barrier to the reparative process.

Do not resterilize; resterilization may alter the physical characteristics of this material.

Do not manipulate with latex gloves as latex proteins deposited in the Bone Wax may precipitate an allergic reaction.

CELLULOSE (Surgicel)

Oxidized cellulose material is an useful option in oral surgery, prepared as a sterile fabric meshwork.

Available form: Available in following sizes: 2” x 14”; 4” x 8”; 2” x 3”; 1/2 “ x 2”

Mechanism of Action: Its mechanism of action appears to be physical rather than involve an alteration of the clotting mechanism. After it is fully absorbed with blood, it swells into a brownish/black gelatinous mass that aids in clotting.

Indications: Absorbable Hemostat (oxidized regenerated cellulose) is used adjunctively in surgical procedures to assist in the control of capillary, venous, and small arterial hemorrhage when ligation or other conventional methods of control are impractical or ineffective

Contraindications: Surgicel should not be used for implantation in bone defects, such as fractures, since there is a possibility of interference with callus formation and a theoretical chance of cyst formation.; It should not be used to control hemorrhage from large arteries. ; It should not be used on non-hemorrhagic serous oozing surfaces, since body fluids other than whole blood, such as serum, do not react with cellulose

Adverse Effects: Encapsulation of fluid and foreign body reactions have been reported.

Reports of stenotic effect when Absorbable Hemostat (oxidized regenerated cellulose) has been applied as a wrap during vascular surgery

Precautions: Precautions should be taken in otorhinolaryngologic surgery to assure that none of the material is aspirated by the patient. ; Since absorption of Absorbable Hemostat could be prevented in chemically cauterized areas, its use should not be preceded by application of silver nitrate or any other escharotic chemicals. Absorbable Hemostat is used temporarily to line the cavity of large open wounds, it should be placed so as not to overlap the skin edges. It should also be removed from open wounds by forceps or by irrigation with sterile water or saline solution after bleeding has stopped

Instructions and Warnings: Use only as much Oxidized regenerated cellulose as is necessary for hemostasis, holding it firmly in place until bleeding stops. Remove any excess before surgical closure in order to facilitate absorption and minimize the possibility of foreign body reaction. Absorbable Hemostat (oxidized regenerated cellulose) is supplied sterile and as the material is not compatible with autoclaving or ethylene oxide sterilization, it should not be resterilized. Closing Absorbable Hemostat in a contaminated wound without drainage may lead to complications and should be avoided. The hemostatic effect of Absorbable Hemostat is greater when it is applied dry; therefore it should not be moistened with water or saline. Although Absorbable Hemostat may be left in situ when necessary, it is advisable to remove it once hemostasis is achieved.

Drug Interactions: Absorbable Hemostat should not be impregnated with anti-infective agents or with other materials such as buffering or hemostatic substances. Its hemostatic effect is not enhanced by the addition of thrombin, the activity of which is destroyed by the low pH of the product

THROMBIN

Dosage form and strength: Thrombin may be used topically as a dry powder, as a solution for use with gelatin sponges, mixed with a gelatin matrix, or as a spray.

Indications: As an aid to hemostasis whenever oozing blood and minor bleeding from capillaries and small venules is accessible. ; It may be used in conjunction with absorbable gelatin sponge for hemostasis. It is commonly used with gelfoam to treat moderate to severe bleeding

Contraindications: In person known to be sensitive to any of its components and/or to material of bovine origin. ; Not used for the treatment of massive or brisk arterial bleeding.

Adverse Effects: Difficulty in breathing ; Severe sudden headache; Slurred speech; Sudden loss of coordination; Sudden unexplained shortness of breath; Vision changes

Allergic reactions may be encountered in persons known to be sensitive to bovine materials. ; Abnormalities in hemostasis ranging from asymptomatic alterations in laboratory determinations such as prothrombin time, partial thromboplastin time to severe bleeding or thrombosis.; Repeated clinical applications of topical bovine thrombin increase the likelihood that

antibodies against thrombin and/or factor V may be formed.

Precautions: Pregnancy; Thrombin should never be injected into the bloodstream or allowed to enter the bloodstream through large, open blood vessels because it can cause extensive intravascular clotting which can be fatal.

Instructions and warning: Consultation with an expert in coagulation disorders is recommended if a patient exhibits abnormal coagulation laboratory values, abnormal bleeding or abnormal thrombosis following its use. Patients with antibodies to bovine thrombin preparations should not be re-exposed to these products.

TRANEXAEMIC ACID

Dosage form and strength: 5% mouthwash (500 mg tablet dissolved in 10mL of water); 10mg/kg body weight IV, with the dose being repeated 4-6 hourly.

Indications: Indicated in dental extractions in patients with hemophilia for short term use (2-8 days) to reduce or prevent hemorrhage and reduce the need for replacement therapy during and following tooth extractions.

Contraindications: In patients with active intravascular clotting Tranexaemic acid injections are contraindicated in patients with acquired defective colour vision.; In patients with hypersensitivity to it or any of its ingredients

Adverse Effects: Nausea and Diarrhoea; Headache and giddiness; Thrombophlebitis of injected veins

Precautions: The dose of tranexaemic acid injection should be reduced in patients with renal insufficiency because of the risk of accumulation Caution should be taken in patients with upper urinary tract bleeding Patients with previous history of thromboembolic disease may be at increased risk for venous or arterial thrombosis.

It may cause dizziness therefore may influence the ability to drive or use machines.

Instructions and Warnings: Convulsions have been reported in association with transxemic acid treatment particularly in patients receiving tranexaemic acid during cardiovascular surgery.

EPSILON AMINO-CAPROIC ACID (EACA)

Generic name: Aminocaproic acid (An analogue of the aminoacid lysine)

Dosage form and strength: Injectable solution - 250mg/ml; Syrup - 1.25g/5ML; Tablet-500 mg, 1000 mg

Indications: It is a specific antidote of fibrinolytic agents and has been used in many hyperplasminemic states associated with excessive intravascular fibrinolysis resulting in bleeding, such as: Overdose of streptokinase/urokinase/alteplase; Certain traumatic and surgical bleedings; To prevent recurrence of subarachnoid and g.i. hemorrhage
Abruptio placentae and certain cases of menorrhagia

Contraindications: It should not be used when there is evidence of an active intravascular clotting process. It must not be used in the presence of DIC without concomitant heparin. It should be cautiously used when renal

function is impaired

Adverse Effects: Edema, headache, malaise.; Allergic and anaphylactoid reactions, anaphylaxis.; Bradycardia, hypotension, peripheral ischemia, thrombosis.; Abdominal pain, diarrhea, nausea, vomiting.; Agranulocytosis, coagulation disorder, leukopenia, thrombocytopenia. Confusion, convulsions, delirium, dizziness, hallucinations, intracranial hypertension, stroke, syncope. Dyspnea, nasal congestion, pulmonary embolism. Pruritis, rash. Tinnitus, vision decreased, watery eyes.

Precautions: EACA inhibits both the action of plasminogen activators and to a lesser degree, plasmin activity. The drug should not be administered without a definite diagnosis and/or laboratory finding indicative of hyperfibrinolysis (hyperplasminemia).

Aminocaproic acid should not be administered with Factor IX Complex concentrates or Anti-Inhibitor Coagulant concentrates, as the risk of thrombosis may be increased.

Pregnancy

Instructions and Warnings: Should not be used in hematuria of upper urinary tract origin, unless the possible benefits outweigh the risk. Administration should be stopped if a rise in CPK (Creatinine phosphokinase) is noted.

Drug/Food Interactions: Aminocaproic acid should not be administered with Factor IX Complex concentrates or Anti-Inhibitor Coagulant concentrates, as the risk of thrombosis may be increased.

19.13 Topical fluoride

Generic name: Sodium fluoride (NaF); Stannous fluoride (SnF₂); Acidulated phosphate fluoride (APF)

Dosage form: Solution; Gel ; Varnish; Spray

Strength: NaF – 2% (9040 ppm) at pH 7; SnF₂- 8% (19360 ppm) ; APF (solution) – 1.23% (12300 ppm) at pH 3; APF (gel) – 1.23% (12300 ppm) at pH 4-5; 5% NaF Varnish – 22500 ppm;

Agent	Fluoride concentration	Average effectiveness* (% caries reduction)	pH
2% NaF	9200 ppm	29%	7
8% SnF ₂	19500 ppm	32%	2.4-2.8
1.23 % APF	12300 ppm	22%	Solution: 3 Gel: 4-5
5% NaF varnish	22600 ppm	38%	7

Indications: In children, shortly after tooth eruption; Patients with reduced salivary flow; Caries active individuals (in high caries risk individuals application at 3-6 month interval & in moderate caries risk application at 3 months interval. ; Patients receiving radiation of head and neck; Mentally or physically challenged individuals; Patient with fixed or removable prosthesis

Contraindications: Avoid use in patients with known hypersensitivity to fluoride

Dosage schedule:

NaF: Recommended at 3,7,11 & 13 years of age four times a year at weekly interval

SnF₂: Applied once a year

APF: Applied semiannually

Precautions: If the patient is allergic to certain component in the preparation; Children <5years of age and handicapped children ; Individuals with inflammatory oral conditions

Patient position(when using gel form); Amount of agent dispensed

Adverse effects:

SnF₂:

Reversible gingival irritation in individuals with poor gingival health i.e manifested as gingival blanching.

Light brown pigmentation of teeth particularly in hypocalcified areas

Staining on margins of restoration

APF:

Prolonged exposure of porcelain & composite restorations to APF can result in surface roughening, loss of material and possible cosmetic change

Warning and instructions: For maximizing the protection afforded by topical fluoride, teeth should be treated soon after eruption.; Proper isolation of teeth; Allow the solution to be in contact with teeth for 4 minutes; Use of salivary ejectors to evacuate the stimulated saliva and excess fluoride; Avoid rinsing of mouth immediately after fluoride application

Patient information: A very serious allergic reaction to the drug is rare. However, seek immediate medical attention if you notice any symptoms of allergic reaction. ; Do not swallow the solution or gel during application.; Advised not to rinse or drink/eat for at least one hour.

19.14 Dentrifices

Dentrifices are tooth cleaning substances which 1) improve the efficiency of removal of debris, plaque, and stained pellicle compared to use of toothbrush alone 2) polish teeth to provide increased reflectance to light and superior esthetic appearance with added benefit of enabling tooth the resistance to plaque accumulation 3) act as vehicle for delivery of therapeutic agents.

Generic name: Dentrifices

Dosage form: Paste; Powder; Gel

Strength: Concentration of fluoride determines the strength of dentrifice.

Indications:

For caries prevention: Use of dentifrifice containing fluoride.

For prevention and treatment of periodontal disease: Use of dentifrifice containing triclosan, chlorhexidine, povidone-iodine, zinc citrate

For treatment of sensitive tooth: Analgesic effect is provided by dentifrifice containing potassium nitrate. Dentin tubule blocking action is contributed by stannous fluoride, arginine and strontium chloride.

For whitening and bleaching of tooth: Abrasive action of silicon dioxide, calcium carbonate and sodium pyrophosphate help in whitening of tooth. Bleaching action is due to hydrogen peroxide.

For specific purposes: Salivary secretion is stimulated by xylitol, olive oil and betaine.

Contraindications: Fluoridated dentifrice is contraindicated in individuals with already high fluoride exposure.; Allergic to fluoride.

Precautions: In pre-school children. Amount of dentifrice dispensed in children below 6yrs of age. In case of xerostomia, the mucous membrane is more sensitive and more vulnerable so one should avoid irritating dentifrice, such as those that contain strong essential oils and foaming substances, but antioxidants and enzymes such as lactoperoxidase, lysozyme, lactoferrin and glycosyloxidase are advisable

Dosage schedule:

Adults – pea sized amount , fluoridated twice daily

Children – smear or thin streak of toothpaste twice daily /half the amount of adult dentifrice

Adverse effects: In children <6 yrs of age there is a risk of dental fluorosis from regular ingestion of small amounts of fluoridated dentifrice; Detergents and flavouring oils in dentifrices may irritate the stomach when ingested in large amounts.

Instructions and warning: Supervision of the child by parents during brushing; Use of optimum amount for adequate time twice daily; Monitor fluoride level in dentifrices for children; Preference towards paste or gel over powder (Gel>Paste>Powder).

Patient information: The duration of tooth brushing should exceed one minute on each occasion and children should be encouraged to spit out excess dentifrice and avoid rinsing with water. Children should be instructed not to eat or swallow the paste.

Children's teeth should be brushed last thing at night before bedtime and on at least one other occasion. Eating directly after brushing should be avoided for approximately 30-60 minutes. Children's teeth can be brushed with either manual or powered toothbrushes with a soft small head

19.15 Salivary stimulants and substitutes

Salivary substitutes and stimulants includes:

1. Mechanical (Masticatory) stimulants:
 - Foods which require mastication such as apples, carrots, celery, meats
 - Sugarless gums with the inclusion of sweeteners (xylitol, aspartane, mannitol, sorbitol)
2. Chemical stimulants: Solutions containing citric acid
3. Electrical stimulants
4. Pharmacologic stimulants: Cholinergic agonists
5. Oral moisturizers/ salivary substitutes

Pharmacologic salivary stimulants

PILOCARPINE

Generic Name: Pilocarpine hydrochloride

Dosage Form and Strength: Tablets and film coated; Adults: Initially 2.5mg

to 5mg three times daily, and for patients who don't respond adequately, titrations upto 30mg per day at variable dosage intervals may be considered

Indications: Treatment of symptoms of dry mouth with salivary gland dysfunction secondary to drug induced and radiation induced xerostomia; Treatment of symptoms of dry mouth in patients with Sjogren's syndrome.

Contraindications: Patients who are known to be hypersensitive to pilocarpine; Patients with uncontrolled asthma; Used with cautions in patients suffering from cardiovascular diseases, urinary tract obstructions, narrow angle glaucoma and Parkinson's disease

Precautions: Pilocarpine should be administered with caution to patients with known or suspected cholelithiasis or biliary tract disease. Pilocarpine may increase ureteral smooth muscle tone and could theoretically precipitate renal colic (or "ureteral reflux"), particularly in patients with nephrolithiasis. Pregnancy

Adverse Effects: Sweating, nausea, flushing, rhinitis, diarrhea, chills, increased salivation; Headache, flu syndrome, dyspepsia, dizziness, pain, sinusitis, abdominal pain, vomiting, pharyngitis, rash, infection; Abnormal vision, conjunctivitis, dysphagia, epistaxis, myalgias, pruritus, rash, sinusitis, tachycardia, taste perversion, tremor, voice alteration.

Instructions and Warnings: Caution should be advised while driving at night or performing hazardous activities in reduced lighting. Patients with significant cardiovascular disease may be unable to compensate for transient changes in hemodynamics or rhythm induced by Pilocarpine. Pilocarpine should be administered with caution in and under close medical supervision of patients with significant cardiovascular disease. Pilocarpine hydrochloride should be administered with caution to and under close medical supervision in patients with controlled asthma, chronic bronchitis, or chronic obstructive pulmonary disease requiring pharmacotherapy.

Drug Interactions: Pilocarpine should be administered with caution to patients taking beta adrenergic antagonists because of the possibility of conduction disturbances.

Drugs with parasympathomimetic effects administered concurrently with Pilocarpine would be expected to result in additive pharmacologic effects.

Patient's Information: Patients should be informed that Pilocarpine may cause visual disturbances, especially at night, that could impair their ability to drive safely.

If a patient sweats excessively while taking Pilocarpine hydrochloride and cannot drink enough liquid, the patient should consult a physician. Dehydration may develop.

CIVIMELINE

Generic Name: Civemeline hydrochloride

Dosage Form and Strength: Capsule; 30 mg

Indications: Treatment of symptoms of dry mouth in patients with Sjögren's Syndrome.

Contraindications: Patients with uncontrolled asthma, known hypersensitivity to Cevimeline, and when miosis is undesirable, e.g., in acute iritis and in narrow-angle (angle-closure) glaucoma.

Precautions: Cevimeline toxicity is characterized by an exaggeration of its parasympathomimetic effects which include headache, visual disturbance, lacrimation, sweating, respiratory distress, gastrointestinal spasm, nausea, vomiting, diarrhea, atrioventricular block, tachycardia, bradycardia, hypotension, hypertension, shock, mental confusion, cardiac arrhythmia, and tremors.

Cevimeline should be administered with caution to patients with a history of nephrolithiasis or cholelithiasis. Pregnancy

Instructions and Warnings: Cevimeline Hydrochloride capsules should be used with caution and under close medical supervision in patients with a history of cardiovascular disease evidenced by angina pectoris or myocardial infarction. It can potentially alter cardiac conduction and/or heart rate.

Cevimeline can potentially increase airway resistance, bronchial smooth muscle tone, and bronchial secretions. It should be administered with caution and with close medical supervision to patients with controlled asthma, chronic bronchitis, or chronic obstructive pulmonary disease.

Ophthalmic formulations of muscarinic agonists have been reported to cause visual blurring which may result in decreased visual acuity, especially at night and in patients with central lens changes, and to cause impairment of depth perception. Caution should be advised while driving at night or performing hazardous activities in reduced lighting.

Drug Interaction: Cevimeline should be administered with caution to patients taking beta adrenergic antagonists, because of the possibility of conduction disturbances.

Drugs with parasympathomimetic effects administered concurrently with Cevimeline can be expected to have additive effects.

Cevimeline should be used with caution in individuals known or suspected to be deficient in CYP2D6 activity, based on previous experience, as they may be at a higher risk of adverse events.

Patient's Information: Patients should be informed that Cevimeline may cause visual disturbances, especially at night, that could impair their ability to drive safely.

If a patient sweats excessively while taking Cevimeline, dehydration may develop. The patient should drink extra water and consult a health care provider.

SALIVARY SUBSTITUTE

Available forms and Dosage:

Oral Preparations: Commercially available in 200ml bottles

Composition: 30% glycerine; 0.5% Sodium carboxy methyl cellulose

Adults: About 20ml of the solution used as and when required (SOS)

Mode of action: Helps in rehydrating oral mucosa

Uses: Used in patients suffering from xerostomia

Antisialagogues

ATROPINE

Generic name: Atropine sulfate

Dosage form and strength: Injectable solution Compounding powder Oral tablet Intravenous solution 0.4 mg/mL ; 0.1 mg/mL ; 0.05 mg/mL ; 1 mg/mL ; 0.5 mg/mL ; 0.8 mg/mL ; 0.4 mg ; 0.4 mg/mL-NaCl 0.9%

Indications: As a preanesthetic medication by decreasing the production of saliva and secretions of the airway prior to surgery.

Contraindications: Avoid in patients with glaucoma, pyloric stenosis or prostatic hypertrophy, except in doses ordinarily used for preanesthetic medication. Allergic to any components of atropine

Precautions: Atropine Sulfate Injection, USP should be used with caution in all individuals over 40 years of age. Pregnancy

Instructions and Warnings: Atropine is a highly potent drug and due care is essential to avoid overdosage, especially with intravenous administration. Children are more susceptible than adults to the toxic effects of anticholinergic agents.

Patient's Information: Atropine may cause drowsiness or blurred vision. These effects may be worse if you take it with alcohol or certain medicines. Use atropine with caution. Do not drive or perform other possibly unsafe tasks until you know how you react to it.

SCOPOLAMINE BROMIDE

Generic Name: Scopolamine hypobromide

Dosage form and strength: Injection and solution 1.5 mg ; 1 mg/mL ; 0.4 mg/mL ; 0.4 mg

Indications and Usage: Preanesthetic medicament for both its sedative-tranquilizing and antisecretory actions. As a sedative and tranquilizing depressant to the central nervous system

Contraindications: patients with narrow-angle glaucoma hypersensitive to scopolamine hypobromide

Precautions: Appropriate dosage precautions must be taken with infants, children, persons with mongolism, brain damage, spasticity, or light irides Men with prostatic hypertrophy should especially be monitored for urinary function. Because of the tachycardic effects of the drugs, care must be exercised when tachycardia, other tachyarrhythmias, coronary heart disease, congestive heart disease or hyperthyroidism preexist. If there is mydriasis and photophobia, dark glasses should be worn. Pregnancy

Adverse Effects: Dry mouth, dry skin Difficulty in swallowing Reflexive flushing and eat intolerance Mydriasis Tachycardia Constipation, even bowel stasis, may occur. In the larger therapeutic doses, dizziness, restlessness, tremors, fatigue and locomotor difficulties occur.

Instructions and Warnings: Scopolamine is one of the most important drugs of the belladonna group from the standpoint of poisoning; infants and young children are especially susceptible to the belladonna alkaloids; Scopolamine is usually stated more toxic than atropine. Idiosyncrasy is more common with scopolamine than with atropine and ordinary therapeutic doses sometimes cause alarming reactions.

Drug Interactions: Drugs, such as phenothiazines, tricyclic antidepressants, certain antihistamines, meperidine, etc., may considerably intensify the effects of antimuscarinic drugs. Aluminum- and magnesium trisilicate-

containing antacids have been shown to decrease the absorption of some antimuscarinic drugs.

Patient's Information: Scopolamine should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus (Scopolamine hydrobromide can pass the placental barrier; the threat to the fetus *in utero* is unknown, but use during pregnancy may cause respiratory depression in the neonate and may contribute to neonatal hemorrhage due to n in Vitamin K-dependent clotting factors in the neonate.)

GLYCOPYRROLATE

It is an anticholinergic, which reduces the secretions in the mouth, throat, airway, and stomach before surgery.

Indications: It is used before and during surgery to block certain reflexes and to protect against certain side-effects of some medicines. It is also used along with other medicines to treat peptic ulcers.

Dose Form And Strength

Usual Pediatric Dose for excessive salivation: 3 years to 16 years with neurologic conditions associated with problem drooling. Initiate dosing at 0.02mg/kg orally three times daily and titrate in increments of 0.02 mg/kg every 5 to 7 days, based on therapeutic response and adverse reactions. Maximum recommended dose is 0.1mg/kg three times daily, not to exceed 1.5 to 3 mg per dose based upon weight. Administer atleast one hour before or two hours after meals.

Adult dose: Initial doage of 1mg tablets is one tablet three times daily(in the morning,early afternoon,and at bedtime). Some patients may require two tablets at bedtime to assure overnight control of the symptoms. 2mg tablets is one tablet two or three times daily at equally spaced intervals. 1.5mg tablets may be used to provide intermediate titration doses based on response of the patient. Glycopyrrolate tablets are not recommended for use in the pediatric patients under the age of 12 years.

Precautions: Glycopyrrolate injectable contains benzyl alcohol and is not recommended for use in neonates. Caution is recommended when glycopyrrolate is given to elderly patients because of the increased risk of side-effects.

19.16 Miscellaneous

SERRAPEPTASE

Generic name: Serratiopeptidase

Dosage form and Strength: Tablets Enteric coated capsule Recommended dose: 5-10mg 3 times/day

Indications: Post-surgical swelling (inflammation) Conditions that involve pain and swelling including sinusitis, laryngitis, sore throat, ear infections

Contraindications: Hypersensitivity to the drug

Mechanism of Action: It is a proteolytic enzyme (protease) which helps the body to break down protein, thus preventing inflammation and fluid retention.

Precautions:

Bleeding disorders: Might worsen bleeding disorders due to its interference with blood clotting.

Surgery: There is a concern that it might increase bleeding during and after surgery. Stop using serrapeptase at least 2 weeks before a scheduled surgery.

Adverse effects: Skin rash Diarrhea Loss of appetite Gastrointestinal disturbance Nosebleed.

Instructions and Warnings: Store it at room temperature (25°C).

Drug Interactions: Serrapeptase has a synergistic effect with anticoagulant and antiplatelets resulting to the increased chances of bruising and bleeding.

Patient's Information: Pregnant and lactating mothers should avoid the medication.

CHYMOTRYPSIN

Chymotrypsin is an enzyme that has ingredients to reduce swelling (inflammation) and tissue destruction.

It possesses potent anti-inflammatory properties that enable to hasten the resorption of inflammatory edema as well as of postoperative and post traumatic hematomas and edemas.

It furthermore possesses proteolytic properties that enable to destroy in situ the fibrinous formations resulting from subacute or chronic inflammatory processes.

Generic Name: Chimotripsina

Dosage form and strength: 1 or 2 ampoules daily, intramuscular, until disappearance of clinical signs.; Chronic conditions: 1 injection two or three times weekly. ; By mouth: to reduce tissue damage in burn patients, a 6:1 ratio (trypsin:chymotrypsin) in a combined amount of 200,000 units USP four times daily for ten days.

By injection: injects a solution of chymotrypsin into the eyes as a part of cataract surgery.

Indications: All inflammatory conditions- deep or superficial hematomas. Effective for cataract surgery, to reduce damage to eyes. Possibly effective for -burns when applied directly on skin as it might decrease tissue destruction in burn patients and in hand fractures as taking them by mouth seems to be effective for reducing redness and swelling associated with hand fractures. They are taken by mouth or as a shot to reduce redness and swelling associated with abscesses, ulcers, surgery or traumatic injuries and to help loosen phlegm in asthma, bronchitis, lung diseases and sinus infections.

Contraindications: A known sensitivity to chymotrypsin.

Precautions: Although not enough is known about the use of chymotrypsin during pregnancy and lactation, its use can be avoided to stay on the safe side.

Warnings: A sensitivity test should be made before injection. It is generally well -tolerated however it may rarely induce allergic troubles in some patients, which necessitates the discontinuation of the medication and treatment with B-adrenergic stimulant, corticosteroids, and antihistaminics.

Adverse Effects: When used in eyes, it can cause an increase in pressure in the eyes and other eye conditions like uveitis, paralysis of the iris and keratitis.

Rarely, it can cause an allergic reaction when taken by mouth, symptoms include itching, shortness of breath, swelling of the lips or throat, shock, loss of consciousness.

Drug and Food interactions: There is no information as such for chymotrypsin drug and food interactions.

Irrigants

Intracanal irrigants and medicaments are used during root canal treatment to reach the natural complexities and remove the smear layer.

SODIUM HYPOCHLORITE

It is the most commonly used irrigant, reducing agent.

Form & strength: Solution; concentration ranges 0.5%-5.25%

Precautions: When working with sodium hypochlorite, one should keep in mind the potential complications that can occur with it and should take some preventive measures accordingly.

- Complication of accidental spillage
- Hypochlorite extrusion beyond the root apex (sodium hypochlorite accident)

Complication of accidental spillage :

Complications	Damage	Emergency management
Eye damage	<ul style="list-style-type: none"> • Severe pain and intense burning • profuse watering • erythema • Blurry vision • patchy coloration of the cornea 	<ul style="list-style-type: none"> • irrigate gently with normal saline. If unavailable, use tap water. • refer to ophthalmology department.
Damage to skin		<ul style="list-style-type: none"> • wash thoroughly and gently with tap water or normal saline.
Oral mucosa injuries	<ul style="list-style-type: none"> • surface injury is caused by reaction of alkali with protein and fats. 	<ul style="list-style-type: none"> • copious rinsing with water • analgesia if required
Damage to clothing	<ul style="list-style-type: none"> • rapid, irreparable bleach 	

NaOCl EXTRUSION BEYOND THE ROOT APEX (NaOCl ACCIDENT):

Signs: Severe excruciating pain

Sudden flooding of canal with blood and tissue fluids

Rapid tissue swelling both intra-orally and extra-orally

Swelling may be edematous, hemorrhagic or both

May result in bruising and ecchymosis of the surrounding mucosa and skin.

Necrotic ulceration of the mucosa adjacent to the tooth may occur.

Management:

Patient should be informed about the accident.

Bleeding from canal is continuously allowed to flow since this is a physiological defense mechanism.

Canal is flooded with normal saline.

Preferred to keep the patient on parenteral antibiotic therapy and analgesics. The extent and rapidity of soft tissue swelling may necessitate urgent hospitalization.

Surgical drainage or debridement may also be required depending on extent and character of swelling and necrosis.

Preventive measures:

Plastic bib to protect patient's clothing.

Provision of protective eyewear for both patient and operator.

The use of sealed rubberdam for isolation.

The use of side exit Luer-Lok needles for root canal irrigation.

Irrigation needle a minimum of 2mm short of the working length.

Avoidance of wedging the needle into the root canal.

Avoidance of excessive pressure during irrigation.

Interactions:

NaOCl and CHX should not be combined during irrigation as they produce an orange-brown precipitate known as Parachloroaniline(PCA). This precipitate may occlude the dentinal tubules and may compromise the seal of the obturated canal.

Leaching of PCA from the insoluble precipitate is of concern because it has been shown to be cytotoxic in rats and possibly carcinogenic in humans.

Intracanal medicaments

Intracanal irrigants and medicaments are used during root canal treatment to reach the natural complexities and remove the smear layer. When treatment cannot be completed in one appointment, the surviving intracanal bacteria often proliferate between appointments. To curtail bacterial regrowth and possibly even improve bacterial suppression, an intracanal medication can be advantageous.

CALCIUM HYDROXIDE

One of the most recommended intracanal medicaments in contemporary endodontic practice is calcium hydroxide.

Dosage form: Paste form: Single paste or in combination with iodoform; Powder form: Powder form is mixed with saline and anesthetic solution. For placement in root canals it is coated with the help of paper points, spreaders or lentulo spirals. The bactericidal effect of calcium hydroxide is due to its high alkaline pH which is approximately 12.5.

Vehicles used for Ca(OH)₂:

Aqueous - sterile water, normal saline

Viscous - glycerine, polyethylene glycol and propylene glycol

Other medicaments that can be combined with calcium hydroxide to obtain a synergistic antimicrobial effect are Camphorated monochlorophenol (CMCP) and 0.12% chlorhexidine.

Indications: In "weeping" canals or persistently wet canals.; In treatment of phoenix abscess; In resorption cases For apexification During pulpotomy For non-surgical treatment of periapical lesion In cases of direct and indirect pulp capping As sealer for obturation To decrease postoperative pain after over instrumentation It is used in combination with Ledermix (1:1)

ZINC OXIDE EUGENOL (in management of dry socket)

Dosage form and strength: Paste form; Paste form in combination with analgesic, antimicrobial and antiseptic components

Indications: Zinc oxide eugenol dressing is used for the management of dry socket or alveolar osteitis, by alleviating the pain and providing a soothing effect.

Contraindications: Allergy to any one of the ingredients of the formula. Not to be used on deciduous teeth (children under 12 years of age).

Dosage schedule: First dressing relieves the pain for 12 to 24 hours. After that, the procedure has to be repeated. Second dressing relieves the pain for longer duration.

After three or so dressings, the tooth extraction socket wound starts healing from inside out and the bone is covered. After that, it is left open to heal.

Precautions: Use with caution in pregnant women and lactating mothers.

Instruction and warning: Irrigation of the socket with a warm sterile isotonic saline solution or a dilute solution of hydrogen peroxide to remove necrotic material and other debris followed by dressing of eugenol. Using a pair of tweezers, apply 0.2g of the paste to adequately cover the bottom of the socket and pack gently into place. Zinc oxide eugenol is not resorbable, therefore never suture after placing the product into site.

Patient's information: Patients should be told not to wash their mouth vigorously within the 24 hours following the placement of the dressing. Sports people should be warned that the product containing additional components contains an active ingredient likely to induce a positive reaction to tests undertaken in antidoping controls.

CHOLINE SALICYLATE

Choline salicylate, a topical analgesic, acts to reduce and relieve the pain and discomfort of sore, tender, inflamed gums. Choline Salicylate is the choline salt of salicylic acid, used as an analgesic, antipyretic and antirheumatic.

Indications And Clinical Uses : For relief of teething pain, denture irritations and gum and mouth sores; also used postoperatively following oral procedures.

Contra-Indications: Known hypersensitivity to salicylates.:

Precautions: Discontinue use if excessive irritation develops, or pain or discomfort persists. Do not administer to children under 2 years of age except on the advice of a physician or dentist.:

Dosage And Administration: Spread an adequate amount (1 cm) of gel on finger and apply to the tender, painful area, without rubbing vigorously or using pressure. The gel may be applied every 3 to 4 hours as needed, including just before bedtime.

Availability: As orogel in combination with benzalkolium chloride

PLACENTAL EXTRACTS

It works by stimulating the cellular renewal and repair.

Indication and use: OSMF and chronic wound healing
contraindication:in breastfeeding and pregnancy

Dosage and administration: as local injections

Availability : as injection having strength of 0.1%

HYALURONIDASE HUMAN INJECTION

Hyaluronidase is a spreading or diffusing substance which modifies the permeability of connective tissue through the hydrolysis of hyaluronic acid, a polysaccharide found in the intercellular ground substance of connective tissue.

Indication: OSMF and adjuvant to increase the absorption and dispersion of other injected drugs.

Contraindication: Hypersensitivity to hyaluronidase or any other ingredient in the formulation is a contraindication to the use of this product.

Drug Interactions : When hyaluronidase is added to a local anesthetic agent, it hastens the onset of analgesia and tends to reduce the swelling caused by local infiltration, but the wider spread of the local anesthetic solution increases its absorption; this shortens its duration of action and tends to increase the incidence of systemic reaction. Patients receiving large doses of salicylates, cortisone, ACTH, estrogens or antihistamines may require larger amounts of hyaluronidase for equivalent dispersing effect, since these drugs apparently render tissues partly resistant to the action of hyaluronidase.

Dosage : Absorption and dispersion of other injected drugs may be enhanced by adding 50-300 U, most typically 150 U hyaluronidase, to the injection solution.

Availability: injection vial

SODIUM TETRADECYL SULFATE INJECTION

Sodium tetradecyl sulfate injection(STS) is a sclerosing agent. Intravenous injection causes inflammation and thrombus formation. This usually occludes the injected vein. Subsequent formation of fibrous tissue results in partial or complete vein obliteration that may or may not be permanent. Indication- Hemangiomas and other AV malformation of oral cavity. Used when surgery is Contraindication

It is contraindicated in previous hypersensitivity reactions to the drug; in acute superficial thrombophlebitis; valvular or deep vein incompetence; huge superficial veins with wide open communications to deeper veins; phlebitis migrans; acute cellulitis; allergic conditions; acute infections; varicosities caused by abdominal and pelvic tumors unless the tumor has been removed; bedridden patients; such uncontrolled systemic diseases as diabetes, toxic hyperthyroidism, tuberculosis, asthma, neoplasm, sepsis, blood dyscrasias and acute respiratory or skin diseases.

Emergency resuscitation equipment should be immediately available. Allergic reactions, including fatal anaphylaxis, have been reported. As a precaution against anaphylactic shock, it is recommended that 0.5 mL of STS be injected into a varicosity, followed by observation of the patient for several hours before administration of a second or larger dose. The possibility of an anaphylactic reaction should be kept in mind, and the physician should be prepared to treat it appropriately.

Dosage : STS injection is for intravenous use only. The strength of solution required depends on the size and degree of varicosity. In general, the 1%

solution will be found most useful with the 3% solution preferred for larger varicosities. The dosage should be kept small, using 0.5 mL to 2 mL (preferably 1 mL maximum) for each injection, and the maximum single treatment should not exceed 10 mL.

Availability: injection in strength of 1% and 3%

TACROLIMUS

It is a calcineurin inhibitor used in case of topical application in cases of autoimmune mucosal lesion and vesiculobullous lesions

Indication : Tacrolimus both 0.03% and 0.1% for adults and only 0.03% for children aged 2 to 15 years, is indicated as a second-line therapy for short and long-term intermittent treatment of moderate to severe atopic dermatitis in non-immunocompromised patients, in whom the use of conventional therapies are deemed inadvisable because of potential risks, or who are not adequately responsive to or intolerant of conventional therapies.

Contraindication : Hypersensitivity to tacrolimus.; Long term use has shown predilection to lymphomas and skin malignancy.

Dosage : Tacrolimus 0.03% and 0.1% should be applied topically morning and evening twice daily as a thin layer to affected areas of skin, including the face, neck and eyelids.

Section III
Appendices

Section III - Appendix 1

Drug Interactions

The names of the main molecules are given all in **CAPITAL** letters and in **bold font** so as to ease in locating the molecules. The interacting molecule is given starting with bullet under the main molecule. If more than one molecule has similar interaction, they are combined together and separated by comma. In case of serious interaction, the molecule has * symbol after the name of the molecule.

ABACAVIR

- Ethanol: Plasma concentration of abacavir is increased
- Methadone: Plasma concentration of methadone possibly reduced
- Phenobarbital, Phenytoin, Rifampicin: Plasma concentration of abacavir possibly reduced
- Ribavirin: Reduces effects of Ribavirin.

ACARBOSE

- Digoxin*: Possibly reduces plasma concentration
- Escitalopram: May increase the hypoglycemic activities of Acarbose
- Insulin: May enhance hypoglycemic effects

ACECLOFENAC

- Aspirin, Hydrocortisone, Ibuprofen: May increase the risk of gastrointestinal ulceration or bleeding
- Ciprofloxacin: Increase the risk of convulsions
- Digoxin, Lithium: May increase plasma concentrations
- Enalapril, Spironolactone,: May affect the plasma serum concentration of aceclofenac
- Methotrexate: Decreased elimination of methotrexate
- Frusemide, Cyclosporin : May increase nephrotoxicity
- Hydrocortisone: Increase the risk of gastrointestinal bleeding
- Methotrexate: Decreased elimination of methotrexate
- Mifepristone*: May reduce the effect of mifepristone
- Warfarin: May enhance the effects of warfarin
- Zidovudine: Increased risk of haematological toxicity

ACETAZOLAMIDE

- Alcohol, Amlodipine, Atenolol, Chlorpromazine, Diazepam, Enalapril, Fluphenazine, Glyceryl trinitrate, Halothane, Hydralazine, Isosorbide dinitrate, Ketamine, Levodopa Methyl dopa, Nifedipine, Nitrous oxide, Propranolol, Sodium nitroprusside, Thiopental, Timolol, Verapamil: Enhanced hypotensive effect.
- Amitriptyline, Clomipramine: Increased risk of postural hypotension
- Aspirin: Increased risk of toxicity when given with high-dose aspirin
- Carbamazepine*: Increased risk of hyponatraemia; acetazolamide increases plasmacarbamazepine concentration
- Cisplatin: Increased risk of nephrotoxicity and ototoxicity

- Contraceptives, Oral: Antagonism of diuretic effect by estrogens
- Cyclosporine: Increased the serum concentration of Cyclosporine
- Dexamethasone, Hydrocortisone, Prednisolone: Increased risk of hypokalaemia; antagonism of diuretic effect
- Digoxin*: Increases cardiac toxicity of digoxin
- Furosemide, Hydrochlorothiazide: Increased risk of hypokalaemia
- Ibuprofen: Risk of nephrotoxicity of ibuprofen increased; antagonism of diuretic effect
- Lidocaine*: Hypokalaemia caused by acetazolamide antagonises action of lidocaine (interaction less likely when lidocaine used topically)
- Lithium*: Excretion of lithium increased
- Mefloquine: Decrease the serum concentration of acetazolamide.
- Morphine: Diminish the therapeutic effect of acetazolamide.
- Metformin: Increased the risk of developing lactic acidosis.
- Phenobarbital, Phenytoin: Increased risk of osteomalacia
- Quinidine*: Cardiac toxicity of quinidine increased if hypokalaemia occurs; acetazolamide possibly reduces excretion of quinidine (increased plasma concentration)
- Salbutamol: Increased risk of hypokalaemia with high doses of salbutamol

ACICLOVIR (Acyclovir)

- Cyclosporin, Tacrolimus: Increased risk of nephrotoxicity.
- Aminophylline, Theophylline: Increased plasma concentration of both.

ADRENALINE: see Ephinephrine

ALBENDAZOLE

- Dexamethasone: Plasma-albendazole concentration possibly increased
- Praziquantel: Increased plasma concentration of active metabolite of albendazole
- Carbamazepine, Phenobarbitone and Phenytoin: Plasma concentration of albendazole is reduced.
- Grapefruit Juice: Plasma concentration of albendazole is increased.
- Cimetidine: Effects of albendazole is enhanced by Cimetidine.

ALPRAZOLAM

- Alcohol: Enhanced effect
- Codeine, Morphine: Enhancement of the euphoria may also occur leading to an increase in psychic dependence.
- Cimetidine, ciprofloxacin, clarithromycin, clozapine, CNS depressants, diltiazem, disulfiram, digoxin, erythromycin, fluconazole*, fluoxetine, grapefruit juice, isoniazid, itraconazole*, ketoconazole*, labetalol, levodopa, metoprolol, metronidazole, miconazole*, omeprazole, phenytoin, ritonavir, rifampin, valproic acid, verapamil: may increase the serum level and/or toxicity of alprazolam;
- Digoxin*: Increased digoxin concentrations especially in elderly (>65 years of age)

ALCOHOL

- Acetazolamide, Amiloride, Amlodipine, Atenolol, Enalapril Furosemide, Glibenclamide, Glycerol trinitrate, Hydralazine, Hydrochlorothiazide, Isosorbide dinitrate, Methyldopa, Nifedipine, Propranolol, Sodium nitroprusside, Spironolactone, Timolol: Enhanced hypotensive effect
- Aspirin: Increase the bleeding risk of aspirin; diminish the therapeutic effect of aspirin.
- Abacavir: see abacavir
- Acetaminophen: Enhance the hepatotoxic effect of acetaminophen.
- Carbamazepine: Possibly enhanced CNS adverse effects of carbamazepine
- Amitriptyline, Chlorphenamine, Chlorpromazine, Clomipramine, Diazepam, Fluphenazine, Haloperidol, Phenobarbital, Promethazine: Enhanced sedative effect
- Codeine, Morphine, Methadone: Enhance sedative and hypotensive effect
- Cycloserine*: Increased risk of convulsions
- Ceftriaxone, Disulfiram, Levamisole, Metronidazole, Procarbazine: Disulfiram-like reaction
- Cannabis: Enhanced the CNS depressant effect of alcohol.
- Didanosine: Increased the risk of pancreatitis with didanosine.
- Griseofulvin: Possibly enhanced effects of alcohol
- Insulins: Enhanced hypoglycaemic effect
- Ketoconazole: Enhanced the toxic effect of alcohol
- Metformin: Enhanced hypoglycaemic effect; increased risk of lactic acidosis
- Phenytoin: Plasma-phenytoin concentration reduced with regular large amounts of alcohol
- Tacrolimus: Absorption of tacrolimus increased.
- Theophylline: Increased the serum concentration of theophylline.
- Verapamil: Enhanced hypotensive effect; plasma concentration of alcohol Possibly increased by verapamil
- Warfarin*: Enhanced anticoagulant effect with large amounts of alcohol; Major changes in alcohol consumption may affect anticoagulant control.

ALCURONIUM

- Amikacin*, Halothane, Nifedipine, Procainamide*, Propranolol, Quinidine*, *Streptomycin, Verapamil: Enhanced muscle relaxant effect.
- Carbamazepine, Neostigmine, Phenytoin, Pyridostigmine: Antagonism of muscle relaxant effect.
- Clindamycin*, Gentamicin*, Lithium, Magnesium (parenteral): Enhanced muscle relaxant effect

ALLOPURINOL

- Amoxicillin, Ampicillin: Increased risk of rash
- Antacids: Decreased the absorption of allopurinol.
- Azathioprine*: Effects of azathioprine enhanced and toxicity increased, reduce dose of azathioprine
- Aminophylline: Increased plasma concentration of Aminophylline.
- Cyclosporin: Plasma cyclosporin concentration possibly increased (risk of nephrotoxicity)
- Carbamazepine: Increased plasma concentration of Carbamazepine

- Cyclophosphamide: Enhanced bone marrow suppression.
- Didanosine: Possibly increased plasma concentration of didanosine.
- Enalapril: Enhanced the potential for hypersensitivity reaction to allopurinol.
- Furosemide: Increased plasma concentration of allopurinol.
- Hydrochlorothiazide: Increased risk of hypersensitivity, especially in renal impairment
- Mercaptopurine*: Effects of mercaptopurine enhanced and toxicity increased, reduce dose of mercaptopurine
- Warfarin: Anticoagulant effect possibly enhanced
-

ALUMINIUM HYDROXIDE: *See Antacids*

AMIODARONE

- Bupivacaine: Increased myocardial depression
- Ciprofloxacin, Chloroquine, Digoxin, Haloperidol, Phenytoin, Warfarin, Quinidine, Disopyramide, Co-trimoxazole: Prolong the QT interval.
- Colchicine: Possibly increase risk of colchicine toxicity
- Digoxin*, Phenytoin, Warfarin: Increases the plasma concentrations
- Diltiazem, Verapamil: Increased risk of bradycardia, AV block and myocardial depression
- Erythromycin*, Levofloxacin*, Moxifloxacin*, Co-trimoxazole*: Increased risk of ventricular arrhythmias avoid concomitant use
- Furosemide: Increased cardiac toxicity
- Phenytoin: Increased Plasma concentration
- Simvastatin: Increased risk of myopathy
- Thyroid Hormones: Affect serum concentration of Thyroid hormones

AMIKACIN

- Alcuronium*: *see alcuronium*
- Amphotericin B, Ciclosporin*: Increased risk of nephrotoxicity.
- Capreomycin, Cisplatin*, Vancomycin: Increased risk of nephrotoxicity and ototoxicity
- Furosemide*: Increased risk of ototoxicity
- Neostigmine*, Pyridostigmine*: Antagonise the effects of both.
- Suxamethonium*, Vecuronium*: Enhanced effects of both.

AMOXICILLIN+CLAVULANIC ACID: *See Amoxicillin*

AMILORIDE

- Alcohol, Amlodipine, Atenolol, Chlorpromazine, Diazepam, Fluphenazine, Glycerol trinitrate, Halothane, Hydralazine, Isosorbide dinitrate, Ketamine, Levodopa, Methyl dopa, Nifedipine, Nitrous oxide, Propranolol, Sodium nitroprusside, Thiopental, Timolol, Verapamil : Enhance hypotensive effect.
- Amitriptyline, Clomipramine: Increased risk of postural hypotension
- Carbamazepine: Increased risk of hyponatraemia
- Cyclosporin*: Increased risk of hyperkalaemia
- Cisplatin: Increased risk of nephrotoxicity and ototoxicity
- Contraceptives, Oral: Antagonism of diuretic effect by estrogens
- Dexamethasone, Hydrocortisone, Prednisolone: Antagonism of diuretic

effect

- Digoxin*: Diminish the therapeutic effect of Digoxin
- Enalapril*: Enhanced hypotensive effect; increased risk of severe hyperkalaemia
- Ibuprofen: Risk of nephrotoxicity of ibuprofen increased; antagonism of diuretic effect; possibly increased risk of hyperkalaemia
- Lithium*: Reduced lithium excretion (increased plasma-lithium concentration and risk of toxicity)
- Potassium salts*: Increased risk of hyperkalaemia
- Spironolactone: Enhanced the hyperkalemic effect of Spironolactone.
- Tacrolimus: Enhanced the hyperkalemic effect of tacrolimus.

AMITRIPTYLINE

- Acetazolamide, Amiloride, Furosemide, Hydrochlorothiazide: Increased risk of postural hypotension
- Alcohol, Methadone, Morphine: Enhance sedative effect.
- Amiodaron*: Increased risk of ventricular arrhythmias with Amiodaron.
- Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Atropine, Biperiden: Increased antimuscarinic adverse effects
- Carbamazepine*: Antagonism of anticonvulsant effect (convulsive threshold lowered); Accelerated metabolism of amitriptyline (reduced plasma concentration; reduced antidepressant effect)
- Chlorphenamine: Increased antimuscarinic and sedative effects.
- Chlorpromazine*: Increased risk of antimuscarinic adverse effects; increased plasma-amitriptyline concentration; possibly increased risk of ventricular arrhythmias
- Codeine, Diazepam: Enhanced sedative effect.
- Contraceptives, Oral: Antagonism of antidepressant effect by estrogens but adverse effects of amitriptyline possibly increased due to increased plasma concentration of amitriptyline.
- Epinephrine*: Increased risk of hypertension and arrhythmias (but local anaesthetics with epinephrine appear to be safe)
- Ethosuximide*: Antagonism of anticonvulsant effect (convulsive threshold lowered).
- Fluphenazine*: Increased risk of antimuscarinic adverse effects; increased plasma-amitriptyline concentration; possibly increased risk of ventricular arrhythmias.
- Glycerol trinitrate: Reduced effect of sublingual glycerol trinitrate tablets (failure to dissolve under tongue owing to dry mouth).
- Haloperidol*: Increased plasma-amitriptyline concentration; possibly increased risk of ventricular arrhythmias
- Halothane, Ketamine, Nitrous oxide, Thiopental, Spironolactone: Increased risk of arrhythmias and hypotension.
- Isosorbide dinitrate: Reduced effect of sublingual isosorbide dinitrate tablets (failure to dissolve under tongue owing to dry mouth)
- Levothyroxine: Enhanced effects of amitriptyline
- Lithium: Risk of toxicity
- Moxifloxacin*: Increased risk of ventricular arrhythmias with Moxifloxacin.

- Phenobarbital*, Phenytoin*: Antagonism of anticonvulsant effect (convulsive threshold lowered);metabolism of amitriptyline possibly accelerated (reduced plasma concentration)
- Procainamide*, Quinidine*: Increased risk of ventricular arrhythmias
- Promethazine: Increased antimuscarinic and sedative effects
- Rifampicin: Plasma concentration of amitriptyline possibly reduced
- Ritonavir*: Plasma concentration possibly increased by ritonavir
- Valproate*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Verapamil: Possibly increased plasma concentration of amitriptyline
- Warfarin*: Enhanced or reduced anticoagulant effect

AMLODIPINE

- Acetazolamide, Alcohol, Amiloride, Atenolol, Chlorpromazine, Diazepam, Enalapril, Fluphenazine, Furosemide, Glyceryl trinitrate, Haloperidol, Halothane, Hydralazine, Hydrochlorothiazide, Isosorbide dinitrate, Ketamine, Levodopa, Methyldopa, Nitrous oxide, Propranolol, Sodium nitroprusside, Spironolactone, Thiopental, Timolol: Enhanced hypotensive effect
- Carbamazepine: Probably reduced effect of amlodipine
- Contraceptives (Oral), Dexamethasone, Hydrocortisone, Ibuprofen, Prednisolone: Antagonism of hypotensive effects
- Mefloquine: Possible increased risk of bradycardia
- Phenobarbital, Phenytoin: Probably reduced effect of amlodipine
- Ritonavir*: Possibly increased plasma concentration of amlodipine
- Chlorpromazine: Plasma concentration of chlorpromazine increased (consider reducing chlorpromazine dose)

AMOXICILLIN (Amoxicillin)

- Allopurinol: Increased risk of rash
- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Methotrexate: Reduced excretion of methotrexate (increased risk of toxicity)
- Probenecid: Increased the serum concentration of amoxicillin.
- Tetracycline: Diminish the therapeutic effect of amoxicillin.
- Warfarin: Studies have failed to demonstrate an interaction, but common experience in anticoagulant clinics is that INR can be altered by a course of amoxicillin

AMOXICILLIN + CLAVULANIC ACID: *see* Amoxicillin

AMPHOTERICIN B

Note. Close monitoring required with concomitant administration of nephrotoxic drugs or cytotoxics

- Amikacin, Ciclosporin*, Gentamicin, Pentamidine, Streptomycin, Tacrolimus, Vancomycin: Increased risk of nephrotoxicity
- Dexamethasone*: Increased risk of hypokalaemia (avoid concomitant use unless dexamethasone needed to control reactions)

- Digoxin*: Hypokalaemia caused by amphotericin B increases cardiac toxicity of digoxin
- Fluconazole: Possible antagonism of effect of amphotericin B
- Flucytosine: Renal excretion of flucytosine decreased and cellular uptake increased (flucytosine toxicity possibly increased)
- Furosemide, Hydrochlorothiazide: Increased risk of hypokalaemia
- Hydrocortisone*, Prednisolone*: Increased risk of hypokalaemia (avoid concomitant use unless hydrocortisone needed to control reactions)
- Miconazole: Possibly antagonism of effects of amphotericin B
- Sodium Stibogluconate: Increased risk of arrhythmias when amphotericin given after Sodium Stibogluconate

AMPICILLIN

- Allopurinol: Increased risk of rash.
- Atenolol: Decreased the bioavailability of atenolol
- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Chloroquine: Decrease serum concentration of ampicillin.
- Probenecid: Increased the serum concentration of ampicillin.
- Tetracycline: Diminish the therapeutic effect of ampicillin.
- Methotrexate: Reduced excretion of methotrexate (increased risk of toxicity)
- Warfarin: Studies have failed to demonstrate an interaction, but common experience in anticoagulant clinics is that INR can be altered by a course of ampicillin

ANTACIDS (ALUMINIUM HYDROXIDE; MAGNESIUM HYDROXIDE)

Note: Antacids should preferably not be taken at the same time as other drugs since they may impair absorption

- Aspirin: Excretion of acetylsalicylic acid increased by alkaline urine
- Azithromycin, Chloroquine, Chlorpromazine, Ciprofloxacin, Digoxin, Doxycycline, Enalapril, Fluphenazine, Folate, Ferrous sulphate, Isoniazid, Ketoconazole, Levofloxacin, Levothyroxine, Ketoconazole, Ofloxacin, Penicillamine, Rifampicin, Tetracycline: Antacids reduced absorption
- Prednisolone: Decreased the bioavailability of Prednisolone
- Quinidine: Reduced quinidine excretion in alkaline urine (plasma-quinidine concentration occasionally increased)

ARTEMETHER+LUMEFANTRINE

- Amitriptyline*, Amiodarone*, Azithromycin*, Chloroquine*, *Chlorpromazine*, Ciprofloxacin*, Clomipramine*, Erythromycin*, Fluconazole*, Fluphenazine*, Haloperidol*, Indinavir*, Levofloxacin*, Mefloquine*, Metoprolol*, Nelfinavir*, Ofloxacin*, Primaquine*, Proguanil*, Pyrimethamine*, Ritonavir*, Saquinavir* : Manufacturer of artemether with lumefantrine advises avoid concomitant use.
- Grapefruit Juice*: Metabolism of artemether and lumefantrine may be inhibited (avoid concomitant use)
- Procainamide*, Quinidine*, Quinidine* Risk of ventricular arrhythmias (manufacturer of artemether with lumefantrine advises avoid concomitant

use)

- Sulfadoxine +Pyrimethamine: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- ASPARAGINASE
- Vaccine, Live: Avoid use of live vaccines with asparaginase (impairment of immune response)
- Dexamethasone: Increase the serum concentration of dexamethasone.
- Insulin: Asparaginase Increased blood glucose level.
- Vincristine: Neurotoxicity is increased by asparaginase.

ASPIRIN (Acetylsalicylic acid)

- Acetazolamide: Increased risk of toxicity when given with high-dose aspirin
- Antacids (Aluminium hydroxide; Magnesium hydroxide): Excretion of Acetylsalicylic acid increased by alkaline urine
- Clopidogrel, Ethanol: Increase risk of bleeding.
- Dexamethasone, Hydrocortisone, Prednisolone: Increased risk of gastrointestinal bleeding and ulceration,dexamethasone reduces plasma salicylate concentration
- Enalapril: Antagonism of hypotensive effect; risk of renal impairment when acetylsalicylic acid given in doses of over 300 mg daily
- Heparin*: Enhanced anticoagulant effect of heparin
- Ibuprofen*: Avoid concomitant use (increased adverse effects); antiplatelet effect of acetylsalicylic acid possibly reduced
- Methotrexate*: Reduced excretion of methotrexate (increased toxicity)
- Metoclopramide: Enhanced effect of acetylsalicylic acid (increased rate of absorption)
- Mifepristone: Manufacturer of mifepristone advises avoid concomitant use
- Nitroglycerin: Increased the serum concentration of Nitroglycerin
- Phenytoin: Enhancement of effect of phenytoin
- Probenecid: Diminished the therapeutic effect of Probenecid.
- Spironolactone: Antagonism of diuretic effect
- Thiopental: Enhance effects of thiopental.
- Valproate: Enhancement of effect of valproate
- Warfarin*: Increase risk of bleeding due to antiplatelet effect

ATENOLOL

- Acetazolamide, Alcohol, Amiloride,Amlodipine, Chlorpromazine, Diazepam, Enalapril, Fluphenazin, Furosemide, Glyceryl trinitrate, Hydralazine, Hydrochlorothiazide, Isosorbide dinitrate, Ketamine, Levodopa, Methyl dopa, Nitrous oxide, Sodium nitroprusside, Spironolacton, Thiopental: Enhanced hypotensive effect.
- Ampicillin: see ampicillin
- Antacid: see antacid
- Contraceptives (Oral), Dexamethasone, Hydrocortisone, Prednisolone: Antagonism of hypotensive effect
- Digoxin: Increased risk of AV block and bradycardia
- Epinephrine*: Severe hypertension
- Glucagon: Diminished the hyperglycemic effect of glucagon
- Ibuprofen: Antagonism of hypotensive effect

- Insulins, Glibenclamide, Metformin: Enhanced hypoglycaemic effect; atenolol may mask warning signs of hypoglycaemia such as tremor.
- Lidocaine*: Increased myocardial depression (interaction less likely when lidocaine used topically).
- Mefloquine: Increased risk of bradycardia
- Nifedipine*: Enhanced hypotensive effect. Possibly severe hypotension and heart failure
- Pilocarpine: Increased risk of arrhythmias
- Procainamide*: Increased myocardial depression
- Quinidine*: Increased myocardial depression
- Verapamil*: Asystole, severe hypotension and heart failure

ATORVASTATIN

- Digoxin: Plasma concentration possibly increased
- Diltiazem: Plasma concentration of Atrovastatin increase-possible increased risk of myopathy
- Cyclosporin: Increased risk of myopathy
- Clarithromycin: Plasma concentration of Atorvastatin increases
- Erythromycin*, Fluconazole, Ketoconazole, Itraconazole: Increased risk of Myopathy avoid concomitant use
- Ethinylestradiol, Norethisterone: Plasma concentration increased.
- Midazolam: Plasma concentration possibly increased.
- Rifampicin: Plasma concentration possibly reduced.
- Verapamil: Plasma concentration increased-possible increased risk of myopathy
- Warfarin*: Anticoagulant effect transiently reduced

ATROPINE

Note: Many drugs have antimuscarinic effects; concomitant use of 2 or more such drugs can increase adverse effects such as dry mouth, urine retention, and constipation, and can also lead to confusion in the elderly.

- Amitriptyline, Chlorphenamine, Chlorphenamine, Clomipramine, Fluphenazine, Promethazine: Increased antimuscarinic adverse effects
- Glyceril trinitrate: Possibly reduced effect of sublingual glyceril trinitrate tablets (failure to dissolve under the tongue owing to dry mouth)
- Glucagon: Enhanced the toxic effect of glucagon.
- Haloperidol: Possibly reduced effects of haloperidol
- Isosorbide dinitrate: Possibly reduced effect of sublingual isosorbide dinitrate tablets (failure to dissolve under the tongue owing to dry mouth)
- Levodopa: Absorption of levodopa possibly reduced
- Metoclopramide: Antagonism of effects of metoclopramide on gastrointestinal activity
- Neostigmine, Pilocarpin, Pyridostigmine: Atropine antagonise the effects.

AZATHIOPRINE

- Allopurinol*: Effects of azathioprine enhanced and toxicity increased, reduce dose of azathioprine
- Mercaptopurine*: Enhanced the myelosuppressive effect of Mercaptopurine
- Phenytoin: Possibly reduced absorption of phenytoin

- Ribavirin: Myelosuppressive effects of azathioprine is enhanced
- Sulfamethoxazole +Trimethoprim*: Increased risk of haematological toxicity
- Sulfasalazine: Possibly increased risk of leukopenia
- Trimethoprim*: Increased risk of haematological toxicity
- Vaccine, Live*: Avoid use of live vaccines with azathioprine (impairment of immune response)
- Warfarin*: Anticoagulant effect possibly reduced.

AZITHROMYCIN

- Amiodarone*: Enhanced the QTc-prolonging effect of amiodarone.
- Antacids: Reduced absorption of azithromycin
- Artemether with lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Ciclosporin*: Possible inhibition of metabolism of ciclosporin (increased plasma concentration)
- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Colchicine: Increased the risk of Colchicine toxicity
- Digoxin: Increased plasma concentration of digoxin (increased risk of toxicity)
- Quinine*: Increased the serum concentration of quinine.
- Ritonavir: Plasma concentration of azithromycin possibly increased
- Tacrolimus: Increased the serum concentration of tacrolimus.
- Warfarin*: Possibly enhanced anticoagulant effect of warfarin

BECLOMETASONE

- Mifepristone: Possibly reduced effects of inhaled beclometasone for 3–4 days
- Amphotericin B : Enhanced the hypokalemic effect of Amphotericin B
- Aminophylline: Increased risk of hypokalaemia with Aminophylline
- Aspirin: Increased risk of gastro-intestinal bleeding and ulceration with aspirin.
- Carbamazepine: Metabolism of beclomethasone is accelerated.
- Neostigmine: Enhanced the adverse effect of neostigmine.

BEDAQUILINE

- Carbamazepine and phenytoin (antiepileptics): plasma concentration possibly reduced
- Ciprofloxacin: plasma concentration possibly increased
- Clarithromycin: plasma concentration possibly increased
- Clofazimine: possible increased risk of ventricular arrhythmias-avoid concomitant use
- Erythromycin: plasma concentration possibly increased-avoid concomitant use if given for more than 14 days
- Ketoconazole and fluconazole (antifungals): plasma concentration possibly increased- avoid concomitant use if given for more than 14 days
- Moxifloxacin avoid concomitant use with moxifloxacin
- Rifampicin: plasma concentration possibly reduced
- Ritonavir: Plasma concentration possibly increased

BENZATHINE BENZYL PENICILLIN see Benzylpenicillin

BENZYL PENICILLIN

- Allopurinol: Increase risk of rashes with Allopurinol
- Tetracyclines: Effects of penicillins is antagonised by Tetracyclines
- Methotrexate: Reduced the excretion of Methotrexate (increased risk of toxicity)
- Sulfapyrazone: Excretion is reduced by Sulfapyrazone
- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)

BETAHISTINE

- Cetrizine, Chlorphenamine, Cinnarizine, Desloratadine: Plasma concentration of betahistine decreased
- Dobutamine, Levocetirizine, Loratadine, Pheniramine, Ranitidine, Salbutamol: Possibly reduce the therapeutic efficacy

BICALUTAMIDE

- Coumarins: possibly enhances anticoagulant effect
- Lipid regulating drugs: separating administration by 12 hours is advised

BIPERIDEN

Note: Many drugs have antimuscarinic effects; concomitant use of 2 or more such drugs can increase adverse effects such as dry mouth, urine retention, and constipation, and can also lead to confusion in the elderly.

- Amitriptyline, Fluphenazine, Chlorphenamine, Chlorpromazine, Clomipramine, Fluphenazine, Promethazine: Increased antimuscarinic adverse effects
- Glycerol trinitrate: Possibly reduced effect of sublingual glycerol trinitrate tablets (failure to dissolve under the tongue owing to dry mouth)
- Haloperidol: Possibly reduced effects of haloperidol
- Isosorbide dinitrate: Possibly reduced effect of sublingual isosorbide dinitrate tablets (failure to dissolve under the tongue owing to dry mouth)
- Levodopa: Absorption of levodopa possibly reduced
- Metoclopramide: Antagonism of effects of metoclopramide on gastrointestinal activity
- Neostigmine: Antagonism of effects of neostigmine
- Pilocarpine: Antagonism of effects of pilocarpine
- Pyridostigmine: Antagonism of effects of pyridostigmine

BLEOMYCIN

- Cisplatin*: Increased pulmonary toxicity
- Oxygen*: Serious pulmonary toxicity in patients exposed to conventional oxygen concentrations during anaesthesia
- Phenytoin: Possibly reduced absorption of phenytoin
- Vaccine, Live: Avoid use of live vaccines with bleomycin (impairment of immune response)
- Vinblastine*: Increased risk of cardiovascular toxicity
- Clozapine: Increased risk of agranulocytosis.

- Digoxin: Reduces absorption of Digoxin.

BUPIVACAINE

- Lidocaine: Increased myocardial depression (interaction less likely when lidocaine used topically)
- Procainamide*: Increased myocardial depression
- Propranolol*: Increased risk of bupivacaine toxicity
- Quinidine: Increased myocardial depression
-

CAFFEINE CITRATE

- Adenosine: antagonises anti-arrhythmic effect –avoid for at least 12 hours before adenosine
- Aminophylline, Theophylline: avoid concomitant use
- Cimetidine: plasma concentration increased
- Phenobarbital: possibly antagonises effects
- Phenytoin: plasma concentration possibly reduced

CALCIUM CARBONATE

- Amlodipine, Dobutamine: Possibly decreased the therapeutic efficacy
- Allopurinol, Ciprofloxacin, Doxycycline, Iron, Levothyroxine, Tetracycline, Zinc: Absorption reduced
- Cefuroxime, Chloroquine, Fexofenadine, Hydrocortisone, Isoniazid, ketoconazole, Levofloxacin: Serum concentration decreased
- Digoxin: Large intravenous doses of calcium can precipitate arrhythmias
- Hydrochlorothiazide: Increased risk of hypercalcaemia

CALCIUM FOLINATE: *see* Folic acid and Folinic acid

CALCIUM GLUCONATE: *see* Calcium salts

CALCIUM SALTS

- Ciprofloxacin, Ferrous salts, Iron Salts, Levothyroxine, Sodium fluoride, Tetracycline, Zinc sulfate: Calcium salt reduce absorption.
- Dexamethasone, Hydrocortisone, Prednisolone: Reduced absorption of calcium salts
- Digoxin: Large intravenous doses of calcium salts can precipitate arrhythmias
- Hydrochlorothiazide: Increased risk of hypercalcaemia

CAPREOMYCIN

- Aminoglycosides: Increased risk of nephrotoxicity and ototoxicity
- Colistimethate Sodium: Increased risk of toxicity
- Oral Typhoid Vaccine: Inactivate the Vaccine-See Oral Typhoid Vaccine
- Platinum Compounds: Increased risk of nephrotoxicity and ototoxicity
- Polymyxins: Increased risk of toxicity
- Vancomycin: Increased risk of toxicity

CARBAMAZEPINE

- Acetazolamide*: Increased risk of hyponatraemia; acetazolamide increases

- plasma-carbamazepine concentration
- Alcohol: Possibly enhanced CNS adverse effects of carbamazepine
 - Alcuronium: Antagonism of muscle relaxant effect (recovery from neuromuscular blockade accelerated)
 - Albendazole: carbamazepine reduces plasma concentration.
 - Amiloride: Increased risk of hyponatraemia
 - Amitriptyline*: Antagonism of anticonvulsant effect (convulsive threshold lowered); accelerated metabolism of amitriptyline (reduced plasma concentration; reduced antidepressant effect)
 - Aminophylline: carbamazepine accelerates metabolism of aminophylline.
 - Amlodipine: Probably reduced effect of amlodipine
 - Chloroquine: Possibly increased risk of convulsions
 - Chlorpromazine*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
 - Cyclosporin*: Accelerated metabolism of cyclosporin (reduced plasma-cyclosporin concentration)
 - Cimetidine: inhibit the metabolism of carbamazepine.
 - Clopidogrel: carbamazepine reduced antiplatelet effect of clopidogrel.
 - Clarithromycin: plasma concentration of carbamazepine is increased
 - Clomipramine*: Antagonism of anticonvulsant effect (convulsive threshold lowered); accelerated metabolism of clomipramine (reduced plasma concentration; reduced antidepressant effect)
 - Contraceptives, Oral*: Accelerated metabolism of estrogens and progestogens (reduced contraceptive effect)
 - Dexamethasone*: Accelerated metabolism of dexamethasone (reduced effect)
 - Doxycycline: Accelerated metabolism of doxycycline (reduced effect)
 - Ergocalciferol: Ergocalciferol requirements possibly increased
 - Erythromycin*: Increased plasma-carbamazepine concentration
 - Ethosuximide: May tration of ethosuximide possibly reduced
 - Fentanyl: carbamazepine accelerates metabolism.
 - Fluphenazine*: Antagonism of anticonvulsant effect (convulsive threshold lowered) be enhanced toxicity without corresponding increase in antiepileptic effect; plasma concen
 - Furosemide: Increased risk of hyponatraemia
 - Haloperidol*: Antagonism of anticonvulsant effect (convulsive threshold lowered); metabolism of haloperidol accelerated (reduced plasma concentration)
 - Hydrochlorothiazide: Increased risk of hyponatraemia
 - Hydrocortisone*: Accelerated metabolism of hydrocortisone (reduced effect)
 - Indinavir: Possibly reduced plasma-indinavir concentration
 - Isoniazid*: Increased plasma-carbamazepine concentration (also isoniazid hepatotoxicity possibly increased)
 - Levonorgestrel*: Accelerated metabolism of levonorgestrel (reduced contraceptive effect)
 - Levothyroxine: Accelerated metabolism of levothyroxine (may increase levothyroxine requirements in hypothyroidism)
 - Lithium: Neurotoxicity may occur without increased plasma-lithium

concentration

- Lopinavir*: Possibly reduced plasma-lopinavir concentration
- Mebendazole: Reduced plasma-mebendazole concentration (possibly increase mebendazole dose for tissue infection)
- Medroxyprogesterone*: Accelerated metabolism of medroxyprogesterone (does not apply to injectable medroxyprogesterone acetate for contraception)
- Mefloquine*: Antagonism of anticonvulsant effect
- Methadone: Reduced plasma concentration of methadone
- Miconazole: Plasma concentration of carbamazepine possibly increased
- Nelfinavir: Possibly reduced plasma-nelfinavir concentration
- Nifedipine- Probably reduced effect of nifedipine
- Norethisterone*: Accelerated metabolism of norethisterone (reduced contraceptive effect)
- Phenobarbital: May be enhanced toxicity without corresponding increase in antiepileptic effect; reduced plasma concentration of carbamazepine
- Paracetamol: carbamazepine accelerates metabolism.
- Phenytoin*: May be enhanced toxicity without corresponding increase in antiepileptic effect; plasma concentration of phenytoin often lowered but may be raised; reduced plasma concentration of carbamazepine often lowered
- Praziquantel: Plasma-praziquantel concentration reduced
- Prednisolone*: Accelerated metabolism of prednisolone (reduced effect)
- Ritonavir*: Plasma concentration possibly increased by ritonavir
- Saquinavir: Possibly reduced plasma-saquinavir concentration
- Spironolactone: Increased risk of hyponatraemia.
- Valproate: May be enhanced toxicity without corresponding increase in antiepileptic effect; reduced plasma concentration of valproate; plasma concentration of active metabolite of carbamazepine increased
- Vecuronium: Antagonism of muscle relaxant effect (recovery from neuromuscular blockade accelerated)
- Verapamil*: Enhanced effect of carbamazepine
- Warfarin*: Accelerated metabolism of warfarin (reduced anticoagulant effect)

CARBOPLATIN: *See Platinum Compounds*

CEFADROXIL

- BCG vaccine: Therapeutic efficacy may be decreased
- Probenecid: Serum concentration of cefadroxil may be increased
- Warfarin: May increase the anticoagulant activities.

CEFIXIME

- Amikacin: increased risk of nephrotoxicity with amikacin.
- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Probenecid: increased the serum concentration of cefixime.
- Warfarin: Possibly enhanced anticoagulant effect

CEFTAZIDIME

- Amikacin: increased risk of nephrotoxicity with amikacin.
- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Chloramphenicol: Diminish the therapeutic effect of ceftazidime.
- Probenecid: increased the serum concentration of ceftazidime.
- Warfarin*: Possibly enhanced anticoagulant effect

CEFTRIAZONE

- Amikacin: increased risk of nephrotoxicity with amikacin.
- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Probenecid: increased the serum concentration of ceftriazone.
- Warfarin*: Possibly enhanced anticoagulant effect

CETIRIZINE

- Alprazolam, Amitriptyline, Bupivacaine, Carbamazepine, Chlordiazepoxide, Chlorphenamine, Clonazepam, Clonidine, Codeine, Haloperidol, Imipramine, Levopoda, Lidocaine, Lithium, Lorazepam, Midazolam, Morphine, Ondansetron, Pethidine, Phenobarbital: Possibly increased risk of severity of adverse effects
- Magnesium Sulphate: May increase the central nervous system depressant activities

CLARITHROMYCIN

- Aminophylline, Benaquiline: Plasma concentration possibly increased
- Atorvastatin, Carbamazepine, Docetaxel, Methylprednisolone: Plasma concentration possibly increased
- Colchicine: Possible increased risk of colchicine toxicity
- Domperidone: Possible increased risk of Ventricular arrhythmias
- Midazolam: Metabolism inhibited
- Itraconazole, Theophylline: Plasma concentration possibly increased
- Warfarin: anticoagulant effect enhanced
- Zidovudine: Possibly reduced absorption

CHLORAMBUCIL

- Amphotericin B: Enhanced the toxic effect of Amphotericin B
- Clozapine: Increased the risk of neutropenia.
- Phenytoin: Possibly reduced absorption of phenytoin
- Tacrolimus*: Enhanced the toxic effect of chlorambucil.
- Vaccine, Live: Avoid use of live vaccines with chlorambucil (impairment of immune response)

CHLORAMPHENICOL

- Cyclosporin*: Plasma concentration of cyclosporin possibly increased
- Clozapine*: avoid concomitant use of chloramphenicol with clozapine (increased risk of agranulocytosis)
- Clopidogrel*: reduces antiplatelet effect of Clopidogrel
- Glibenclamide*: Enhanced effect of glibenclamide

- Hydroxocobalamin: Response to hydroxocobalamin reduced
- Phenobarbital*: Metabolism of chloramphenicol accelerated (reduced chloramphenicol concentration)
- Phenytoin*: Plasma-phenytoin concentration increased (increased risk of toxicity)
- Rifampicin: Accelerated metabolism of chloramphenicol (reduced plasma-chloramphenicol concentration)
- Tacrolimus: increased the plasma concentration of tacrolimus.
- Warfarin*: Enhanced anticoagulant effect

CHLORMETHINE

- Amphotericin B: Enhanced the toxic effect of Amphotericin B.
- Clozapine: Increased the risk of neutropenia
- Phenytoin: Possibly reduced absorption of phenytoin
- Vaccine, Live: Avoid use of live vaccines with chlormethine (impairment of immune response)

CHLOROQUINE

- Amiodarone*: increased risk of ventricular arrhythmias with Amiodarone - avoid concomitant use
- Antacids (Aluminium hydroxide; Magnesium hydroxide): Reduced absorption of chloroquine
- Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Carbamazepine: Possible increased risk of convulsions
- Cyclosporin*: Increased plasma-ciclosporin concentration (increased risk of toxicity)
- Cimetidine: metabolism of chloroquine is inhibited
- Digoxin*: Plasma-digoxin concentration possibly increased
- Ethosuximide: Possible increased risk of convulsions
- Mefloquine*: Increased risk of convulsions
- Moxifloxacin*: increased risk of ventricular arrhythmias with Moxifloxacin - avoid concomitant use
- Neostigmine: Chloroquine has potential to increase symptoms of myasthenia gravis and thus diminish effect of neostigmine
- Phenytoin: Possible increased risk of convulsions
- Praziquantel: Plasma-praziquantel concentration possibly reduced
- Pyridostigmine: Chloroquine has potential to increase symptoms of myasthenia gravis and thus diminish effect of pyridostigmine
- Quinidine*: Increased risk of ventricular arrhythmias
- Quinine*: Increased risk of ventricular arrhythmias
- Valproate: Possible increased risk of convulsions

CHLORPHENIRAMINE

- Alcohol, Diazepam: Enhanced sedative effect
- Amitriptyline: Increased antimuscarinic and sedative effects
- Amphetamines: Diminish the sedative effect of chlorphenamine
- Atropine, Biperiden, Clomipramine: Increased antimuscarinic adverse effects

- Chloroquine: Increased the serum concentration of chloroquine.
- Lopinavir: Possibly increased plasma concentration of chlorphenamine
- Phenytoin: Increased the serum concentration of phenytoin.

CHLORPROMAZINE

- Acetazolamide, Amiloride, Amlodipine, Atenolol, Enalapril, Furosemide, Halothane*, Hydralazine, Hydrochlorothiazide, Glycerol trinitrate, Isosorbide dinitrate, Nifedipine, Sodium nitroprusside, Spironolactone, Thiopental*, Timolol, Verapamil : Enhanced hypotensive effect
- Alcohol, Codeine, Diazepam: Enhanced sedative effect
- Amitriptyline*: Increased risk of antimuscarinic adverse effects; increased plasma-amitriptyline concentration; possibly increased risk of ventricular arrhythmias
- Amodiaquine: Plasma concentration of chlorpromazine increased (consider reducing chlorpromazine dose)
- Antacids (Aluminium hydroxide; Magnesium hydroxide): Reduced absorption of chlorpromazine
- Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Atropine: Increased antimuscarinic adverse effects (but reduced plasma-chlorpromazine concentration)
- Biperiden: Increased antimuscarinic adverse effects (but reduced plasma - chlorpromazine concentration)
- Carbamazepine*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Clomipramine*: Increased antimuscarinic adverse effects; increased plasma - clomipramine concentration; possibly increased risk of ventricular arrhythmias
- Dopamine , Ephedrine, Epinephrine: Antagonism of hypertensive effect
- Ethosuximide*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Glibenclamide: Possible antagonism of hypoglycaemic effect
- Haloperidol*: Enhance the QTc prolonging effect of haloperidol.
- Ketamine*: Enhanced hypotensive effect
- Levodopa: Antagonism of effects of levodopa
- Lithium: Increased risk of extrapyramidal effects and possibility of neurotoxicity
- Methadone, Morphine: Enhanced hypotensive and sedative effects
- Methyldopa: Enhanced hypotensive effect; increased risk of extrapyramidal effects
- Metoclopramide: Increased risk of extrapyramidal effects
- Phenobarbital*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Procainamide: Increased risk of ventricular arrhythmias
- Propranolol*: Concomitant administration may increase plasma concentration of both drugs; enhanced hypotensive effect
- Quinidine*: Increased risk of ventricular arrhythmias
- Ritonavir*: Plasma concentration possibly increased by ritonavir
- Valproate*: Antagonism of anticonvulsant effect (convulsive threshold

lowered)

CLONAZEPAM

- Diazepam: Plasma concentration increased or decreased
- Phenytoin: Plasma concentration often reduced
- Sodium Valproate or Valproic Acid: increased risk of side-effects

CLOPIDOGREL

- Aspirin: increased risk of bleeding
- Chloramphenicol, Ciprofloxacin, Erythromycin, Fluconazole, Itraconazole, Ketoconazole, Pantoprazole: antiplatelet effect possibly reduced
- Warfarin: Antiplatelet action enhances
- Heparin: Increased risk of bleeding
- Carbamazepine, Fluoxetine: Antiplatelet effect of clopidogrel possibly reduced
- Rosuvastatin: Increases plasmaconcentration of rosuvastatin—adjust dose of rosuvastatin
- Esomeprazole, Omeprazole, Pantoprazole, Rabeprazole: antiplatelet effect of clopidogrel possibly reduced

CYCLOSPORIN

- Aciclovir, Amikacin*, Amphotericin B*, Ciprofloxacin*, Gentamicin*, Streptomycin*, Ofloxacin*, Vancomycin*: Increased risk of nephrotoxicity
- Allopurinol: Plasma-cyclosporin concentration possibly increased (risk of nephrotoxicity)
- Amiloride*: Increased risk of hyperkalaemia
- Azithromycin*: Plasma concentration of cyclosporin possibly increased
- Carbamazepine*: Accelerated metabolism of cyclosporin (reduced plasma-cyclosporin concentration)
- Chloramphenicol*: Plasma concentration of cyclosporin possibly increased
- Chloroquine*: Increased plasma-cyclosporin concentration (increased risk of toxicity)
- Cimetidine: plasma concentration of cyclosporin is increased.
- Contraceptives, Oral: Plasma-cyclosporin concentration increased by progestogens and possibly increased by estrogens
- Digoxin*: Increased plasma concentration of digoxin (increased risk of toxicity)
- Diclofenac: increases plasma concentration of Diclofenac.
- Doxorubicin*: Increased risk of neurotoxicity
- Doxycycline*: Possibly increased plasma-cyclosporin concentration
- Enalapril*: Increased risk of hyperkalaemia
- Erythromycin*: Increased plasma-cyclosporin concentration (inhibition of metabolism of cyclosporin)
- Etoposide: Possibly increased plasma concentration of etoposide (increased risk of toxicity)
- Fluconazole*: Metabolism of cyclosporin inhibited (increased plasma-concentration)
- Grapefruit Juice*: Increased plasma-cyclosporin concentration (risk of toxicity)

- Cyclosporin: Plasma-cyclosporin concentration possibly reduced
- Hydrochlorothiazide: Increased risk of nephrotoxicity and possibly hypermagnesaemia
- Levonorgestrel*: Inhibition of cyclosporin metabolism (increased plasma-cyclosporin concentration)
- Mannitol: increased risk of nephrotoxicity with cyclosporin.
- Medroxyprogesterone*: Inhibition of cyclosporin metabolism (increased plasma-cyclosporin concentration)
- Methotrexate*: Increased toxicity
- Metoclopramide*: Plasma-cyclosporin concentration increased
- Nelfinavir*: Possibly increased plasma-cyclosporin concentration
- Nifedipine; Possibly increased plasma-nifedipine concentration (increased risk of adverse effects such as gingival hyperplasia)
- Norethisterone*: Inhibition of cyclosporin metabolism (increased plasma-cyclosporin concentration)
- *Phenobarbital, Phenytoin*, Rifampicin*: Metabolism of cyclosporin accelerated (reduced effect)
- Potassium salts*: Increased risk of hyperkalaemia
- Prednisolone: Increased plasma concentration of prednisolone
- Ritonavir: Plasma concentration possibly increased by ritonavir
- Saquinavir*: Plasma concentration of both cyclosporin and saquinavir increased
- Silver sulfadiazine*: Increased risk of nephrotoxicity; possibly reduced plasma-concentration of cyclosporin
- Spironolactone*: Increased risk of hyperkalaemia
- Sulfadiazine*: Plasma-cyclosporin concentration possibly reduced; increased risk of nephrotoxicity
- Sulfadoxine +Pyrimethamine*: Increased risk of nephrotoxicity
- Sulfamethoxazole +Trimethoprim*: Increased risk of nephrotoxicity; plasma-cyclosporin concentration possibly reduced by intravenous trimethoprim
- Trimethoprim*: Increased risk of nephrotoxicity; plasma-cyclosporin concentration possibly reduced by intravenous trimethoprim
- Tacrolimus: plasma concentration of cyclosporin is increased (increased risk of nephrotoxicity)
- Vaccine, Live*: Avoid use of live vaccines with cyclosporin (impairment of immune response)
- Verapamil*: Increased plasma-cyclosporin concentration

CIPROFLOXACIN

- Aminophylline: Increased risk of convulsions with ciprofloxacin.
- Antacids (Aluminium hydroxide; Magnesium hydroxide): Reduced absorption of ciprofloxacin
- Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use.
- Bedaquiline*: Increased the plasma concentration of bedaquiline.
- Calcium salts: Reduced absorption of ciprofloxacin
- Carbamazepine: Increased the serum concentration of carbamazepine.
- Cyclosporin*: Increased risk of nephrotoxicity
- Clozapine: Increased the serum concentration of clozapine.

- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Dairy products: Reduced absorption of ciprofloxacin
- Ferrous salts: Absorption of ciprofloxacin reduced by oral ferrous salts
- Glibenclamide: Possibly enhanced effect of glibenclamide
- Ibuprofen*: Possibly increased risk of convulsions
- Iron Salts: absorption of ciprofloxacin is reduced
- Morphine: Manufacturer of ciprofloxacin advises avoid premedication with morphine (reduced plasma-ciprofloxacin concentration) when ciprofloxacin used for surgical prophylaxis
- Phenytoin: Plasma-phenytoin concentration can be increased or decreased by ciprofloxacin
- Sucralfate: absorption of ciprofloxacin is reduced
- Tizanidine: Increased the serum concentration of Tizanidine.
- Warfarin*: Enhanced anticoagulant effect
- Zinc sulfate: Reduced absorption of ciprofloxacin

CISPLATIN

- Acetazolamide, Amiloride, Amikacin*, Gentamicin*, Streptomycin*, Furosemid, Hydrochlorothiazide, Spironolactone, Streptomycin*, Vancomycin: Increased risk of nephrotoxicity and ototoxicity
- Bleomycin*: Increased pulmonary toxicity
- Clozapine*: increased risk of agranulocytosis
- Methotrexate*: Risk of pulmonary toxicity
- Phenytoin: Reduced absorption of phenytoin
- Vaccine, Live: Avoid use of live vaccines with cisplatin (impairment of immune response)

CLINDAMYCIN

- Alcuronium*, Vecuronium*: Enhanced muscle relaxant effect
- Neostigmine: Antagonism of effects of neostigmine
- Pyridostigmine: Antagonism of effects of pyridostigmine
- Suxamethonium*: Enhanced effects of suxamethonium

CLOMIPRAMINE

- Acetazolamide, Amiloride, Furosemide, Spironolactone: Increased risk of postural hypotension
- Alcohol, Codeine, Diazepam, Morphine, Methadone: Enhanced sedative effect
- Artemether + Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Atropine, Biperiden, Chlorphenamine: Increased antimuscarinic adverse effects
- Carbamazepine*: Antagonism of anticonvulsant effect (convulsive threshold lowered); accelerated metabolism of clomipramine (reduced plasma concentration; reduced antidepressant effect)
- Chlorpromazine*: Increased antimuscarinic adverse effects; increased plasma-clomipramine concentration; possibly increased risk of ventricular arrhythmias

- Contraceptives, Oral: Antagonism of antidepressant effect by estrogens but adverse effects of clomipramine possibly increased due to increased plasma concentration of clomipramine
- Epinephrine*: Increased risk of hypertension and arrhythmias (but local anaesthetics with epinephrine appear to be safe)
- Ethosuximide*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Fluphenazine*: Increased antimuscarinic adverse effects; increased plasma-clomipramine concentration; possibly increased risk of ventricular arrhythmias
- Glycerol trinitrate: Reduced effect of sublingual glycerol trinitrate tablets (failure to dissolve under the tongue owing to dry mouth)
- Haloperidol*: Increased plasma-clomipramine concentration; possibly increased risk of ventricular arrhythmias
- Halothane, Ketamine, Promethazine: Increased risk of arrhythmias and hypotension
- Hydrochlorothiazide: Increased risk of postural hypotension Reduced effect of sublingual
- Isosorbide dinitrate: isosorbide dinitrate tablets (failure to dissolve under the tongue owing to dry mouth)
- Levothyroxine: Possibly enhanced effects of clomipramine
- Lithium: Risk of toxicity
- Nitrous oxide: Increased risk of arrhythmias and hypotension
- Phenobarbital*, Phenytoin*, Valproate*: Antagonism of anticonvulsant effect (convulsive threshold lowered); metabolism of clomipramine possibly accelerated (reduced plasma concentration)
- Procainamide*, Quinidine*: Increased risk of ventricular arrhythmias
- Rifampicin: Plasma concentration of clomipramine possibly reduced
- Ritonavir*: Plasma concentration possibly increased by ritonavir
- Thiopental: Increased risk of arrhythmias and hypotension
- Verapamil: Possibly increased plasma concentration of clomipramine
- Warfarin*: Enhanced or reduced anticoagulant effect

CLOXACILLIN: see Benzylpenicillin

CODEINE

- Alcohol, Chlorpromazine, Fluphenazine, Haloperidol: Enhanced sedative and hypotensive effect
- Amitriptyline, Clomipramine, Diazepam: Possibly increased sedation
- Metoclopramide: Antagonism of effect of metoclopramide on gastrointestinal activity
- Ritonavir*: Ritonavir possibly increases plasma concentration of codeine
- Rifampicin: metabolism of codeine is accelerated.

CONTRACEPTIVES, ORAL

Note: Interactions also apply to ethinylestradiol taken alone. In hormone replacement therapy low dose unlikely to induce interactions

- Acetazolamide, Amiloride: Antagonism of diuretic effect by estrogens
- Amitriptyline: Antagonism of antidepressant effect by estrogens but

- adverse effects of amitriptyline possibly increased due to increased plasma concentration of amitriptyline
- Amlodipine, Atenolol: Antagonism of hypotensive effect by estrogens
 - Amoxicillin, Ampicillin: Contraceptive effect of estrogens possibly reduced (risk probably small)
 - Azithromycin, Benzylpenicillin, Cefixime, Ceftazidime, Ceftriaxone, Ciprofloxacin, Erythromycin: Contraceptive effect of estrogens possibly reduced (risk probably small)
 - Carbamazepine*: Accelerated metabolism of estrogens and progestogens (reduced contraceptive effect)
 - Cyclosporin*: Plasma-cyclosporin concentration increased by progestogens and possibly increased by estrogens
 - Clomipramine: Antagonism of antidepressant effect by estrogens but adverse effects of clomipramine possibly increased due to increased plasma concentration of clomipramine
 - Dexamethasone: Oral contraceptives containing estrogens increase plasma concentration of dexamethasone
 - Efavirenz: Efficacy of estrogen-containing oral contraceptives possibly reduced
 - Fluconazole: Anecdotal reports of failure of estrogen-containing contraceptives
 - Furosemide: Antagonism of diuretic effect by estrogens
 - Enalapril, Glibenclamide: Antagonism of hypoglycaemic effect by estrogens and progestogens
 - Glyceryl trinitrate, Hydralazine, Hydrochlorothiazide: Antagonism of hypotensive effect by estrogens
 - Griseofulvin*: Accelerated metabolism of estrogens and progestogens (reduced contraceptive effect)
 - Hydrocortisone: Oral contraceptives containing estrogens increase plasma-concentration of hydrocortisone
 - Imipenem + Cilastatin: Contraceptive effect of estrogens possibly reduced (risk probably small)
 - Insulins, Metformin: Antagonism of hypoglycaemic effect by estrogens and progestogens
 - Levofloxacin: Contraceptive effect of estrogens possibly reduced (risk probably small)
 - Isosorbide dinitrate, Methyldopa, Nifedipine, Propranolol, Sodium nitroprusside, Spironolactone, Verapamil: Antagonism of hypotensive effect by estrogens
 - Metronidazole: Contraceptive effect of estrogens possibly reduced (risk probably small)
 - Nelfinavir*: Accelerated metabolism of estrogens (reduced contraceptive effect); nelfinavir possibly reduces contraceptive effect of progestogens
 - Nevirapine*: Accelerated metabolism of estrogens and progestogens (reduced contraceptive effect)
 - Ofloxacin: Contraceptive effect of estrogens possibly reduced (risk probably small)
 - Phenobarbital*, Phenytoin*, Rifampicin*: Accelerated metabolism of estrogens and progestogens (reduced contraceptive effect)

- Phenoxymethylpenicillin: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Prednisolone: Oral contraceptives containing estrogens increase plasma-concentration of prednisolone
- Ritonavir*: Accelerated metabolism of estrogens (reduced contraceptive effect)
- Warfarin*: Antagonism of anticoagulant effect by estrogens and progestogens

CYCLOPHOSPHAMIDE

- Allopurinol: Enhance toxic effect of cyclophosphamide.
- Amiodarone: Enhanced the toxic effect of Amiodarone.
- Azathiopirin: Enhanced the hepatotoxic effect of cyclophosphamide.
- Cyclosporin: Enhanced the immunosuppressive effect of cyclosporine.
- Phenytoin: Possibly reduced absorption of phenytoin
- Suxamethonium: Enhanced effect of suxamethonium
- Vaccine, Live: Avoid use of live vaccines with cyclophosphamide (impairment of immune response)

CYCLOSERINE

- Alcohol*: Increased risk of convulsions
- Isoniazid: Increased risk of CNS toxicity

CYTARABINE

- Clozapine*: Increased risk of agranulocytosis.
- Digoxin: reduces the absorption of digoxin.
- Flucytosine: Plasma-flucytosine concentration possibly reduced
- Phenytoin: Reduced absorption of phenytoin
- Vaccine, Live: Avoid use of live vaccines with cytarabine (impairment of immune response)

DACARBAZINE

- Clozapine*: Increased risk of agranulocytosis.
- Levodopa: Diminish the therapeutic effect of levodopa.
- Phenytoin: Possibly reduced absorption of phenytoin
- Vaccine, Live: Avoid use of live vaccines with dacarbazine (impairment of immune response)

DACTINOMYCIN

- Clozapine*: Increased risk of agranulocytosis.
- Phenytoin: Possibly reduced absorption of phenytoin
- Vaccine, Live: Avoid use of live vaccines with dactinomycin (impairment of immune response)
- Vitamins: reduces the effects of vitamins.

DAIRY PRODUCTS

- Ciprofloxacin: Reduced absorption of ciprofloxacin
- Mercaptopurine: reduced plasma concentration of Mercaptopurine.
- Tetracycline: reduced absorption of tetracycline.

DAPSONE

- Rifampicin: Reduced plasma-dapsone concentration
- Trimethoprim: Plasma concentration of both dapsone and trimethoprim may increase with concomitant use
- Saquinavir: increased risk of ventricular arrhythmias with Saquinavir.
- Probenecid: Increased the serum concentration of dapsone.

DAUNORUBICIN

- Clozapine: Increased risk of neutropenia with clozapine. Avoid concomitant use (increased risk of agranulocytosis)
- Cyclophosphamide*: Enhanced the cardiotoxic effect of daunorubicin.
- Phenytoin: Possibly reduced absorption of phenytoin
- Trastuzumab: Avoid concomitant use for up to 28 weeks after stopping trastuzumab
- Vaccine, Live: Avoid use of live vaccines with daunorubicin (impairment of immune response) Risk of generalized infections when given with live vaccine - avoid concomitant use

DEFERRIOXAMINE

- Prochlorperazine: avoid concomitant use

DEXAMETHASONE

- Acetazolamide, Furosemide, Hydrochlorothiazide: Increased risk of hypokalaemia; antagonism of diuretic effect
- Albendazole: Plasma-albendazole concentration possibly increased
- Amiloride: Antagonism of diuretic effect
- Amlodipine, Atenolol, Enalapril, Hydralazine, Glyceryl trinitrate, Isosorbide dinitrate, Methyldopa, Nifedipine, Propranolol: Antagonism of hypotensive effect
- Amphotericin B*: Increased risk of hypokalaemia (avoid concomitant use unless dexamethasone needed to control reactions)
- Aspirin: Increased risk of gastrointestinal bleeding and ulceration; dexamethasone reduces plasma-salicylate concentration
- Calcium salts: Reduced absorption of calcium salts
- Carbamazepine*: Accelerated metabolism of dexamethasone (reduced effect)
- Contraceptives, Oral: Oral contraceptives containing estrogens increase plasma-concentration of dexamethasone
- Digoxin*: Increased risk of hypokalaemia
- Ephedrine: Metabolism of dexamethasone accelerated
- Erythromycin: Erythromycin possibly inhibits metabolism of dexamethasone
- Glibenclamide, Insulins, Metformin: Antagonism of hypoglycaemic effect
- Ibuprofen: Increased risk of gastrointestinal bleeding and ulceration
- Indinavir: Possibly reduced plasma-indinavir concentration
- Lopinavir*: Possibly reduced plasma-lopinavir concentration
- Methotrexate*: Increased risk of haematological toxicity
- Mifepristone: Possibly reduced effects of dexamethasone for 3–4 days
- Phenobarbital*, Phenytoin*, Rifampicin*: Metabolism of dexamethasone accelerated

- Praziquantel: Plasma-praziquantel concentration reduced
- Ritonavir: Plasma concentration possibly increased by ritonavir
- Salbutamol: Increased risk of hypokalaemia if high doses of salbutamol given with dexamethasone
- Saquinavir: Possibly reduced plasma-saquinavir concentration
- Spironolactone: Antagonism of diuretic effect
- Vaccine, Influenza: High doses of dexamethasone impair immune response
- Vaccine, Live*: High doses of dexamethasone impair immune response; avoid use of live vaccines
- Warfarin*: Anticoagulant effect possibly enhanced or reduced (high-dose dexamethasone enhances anticoagulant effect)

DIAZEPAM

- Acetazolamide, Amiloride, Amlodipine, Atenolol: Enhanced hypotensive effect
- Alcohol, Amitriptyline, Chlorphenamine Chlorpromazine, Clomipramine, Codeine, Halothane, Ketamine, Methadone, Morphine, Nitrous oxide, Promethazine: Enhanced sedative effect
- Aminophylline: Effect is reduced by Aminophylline
- Cimetidine: Metabolism of diazepam is inhibited by cimetidine.
- Enalapril, Fluphenazine, Furosemide, Glycerol trinitrate, Hydralazine, Hydrochlorothiazide, Methyldopa, Nifedipine, Propranolol: Enhanced hypotensive effect
- Fluconazole: plasma concentration of diazepam is increased by Fluconazole
- Isoniazid: Metabolism of diazepam inhibited
- Isosorbide dinitrate: Enhanced hypotensive effect
- Levodopa: Possibly antagonism of levodopa effects
- Phenytoin, Rifampicin: Metabolism of diazepam accelerated (reduced plasma concentration)
- Ritonavir*: Plasma concentration possibly increased by ritonavir (risk of extreme sedation and respiratory depression—avoid concomitant use)
- Sodium nitroprusside: Enhanced hypotensive effect
- Sodium valproate: plasma concentration of diazepam is increased by Sodium valproate.
- Theophylline: Effect of diazepam is reduced.
- Thiopental: Enhanced sedative effect
- Spironolactone, Timolol, Verapamil: Enhanced hypotensive effect

DIDANOSINE

Note: Antacids in tablet formulation might affect absorption of other drugs—give at least 2 hours apart.

- Allopurinol: Possibly increased plasma concentration of didanosine.
- Ganciclovir: plasma concentration of didanosine is increased.
- Hydroxycarbamide*: Increased risk of toxicity with didanosine.
- Methadone: plasma concentration of didanosine is reduced.
- Stavudine*: Increased risk of adverse effects

DIGOXIN

- Acetazolamide*: Hypokalaemia caused by acetazolamide increases cardiac

toxicity of digoxin

- Alprazolam: plasma concentration of digoxin is increased (increased risk of toxicity)
- Amphotericin B*: Hypokalaemia caused by amphotericin B increases cardiac toxicity of digoxin
- Amiodarone: plasma concentration of digoxin is increased (halve dose of digoxin)
- Antacids (Aluminium hydroxide; Magnesium hydroxide): Possibly reduced absorption of digoxin
- Atenolol: Increased risk of AV block and bradycardia
- Azithromycin: Increased plasma concentration of digoxin (increased risk of toxicity)
- Calcium salts: Large intravenous doses of calcium salts can precipitate arrhythmias
- Captopril: plasma concentration of digoxin is increased
- Chloroquine*: Plasma-digoxin concentration possibly increased
- Ciclosporin*: Increased plasma concentration of digoxin (increased risk of toxicity)
- Colchicine: Increased risk of myopathy with digoxin.
- Dexamethasone: Increased risk of hypokalaemia
- Erythromycin: Increased plasma concentration of digoxin (increased risk of toxicity)
- Furosemide*: Hypokalaemia caused by furosemide increases cardiac toxicity of digoxin
- Gentamicin: Possibly increased plasma concentration of digoxin
- Hydrochlorothiazide*: Hypokalaemia caused by hydrochlorothiazide increases cardiac toxicity of digoxin
- Hydrocortisone: Increased risk of hypokalaemia
- Ibuprofen: Possibly exacerbation of heart failure, reduced renal function, and increased plasma-digoxin concentration
- Itraconazole: plasma concentration of digoxin is increased.
- Mefloquine: Possibly increased risk of bradycardia
- Nifedipine*: Possibly increased plasma concentration of digoxin
- Penicillamine: Plasma concentration of digoxin possibly reduced
- Phenytoin: Plasma concentration of digoxin possibly reduced
- Prazosin: plasma concentration of digoxin is increased
- Prednisolone: Increased risk of hypokalaemia
- Propranolol: Increased risk of AV block and bradycardia
- Quinidine*: Plasma concentration of digoxin increased (halve dose of digoxin)
- Quinine*: Plasma concentration of digoxin increased.
- Rifampicin: Plasma concentration of digoxin possibly reduced
- Salbutamol: Possibly reduced plasma concentration of digoxin
- Spironolactone*: Plasma concentration of digoxin increased
- Sulfamethoxazole +Trimethoprim: Plasma concentration of digoxin possibly increased
- Sulfasalazine: Absorption of digoxin possibly reduced
- Suxamethonium: Risk of ventricular arrhythmias
- Timolol: Increased AV block and bradycardia

- Trimethoprim: Plasma concentration of digoxin possibly increased
- Verapamil*: Increased plasma concentration of digoxin; increased AV block and bradycardia
- Vincristine: absorption of digoxin is reduced by vincristine.

DIMERCAPROL

- Ferrous salts*: Avoid concomitant use

DOMPERIDONE

- Ketoconazole, Itraconazole: Risk of Ventricular arrhythmias avoid concomitant use
- Morphine: effects of domperidone on gastro-intestinal activity antagonized
- Clarithromycin: Possible increased risk of ventricular arrhythmias-avoid concomitant use
- Erythromycin: Plasma concentration of domperidone increased (increased risk of ventricular arrhythmias—avoid concomitant use)
- Ritonavir, Telaprevir: possible increased risk of ventricular arrhythmias-avoid concomitant use

DOPAMINE

- Chlorpromazine: Antagonism of hypertensive effect
- Ergometrine: Increased risk of ergotism
- Fluphenazine: Antagonism of hypertensive effect
- Haloperidol: Antagonism of hypertensive effect

DOXORUBICIN

- Cyclosporin*: Increased risk of neurotoxicity
- Cimetidine: plasma concentration of doxorubicin reduced.
- Digoxin: reduces absorption of digoxin
- Phenytoin: Possibly reduced absorption of phenytoin
- Stavudine: Doxorubicin may inhibit effect of stavudine
- Vaccine, Live: Avoid use of live vaccines with doxorubicin (impairment of immune response)
- Verapamil: Plasma concentration of doxorubicin is increased.

DOXYCYCLINE

- Antacids (Aluminium hydroxide; Magnesium hydroxide): Reduced absorption of doxycycline
- Carbamazepine: Accelerated metabolism of doxycycline (reduced effect)
- Cyclosporin*: Possibly increased plasma-ciclosporin concentration
- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Ferrous salts: Absorption of oral ferrous salts reduced by doxycycline; absorption of doxycycline reduced by oral ferrous salts
- Methotrexate: Increased risk of methotrexate toxicity
- Phenobarbital: Metabolism of doxycycline accelerated (reduced plasma-concentration)
- Phenytoin: Increased metabolism of doxycycline (reduced plasma concentration)

- Rifampicin: Plasma-doxycycline concentration possibly reduced
- Warfarin*: Anticoagulant effect possibly enhanced

EFAVIRENZ

- Atovaquone: reduces plasma concentration of atovaquone.
- Atorvastatin: reduces plasma concentration of atorvastatin.
- Carbamazepine: plasma concentration of both drugs reduced when efavirenz given with Carbamazepine
- Contraceptives, Oral: Efficacy of estrogen-containing oral contraceptives possibly reduced
- Clarithromycin: reduces plasma concentration of Clarithromycin.
- Ciclosporin: reduces plasma concentration of ciclosporin.
- Diltiazem: reduces plasma concentration of diltiazem.
- Ergometrine*: Increased risk of ergotism (avoid concomitant use)
- Grapefruit Juice: Plasma concentration of efavirenz possibly increased
- Indinavir: Efavirenz reduces plasma concentration of indinavir
- Ketoconazole: reduces plasma concentration of ketoconazole
- Lopinavir: Plasma concentration of lopinavir reduced
- Methadone: Reduced plasma concentration of methadone
- Midazolam*: Increased risk of prolonged sedation when efavirenz given with midazolam.
- Nevirapine: Plasma-efavirenz concentration reduced
- Rifampicin: Reduced plasma concentration of efavirenz (increase efavirenz dose)
- Ritonavir: Increased risk of toxicity (monitor liver function tests)
- Saquinavir: Efavirenz significantly reduces plasma concentration of saquinavir

EMTRICITABINE

- Lamivudine: Avoid concomitant use

EMTRICITABINE + TENOFOVIR: See Emtricitabine and Tenofovir

ENALAPRIL

- Acetazolamide*, Alcohol, Amlodipine, Atenolol, Chlorpromazine, Diazepam, Fluphenazine, Furosemide*, Glycerol trinitrate, Haloperidol, Halothane, Hydralazine, Hydrochlorothiazide*, Isosorbide dinitrate, Ketamine, Levodopa: Enhanced hypotensive effect.
- Allopurinol: manufacturers state possible increased risk of leucopenia and hypersensitivity reactions.
- Amiloride*: Enhanced hypotensive effect; increased risk of severe hyperkalaemia
- Antacids (Aluminium hydroxide; Magnesium hydroxide): Absorption of enalapril reduced
- Aspirin, Ibuprofen: Antagonism of hypotensive effect; risk of renal impairment when acetylsalicylic acid given in doses of over 300 mg daily
- Azathioprine: increased risk of anaemia when enalapril given with Azathioprine especially in renal impairment
- Cyclosporin*: Increased risk of hyperkalaemia

- Contraceptives (Oral), Dexamethasone, Hydrocortisone, Prednisolone: Antagonism of hypotensive effect by estrogens
- Glibenclamide, Insulins, Metformin: Hypoglycaemic effect possibly enhanced
- Heparin: Increased risk of hyperkalaemia
- Lithium*: Enalapril reduces excretion of lithium (increased plasma-lithium concentration)
- Methyldopa, Nifedipine, Nitrous oxide, Propranolol, Sodium nitroprusside, Thiopental, Timolol, Verapamil: Enhanced hypotensive effect
- Potassium salts*: Increased risk of severe hyperkalaemia
- Spironolactone*: Enhanced hypotensive effect; increased risk of severe hyperkalaemia (monitor plasma-potassium concentration with low-dose spironolactone in heart failure)

EPHEDRINE

- Anesthetics, Digoxin: Increase cardiac stimulation
- Antacids: Decrease the excretion of ephedrine
- Atropine: Increase blood pressure
- Chlorpromazine: Antagonism of hypertensive effect
- Dexamethasone: Metabolism of dexamethasone accelerated
- Fluphenazine, Haloperidol: Antagonism of hypertensive effect
- Isoflurane*: Risk of Ventricular arrhythmias (avoid)
- Oxytocin: Risk of hypertension due to enhanced vasopressor effect of ephedrine
- Theophylline*: Enhance the adverse effect (avoid in children)

EPINEPHRINE (ADRENALINE)

- Amitriptyline*, Clomipramine*: Increased risk of hypertension and arrhythmias (but local anaesthetics with epinephrine appear to be safe)
- Atenolol*, Propranolol*, Timolol*: Increases Blood Pressure
- Chlorpromazine, Fluphenazine, Haloperidol: Antagonism of hypertensive effect
- Halothane*: Risk of arrhythmias
- Oxytocin: Risk of hypertension due to enhanced vasopressor effect of epinephrine

EPIRUBICIN

- Ciclosporin: Plasma concentration increased
- Clozapine: Avoid concomitant use (increased risk of agranulocytosis)
- Trastuzumab: Increase risk of cardiotoxicity-avoid concomitant use for up to 28 weeks after stopping trastuzumab

ERGOCALCIFEROL

- Carbamazepine, Phenobarbital, Phenytoin: Ergocalciferol requirements possibly increased
- Dactinomycin, Miconazole: Effect possibly reduced
- Digoxin: Increased risk of toxicity
- Dopamine: Increased risk of ergotism
- Hydrochlorothiazide: Increased risk of hypercalcaemia

ERGOMETRINE

- Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Carbamazepine*, Ciclosporin*, Clarithromycin*, Digoxin*: Increased plasma concentration
- Contraceptives, Oral: Contraceptive effect of estrogens possibly reduced (risk probably small)
- Dexamethasone: Possibly inhibits metabolism of dexamethasone
- Efavirenz*, Erythromycin*, Itraconazole*, Ketoconazole*, Tetracycline: Increased risk of ergotism (avoid concomitant use)
- Halothane: Reduced effect of ergometrine on parturient uterus
- Hydrocortisone, Prednisolone: Possibly inhibits metabolism
- Quinidine*: Increased risk of ventricular arrhythmias with parenteral erythromycin
- Ritonavir: Plasma concentration possibly increased by ritonavir
- Valproate: Metabolism of valproate possibly inhibited (increased plasma concentration)
- Verapamil*: Possible inhibition of metabolism of verapamil (increased risk of toxicity)
- Vinblastine*: Increased toxicity of vinblastine (avoid concomitant use)
- Warfarin*: Enhanced anticoagulant effect

ESCITALOPRAM

- Acarbose: May increase the hypoglycemic activities of Acarbose
- Amiodarone: May increase the risk of ventricular arrhythmias-avoid concomitant use
- Aspirin: May increase the antiplatelet activities of Aspirin
- Carbamazepine, Rifampin, Phenytoin: Plasma concentration may decrease
- Chloroquine, Erythromycin, Haloperidol, Quinine: Risk of ventricular arrhythmias
- Fluconazole, Metoprolol, Omeprazole: May increase plasma concentration

ETHINYLESTRADIOL: see Contraceptives, Oral**ETHOSUXIMIDE**

- Amitriptyline*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Carbamazepine: May be enhanced toxicity without corresponding increase in antiepileptic effect; possibly reduced plasma concentration of ethosuximide
- Chloroquine: Possible increased risk of convulsions
- Chlorpromazine*, Clomipramine*, Fluphenazine*, Haloperidol*, Mefloquine*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Isoniazid*: Metabolism of ethosuximide inhibited (increased plasma-ethosuximide concentration and risk of toxicity)
- Phenobarbital: May be enhanced toxicity without corresponding increase in antiepileptic effect; possibly reduced plasma concentration of ethosuximide
- Phenobarbitone: Plasma Concentration possibly reduced

- Phenytoin*: May be enhanced toxicity without corresponding increase in antiepileptic effect; plasma concentration of phenytoin possibly increased; plasma concentration of ethosuximide possibly reduced
- Valproate: May be enhanced toxicity without corresponding increase in antiepileptic effect; possibly increased plasma concentration of ethosuximide

ETOPOSIDE

- Cyclosporin, Ketoconazole: Possibly increased plasma concentration of etoposide (increased risk of toxicity)
- Methotrexate: Intercellular accumulation of Methotrexate.
- Phenobarbital, Phenytoin: Possibly reduced plasma concentration of etoposide
- Vaccine, Live: Avoid use of live vaccines with etoposide (impairment of immune response)
- Warfarin*: Possibly enhanced anticoagulant effect

FENTANYL

- Carbamazepine: possibly accelerates metabolism (reduced effect)
- Clarithromycin: possibly increases plasma concentration
- Fluconazole, Itraconazole, Ketoconazole: possibly increase plasma concentration
- Fluoxetine: Possible increased serotonergic effects
- Midazolam: metabolism of midazolam possibly inhibited by FENTANYL
- Phenytoin: accelerates metabolism of FENTANYL (reduced effect)
- Rifampicin: accelerate metabolism of fentanyl (reduced effect);
- Ritonavir: increase plasma concentration of fentanyl

FERROUS SALTS

- Antacids, Calcium Salts, Ciprofloxacin: Reduced absorption of oral ferrous salts.
- Dimercaprol*: Avoid concomitant use
- Doxycycline: Absorption of oral ferrous salts reduced by doxycycline; absorption of doxycycline reduced by oral ferrous salts
- Levodopa, Levofloxacin, Levothyroxine, Ofloxacin, Penicillamine, Zinc Sulfate: Absorption may be reduced by oral ferrous salts
- Methyldopa: Oral ferrous salts reduce hypotensive effect of methyldopa

FERROUS SULPHATE + FOLIC ACID

- Dimercaprol: Increase the nephrotoxic effect of iron.
- Alendronate: Decrease serum concentration of alendronate.
- Cefdinir: Decrease the serum concentration of Cefdinir.
- Antacids: Decrease the absorption of iron sulphate.
- Tetracycline: decrease the absorption of iron sulphate.
- Levodopa: Ferrous sulphate decreases the serum concentration of Levodopa.
- Levothyroxine: Ferrous sulphate decrease the serum concentration of Levothyroxine.
- Penicillamine: Ferrous sulphate decrease the absorption of penicillamine.

- Ciprofloxacin: Ferrous sulphate decrease the serum concentration of ciprofloxacin .
- Sulfasalazine: Decrease the serum concentration of folic acid.
- Ranitidine: Decrease the absorption of Ferrous sulphate.
- Omeprazole: Decrease the absorption of Ferrous sulphate.
- Phenobarbitone, Phenyton: Folic acid decrease the serum concentration.

FEXOFENADINE

- Antacid: Reduce the absorption of Fexofenadine
- Erythromycin, Ketoconazole: May increase the plasma concentration
- Betahistine, Rifampicin: Effects possibly reduced
- Phenothiazine: May increase arrhythmogenic effect
- Verapamil: Bioavailability may be increased.

FLAVOXATE

- Domperidone, Metoclopramide: May antagonize the GI effects
- Glucagon: Enhance the toxic effect of glucagon.
- Morphine: Increase the risk of constipation and urinary retention with morphine.
- Metoclopramide: Diminish the therapeutic effect of Metoclopramide.
- Nitroglycerine: Decrease the absorption of Nitroglycerine.
- Tiotropium: Enhance the anticholinergic effect of tiotropium.
- Thiazide diuretic: Increase the serum concentration of Thiazide diuretic.
- Secretin: Diminish the therapeutic effect of secretin.

FLUCONAZOLE

- Aminophylline, Carbamazepine, Ciclosporin, Glibenclamide*, Glipizide*, Nevirapine*, Phenytoin*, Rifampicin*: Increases plasma concentration of Aminophylline
- Amphotericin B: Possible antagonism of effect of amphotericin
- Artemether + Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Contraceptives, Oral: Anecdotal reports of failure of estrogen-containing contraceptives
- Hydrochlorothiazide, Ritonavir: Plasma concentration of fluconazole increased
- Saquinavir: Plasma concentration of saquinavir possibly increased
- Tacrolimus: Nephrotoxicity may increase
- Warfarin*: Enhanced anticoagulant effect
- Zidovudine*: Increased plasma concentration of zidovudine (increased risk of toxicity)

FLUCLOXACILLIN

- Aminoglycosides: Decrease the serum concentration of aminoglycosides.
- Cholera vaccine: Diminish the therapeutic effect of Cholera vaccine.
- Methotrexate: Increase the serum concentration of Methotrexate.
- Probenecid, Piperacillin: Increase the serum concentration of flucloxacillin.
- Quinidine: Decrease the serum concentration of Quinidine.
- Tetracycline: Diminish the therapeutic effect of flucloxacillin.

- Warfarin: Diminish the anticoagulant effect of Warfarin.

FLUCYTOSINE

- Amphotericin B: Renal excretion of flucytosine decreased and cellular uptake increased (flucytosine toxicity possibly increased)
- Cytarabine: Plasma-flucytosine concentration possibly reduced
- Folates: toxicity of fluorouracil increased (avoid concomitant use)
- Metronidazole: Metabolism of fluorouracil inhibited (increased toxicity)
- Phenytoin: Metabolism of phenytoin possibly inhibited (increased risk of toxicity)
- Vaccine, Live: Avoid use of live vaccines with fluorouracil (impairment of immune response)
- Warfarin*: Anticoagulant effect possibly enhanced

FLUPHENAZINE

- Acetazolamide, Amiloride: Enhanced hypotensive effect
- Alcohol: Enhanced sedative effect
- Amitriptyline*: Increased risk of antimuscarinic adverse effects; increased plasma-amitriptyline concentration; possibly increased risk of ventricular arrhythmias
- Amlodipine, Atenolol: Enhanced hypotensive effect
- Antacids: Reduced absorption of fluphenazine
- Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Atropine: Increased antimuscarinic adverse effects (but reduced plasma-fluphenazine concentration)
- Carbamazepine*, Ethosuximide*, Phenobarbital*, Phenytoin*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Chloroquine: Increase the concentration of fluphenazine
- Clomipramine*: Increased antimuscarinic adverse effects; increased plasma-clomipramine concentration; possibly increased risk of ventricular arrhythmias
- Codeine, Methadone, Morphine: Enhanced sedative and hypotensive effect
- Diazepam: Enhanced sedative effect
- Dopamine, Ephedrine, Epinephrine: Antagonism of hypertensive effect
- Enalapril, Furosemide, Gluceryl trinitrate, Propranolol, Sodium nitroprusside, Spironolactone, Thiopental*, Timolol, Verapamil : Enhanced hypotensive effect
- Glibenclamide: Possible antagonism of hypoglycaemic effect
- Halothane*, Hydralazine, Hydrochlorothiazide, Isosorbide dinitrate, Ketamine*, Nifedipine, Nitrous oxide*: Enhanced hypotensive effect
- Levodopa: Antagonism of effects of levodopa
- Lithium: Increased risk of extrapyramidal effects and possibility of neurotoxicity
- Methyldopa: Enhanced hypotensive effect; increased risk of extrapyramidal effects
- Metoclopramide: Increased risk of extrapyramidal effects
- Procainamide*, Quinidine*: Increased risk of ventricular arrhythmias
- Ritonavir*: Plasma concentration possibly increased by ritonavir

- Valproate*: Antagonism of anticonvulsant effect (convulsive threshold lowered)

FLUOXETINE

- Clarithromycin, Mifepristone: Enhance the QTc prolonging effect of fluoxetine.
- Codeine: Diminish the therapeutic effect codeine.
- Cimetidine: Decrease the metabolism of fluoxetine.
- Dapoxetine: Enhance the toxic effect of fluoxetine.
- Doxorubicin: Increase the serum concentration of Doxorubicin.
- Ethanol: Enhance risk of psychomotor impairment.
- Haloperidol: Increase the serum concentration of Haloperidol.
- Metoprolol: Increase the serum concentration of Metoprolol.
- NSAID: Diminish the therapeutic effect of fluoxetine.
- Tryptophan: Enhance the serotonergic effect of fluoxetine.

FOLIC ACID

- Antacids, Sulfasalazine: Reduced absorption of folic acid
- Capecitabine*, Fluorouracil*: Toxicity increased (avoid concomitant use)
- Phenobarbital, Phenytoin: Plasma concentration possibly reduced

FUROSEMIDE

- Acetazolamide, Amphotericin B: Increased risk of hypokalaemia
- Alcohol, Amlodipine, Atenolol, Chlorpromazine, Diazepam, Enalapril*, Fluphenazine: Enhanced hypotensive effect.
- Amikacin*: Increased risk of ototoxicity
- Amitriptyline, Clomipramine: Increased risk of postural hypotension
- Carbamazepine: Increased risk of hyponatraemia
- Cephalexin: Nephrotoxicity may occur
- Cisplatin: Increased risk of nephrotoxicity and ototoxicity
- Clofibrate: Protein binding may be altered in hypoalbuminemia patients receiving furosemide, potentially increasing toxicity
- Contraceptives, Oral: Antagonism of diuretic effect by estrogens
- Dexamethasone, Hydrocortisone, Prednisolone: Antagonism of diuretic effect; increased risk of hypokalaemia
- Digoxin*: Hypokalaemia caused by furosemide increases cardiac toxicity of digoxin
- Gentamicin*: Increased risk of ototoxicity
- Glibenclamide, Metformin: Antagonism of hypoglycaemic effect
- Glycerol trinitrate, Halothane, Hydralazine, Isosorbide dinitrate, Ketamine, Levodopa, Methyl dopa, Nifedipine, Nitrous oxide, Propranolol, Sodium nitroprusside, Thiopental, Timolol, Verapamil: Enhanced hypotensive effect
- Hydrochlorothiazide: Increased risk of hypokalaemia
- Ibuprofen: Risk of nephrotoxicity of ibuprofen increased; antagonism of diuretic effect
- Indomethacin (and other NSAIDs): may reduce natriuretic and hypotensive effects of furosemide
- Insulins: Antagonism of hypoglycaemic effect
- Lidocaine*: Action of lidocaine antagonized by hypokalaemia caused by

furosemide (interaction less likely when lidocaine used topically)

- Lithium*: Reduced lithium excretion (increased plasma-lithium concentration and risk of toxicity); furosemide safer than hydrochlorothiazide
- Phenobarbital, Phenytoin: May reduce diuretic response to furosemide.
- Quinidine*: Cardiac toxicity of quinidine increased by hypokalaemia caused by furosemide
- Salbutamol: Increased risk of hypokalaemia with high doses of salbutamol
- Streptomycin*, Vancomycin*: Increased risk of ototoxicity
- Tubocurarine: The skeletal muscle relaxing effect may be attenuated

GABAPENTINE

- Amitriptyline: Antagonize anticonvulsant effect of gabapentin
- Antacids: Reduce the absorption of gabapentin.
- Cimetidine: Increase the serum concentration of gabapentin.
- Ethanol: Enhance the CNS depressant effect of ethanol.
- Magnesium salt: Enhance the CNS depressant effect of gabapentine.
- Morphine: Increase the bioavailability of gabapentin.
- Mefloquine: Antagonize anticonvulsant effect of gabapentin.

GENTAMICIN

- Alcuronium*: Enhanced muscle relaxant effect
- Amphotericin B, Ciclosporin*: Increased risk of nephrotoxicity
- Capreomycin, Cisplatin*, Vancomycin: Increased risk of nephrotoxicity and ototoxicity
- Digoxin: Possibly increased plasma concentration of digoxin
- Furosemide*: Increased risk of ototoxicity
- Indometacin: Plasma concentration possibly increased in neonates.
- Neostigmine*, Pyridostigmine*: Antagonism of effect
- Suxamethonium*, Vecuronium*: Enhanced muscle relaxant effect

GLIBENCLAMIDE

- Alcohol, Chloramphenicol*, Ciprofloxacin, Enalapril, Fluconazole*: Enhanced hypoglycemic effect
- Atenolol, Propanolol, Timolol: Atenolol may mask warning signs of hypoglycaemia such as tremor
- Chlorpromazine, Dexamethasone, Fluphenazine, Furosemide, Hydrochlorothiazide, Hydrocortisone, Levonorgestrel, Medroxyprogesterone, Norethisterone, Prednisolone : Possible antagonism of hypoglycaemic effect
- Contraceptives, Oral: Antagonism of hypoglycaemic effect by estrogens and progestogens
- Ibuprofen*: Possibly enhanced effect of glibenclamide
- Levonorgestrel: Antagonism of hypoglycaemic effect
- Norfloxacin: Effect possibly enhanced
- Rifampicin*: Possibly accelerated metabolism (reduced effect) of glibenclamide
- Silver sulfadiazine, Suladiazine, Sulfadoxine +Pyrimethamine, Sulfamethoxazole +Trimethoprim, Trimethoprim: Effect of glibenclamide rarely enhanced

- Testosterone: Hypoglycaemic effect possibly enhanced
- Warfarin*: Possibly enhanced hypoglycaemic effects and changes to anticoagulant effect

GLYCERYL TRINITRATE

- Acetazolamide, Alcohol, Amiloride, Amlodipine, Atenolol, Chlorpromazine, Diazepam, Enalapril, Fluphenazine, Furosemide, Halothane, Hydralazine, Hydrochlorothiazide, Ketamine, Levodopa, Methyl dopa, Nifedipine, Nitrous oxide, Propranolol, Sodium nitroprusside, Spironolactone, Thiopental, Timolol, Verapamil: Enhanced hypotensive effect
- Amitriptyline: Reduced effect of sublingual glyceryl trinitrate tablets (failure to dissolve under the tongue owing to dry mouth)
- Atropine, Biperiden, Clomipramine: Possibly reduced effect of sublingual glyceryl trinitrate tablets (failure to dissolve under the tongue owing to dry mouth)
- Contraceptives, Oral, Dexamethasone, Hydrocortisone, Ibuprofen, Prednisolone: Antagonism of hypotensive effect
- Heparin*: Anticoagulant effects reduced by infusion of glyceryl trinitrate

GRAPEFRUIT JUICE

- Artemether +Lumefantrine: Metabolism of artemether and lumefantrine may be inhibited (manufacturer advises to avoid)
- Ciclosporin*, Efavirenz, Nifedipine, Verapamil: Increased plasma concentration (risk of toxicity)

GRANISETRON HYDROCHLORIDE

- Apomorphine: Increase hypotensive effect of apomorphine.
- Paracetamol: Decrease the analgesic effect of paracetamol.
- Bleomycin: Increase the cytotoxic effects of bleomycin.
- Rifampicin: Reduce granisetron levels.
- Tramadol: Decrease the analgesic effect of Tramadol.
- Amitriptyline: Enhance the serotonergic effect of Amitriptyline.

GRISEOFULVIN

- Alcohol: Possibly enhanced effects of alcohol
- Ciclosporin: Plasma-ciclosporin concentration possibly reduced
- Contraceptives*, Oral: Accelerated metabolism of estrogens and progestogens (reduced contraceptive effect)
- Levonorgestrel*, Norethisterone*: Accelerated metabolism of levonorgestrel (reduced contraceptive effect)
- Medroxyprogesterone*: Accelerated metabolism of medroxyprogesterone (does not apply to injectable medroxyprogesterone acetate for contraception)
- Phenobarbital: Reduction in absorption of griseofulvin (reduced effect)
- Warfarin*: Reduced anticoagulant effect

HALOPERIDOL

- Alcohol: Enhanced sedative effect
- Amitriptyline*, Clomipramine*: Increased plasma-amitriptyline

- concentration; possibly increased risk of ventricular arrhythmias
- Amlodipine, Enalapril, Halothane*, Ketamine*, Nifedipine, Nitrous oxide*, Thiopental*, Verapamil, Enhanced hypotensive effect
 - Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
 - Atropine, Biperiden: Possibly reduced effects of haloperidol
 - Carbamazepine*, Ethosuximide*: Antagonism of anticonvulsant effect (convulsive threshold lowered); metabolism of haloperidol accelerated (reduced plasma concentration)
 - Chloroquine: may increase haloperidol concentration
 - Codeine, Methadone, Morphine: Enhanced sedative and hypotensive effect
 - Diazepam: Enhanced sedative effect
 - Dopamine, Ephedrine, Epinephrine: Antagonism of hypertensive effect
 - Fluoxetine: May inhibit the metabolism of haloperidol
 - Indometacin: Possible severe drowsiness
 - Levodopa: Antagonism of effects of levodopa
 - Lithium: Increased risk of extrapyramidal effects and possibility of neurotoxicity
 - Methyldopa: Enhanced hypotensive effect; increased risk of extrapyramidal effects
 - Metoclopramide: Increased risk of extrapyramidal effects
 - Phenobarbital*, Phenytoin*: Antagonism of anticonvulsant effect (convulsive threshold lowered); metabolism of haloperidol accelerated (reduced plasma concentration)
 - Procainamide*, Quinidine*: Increased risk of ventricular arrhythmias
 - Propranolol: May increase haloperidol concentrations.
 - Rifampicin*: Accelerated metabolism of haloperidol (reduced plasmahaloperidol concentration)
 - Ritonavir*: Plasma concentration possibly increased by ritonavir
 - Valproate*: Antagonism of anticonvulsant effect (convulsive threshold lowered)

HALOTHANE

- Acetazolamide, Amiloride, Amlodipine, Atenolol, *Chlorpromazine, Enalapril, *Fluphenazine, Furosemide, Glyceril trinitrate, *Haloperidol, Hydralazine, Hydrochlorothiazide, Isosorbide dinitrate, Methyldopa, Nifedipine, Propranolol, Spironolactone, Timolol: Enhanced hypotensive effect
- Alcuronium: Effects of alcuronium enhanced
- Amitriptyline, Clomipramine: Increased risk of arrhythmias and hypotension
- Diazepam: Enhanced sedative effect
- Epinephrine*, Levodopa*: Risk of arrhythmias
- Ergometrine: Reduced effect of ergometrine on parturient uterus
- Isoniazid: Possible potentiation of isoniazid hepatotoxicity
- Oxytocin: Oxytocic effect possibly reduced; enhanced hypotensive effect and risk of arrhythmias
- Suxamethonium: Enhanced effects of suxamethonium
- Vancomycin: Hypersensitivity-like reactions can occur with concomitant intravenous vancomycin
- Vecuronium: Enhanced effects of vecuronium

- Verapamil*: Enhanced hypotensive effect and AV delay

HEPARIN

- Aspirin*, Glyceryl trinitrate*: Enhanced anticoagulant effect of heparin
- Cephalosporin (Cefaclor, Cefuroxime), Digoxin, Ibuprofen, Increased risk of haemorrhage.
- Diclofenac*, Ibuprofen, Ketorolac: Increased risk of haemorrhage (avoid concomitant use)
- Digoxin, Quinine, Tetracycline: Increased risk of haemorrhage
- Enalapril, Losartan: Increased risk of hyperkalaemia

HEPATITIS B VACCINE

- Aminophylline: Increase the risk of hypokalaemia with Aminophylline.
- Amphotericin: increase the risk of hypokalaemia with Amphotericin.
- Antacid: Decrease the bioavailability of corticosteroids.
- Ciclosporin: Increases the plasma concentration of Ciclosporin.
- Carbamazepine: Decreased the serum concentration of methylprednisolone.
- Clarithromycin, Diltiazem, : Increase plasma concentration of methylprednisolone .
- Diuretics: Antagonise the diuretic effect of diuretics.
- Erythromycin, Ketoconazole, : Inhibit the metabolism of methylprednisolone.
- Methyl dopa: Antagonise hypotensive effect of methyl dopa.
- Mifepristone: Diminish the therapeutic effect of corticosteroids.
- Nitrates: Antagonise hypotensive effect of nitrates.
- NSAIDs: Increase the risk of gastro-intestinal bleeding and ulceration with NSAID.
- Oestrogens: Increase the plasma concentration of corticosteroids.
- Pancuronium: Antagonise the effects of pancuronium.
- Progesterin: Increase the plasma concentration of methylprednisolone and corticosteroids.
- Warfarin: Enhance the anticoagulant effect of warfarin.
- Antacids: Absorption of moxifloxacin, norfloxacin ciprofloxacin, levofloxacin and ofloxacin reduced by antacids.
- Amiodarone: Increased risk of ventricular arrhythmias when moxifloxacin given with Amiodarone.
- Sotalol: Increased risk of ventricular arrhythmias when moxifloxacin given with sotalol.
- Sucralfate: Absorption of moxifloxacin, ciprofloxacin, levofloxacin and ofloxacin reduced by Sucralfate.
- Zinc: Absorption of moxifloxacin, ciprofloxacin, levofloxacin, and ofloxacin reduced by zinc.
- Didanosine, Iron salts, Aspirin: Decreased the serum concentration of moxifloxacin.
- Corticosteroid: Risk of tendonitis and tendon rupture is increased.
- Warfarin: Enhance the anticoagulant effect of warfarin.
- Insulin: Enhance the hypoglycemic effect of insulin.
- Amiodarone : Increased risk of arrhythmia if amiodarone is used with gatifloxacin or moxifloxacin.

MUMPS VIRUS

- Hydrocortisone: Increased risk of disseminated infection due to enhanced replication of vaccine virus or bacteria in the presence of diminished immune competence.
- Doxorubicin, Cisplatin, Cyclosporin: Increased risk for developing an infection from the vaccine or a reduced response

NAPROXEN

- Methotrexate: Excretion of naproxen reduced
- Dabigatran: Increase the risk of bleeding
- Dalteparin, Enoxaparin: Risk of developing an epidural or spinal hematoma

NELFINAVIR

- Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Carbamazepine, Phenobarbital*: Possibly reduced plasma nelfinavir concentration
- Cyclosporin*: Possibly increased plasma ciclosporin concentration
- Contraceptives, Oral*: Accelerated metabolism of estrogens (reduced contraceptive effect); nelfinavir possibly reduces contraceptive effect of progestogens
- Indinavir, Ritonavir: Combination may lead to increased plasma concentration of either drug (or both)
- Levonorgestrel: Contraceptive effect of levonorgestrel possibly reduced
- Lopinavir: Plasma concentration of lopinavir reduced; plasma concentration of active metabolite of nelfinavir increased
- Methadone: Reduced plasma concentration of methadone
- Norethisterone*: Possibly reduced contraceptive effect
- Phenytoin: Reduced plasma-phenytoin concentration
- Quinidine*: Increased risk of ventricular arrhythmias (avoid concomitant use)
- Rifampicin*: Plasma concentration of nelfinavir significantly reduced (avoid concomitant use)

NEOSTIGMINE

- Alcuronium: Antagonism of muscle relaxant effect
- Amikacin*, Atropine, Biperiden, Clindamycin, Gentamicin*, Lithium, Procainamide, Propranolol, Quinidine, Streptomycin*: Antagonism of effect of neostigmine
- Chloroquine: Chloroquine has potential to increase symptoms of myasthenia gravis and thus diminish effect of neostigmine
- Suxamethonium: Effect of suxamethonium enhanced
- Vecuronium: Antagonism of muscle relaxant effect

NEVIRAPINE

- Contraceptives, Oral*: Accelerated metabolism of estrogens and progestogens (reduced contraceptive effect)
- Efavirenz: Plasma-efavirenz concentration reduced
- Fluconazole*: Increased plasma concentration of nevirapine

- Indinavir: Nevirapine reduces plasma concentration of indinavir
- Levonorgestrel*: Accelerated metabolism of levonorgestrel (reduced contraceptive effect)
- Lopinavir: Plasma concentration of lopinavir possibly reduced
- Medroxyprogesterone*: Accelerated metabolism of medroxy-progesterone (does not apply to injectable medroxyprogesterone acetate for contraception)
- Methadone: Possibly reduced plasma concentration of methadone
- Norethisterone*: Accelerated metabolism of norethisterone (reduced contraceptive effect)
- Rifampicin*: Reduced plasma concentration of nevirapine (avoid concomitant use)
- Saquinavir: Plasma concentration of saquinavir reduced
- Warfarin*: Enhanced or reduced anticoagulant effect

NIFEDIPINE

- Acetazolamide, Alcohol, Alcuronium, Amiloride, Chlorpromazine, Diazepam, Enalapril, Fluphenazine, Furosemide, Glyceryl trinitrate, Haloperidol, Halothane, Hydralazine, Hydrochlorothiazide, Isosorbide dinitrate, Ketamine, Levodopa, Methyldopa, Nitrous oxide, Sodium nitroprusside, Spironolactone, Thiopental: Enhanced hypotensive effect
- Atenolol*, Propranolol*, Timolol*: Enhanced hypotensive effect. Possibly severe hypotension and heart failure
- Carbamazepine: Probably reduced effect of nifedipine
- Cyclosporin: Possibly increased plasma nifedipine concentration (increased risk of adverse effects such as gingival hyperplasia)
- Contraceptives, Oral, Dexamethasone, Hydrocortisone, Ibuprofen, Prednisolone: Antagonism of hypotensive effect
- Digoxin*: Possibly increased plasma concentration of digoxin
- Grapefruit juice: Increased plasma-nifedipine concentration
- Insulins: Occasionally impaired glucose tolerance
- Magnesium (parenteral)*: Profound hypotension reported with nifedipine and intravenous magnesium sulfate in preeclampsia
- Mefloquine: Possibly increased risk of bradycardia
- Phenobarbital*, Phenytoin*: Probably reduced effect of nifedipine
- Quinidine: Reduced plasma-quinidine concentration
- Ritonavir*: Plasma concentration possibly increased by ritonavir
- Rifampicin*: Accelerated metabolism of nifedipine (plasma concentration significantly reduced)
- Vecuronium: Enhanced muscle relaxant effect
- Vincristine: Possibly reduced metabolism of vincristine

NITROUS OXIDE

- Acetazolamide, Amiloride, Amlodipine, Atenolol, Chlorpromazine*, Enalapril, Fluphenazine*, Furosemide, Glyceryl trinitrate, Haloperidol*, Hydralazine, Hydrochlorothiazide, Isosorbide dinitrate, Methyldopa, Nifedipine, Propranolol, Sodium nitroprusside, Spironolactone, Timolol: Enhanced hypotensive effect
- Amitriptyline, Clomipramine: Increased risk of arrhythmias and hypotension

- Diazepam: Enhanced sedative effect
- Isoniazid: Possible potentiation of isoniazid hepatotoxicity
- Methotrexate*: Increased antifolate effect (avoid concomitant use)
- Vancomycin: Hypersensitivity-like reactions can occur with concomitant intravenous vancomycin
- Verapamil*: Enhanced hypotensive effect and AV delay

NORETHISTERONE: *See also* Contraceptives, Oral

- Atorvastatin, Rosuvastatin: Increases plasma concentration
- Carbamazepine*, Griseofulvin*, Nevirapine*, Phenobarbital*, Phenytoin*, Rifampicin*,
- Cyclosporin*: Inhibition of Cyclosporin metabolism (increased plasma-Cyclosporin concentration)
- Glibenclamide, Insulins, Nelfinavir, Metformin: Antagonism of hypoglycemic effect
- Warfarin*: Antagonism of anticoagulant effect

OFLOXACIN

- Antacids (Aluminium hydroxide; Magnesium hydroxide), Sucralfate, Iron salts: Reduced absorption of ofloxacin
- Cyclosporin*: Increased risk of nephrotoxicity
- Contraceptives, Oral: Contraceptive effect of estrogens reduced (risk probably small)
- Ferrous salts: Absorption of ofloxacin reduced by oral ferrous salts
- Warfarin*: Enhanced anticoagulant effect
- Zinc sulfate: Reduced absorption of ofloxacin

OLANZAPINE

- Fentanyl*, Buprenorphine, coedine: result in profound sedation, respiratory depression, coma, and death.
- Clozapine: Reduces blood pressure

OMEPRAZOLE

- Phenytoin: Effects are enhanced
- Clarithromycin, Squinavir, Digoxin, Cilostazol: Plasma concentration increased
- Escitalopram: Increases plasma concentration
- Clozapine: Reduces the plasma concentration
- Methotrexate: Reduces the excretion

OSELTAMVIR

- Entecavir: Increase the concentration of both oseltamvir and entecavir
- Influenza virus vaccine, live, trivalent: Can interfere with the immune response to this vaccine
- Methotrexate: Increase the concentration of methotrexate and its toxicity

OXYGEN

- Bleomycin*: Serious pulmonary toxicity in patients exposed to conventional oxygen concentrations during anesthesia

OXYMETAZOLINE

- Guanaethidine: Antagonizes the hypotensive effect of oxymetazoline

OXYTOCIN

- Epinephrine, Ephedrine: Risk of hypertension due to enhanced vasopressor effect of ephedrine
- Halothane: Oxytocic effect reduced; enhanced hypotensive effect and risk of arrhythmias
- Prostaglandins: Enhances uterogenic actions

PANTOPRAZOLE

- Warfarin: Enhanced anticoagulant effect
- Saquinavir: Increases the plasma concentration

PARA AMINO SALICYCLIC ACID (PAS)

- Diclorphenamide: Increases the concentration of PAS
- Benazepril: Decreases the effect of benazepril
- Captopril, Enalapril: Increases the nephrotoxicity
- Dapsone: Increases the toxicity of dapsone

PARACETAMOL

- Metoclopramide: Increased absorption of paracetamol
- Warfarin: Prolonged regular use of paracetamol enhances anticoagulant effect

PENICILLAMINE

- Antacids (Aluminum hydroxide; Magnesium hydroxide): Reduced absorption of penicillamine
- Digoxin: Plasma concentration of digoxin reduced
- Ferrous salts: Oral ferrous salts reduce absorption of penicillamine
- Zinc sulfate, Iron salts: Absorption of penicillamine reduced
- Clozapine: Increased risk of agranulocytosis
- NSAIDs: Increased risk of nephrotoxicity

PENTAMIDINE

- Amphotericin B: Increased risk of nephrotoxicity
- Amiodarone, Disopyramide, Erythromycin, Citalopram, Escitalopram: Increased risk of ventricular arrhythmias

PETHIDINE

- Fosphenytoin: Increase the risk of toxicity
- Moclobemide: Can cause CNS excitation or depression
- Rifampicin: Increased metabolism
- Fluoxetine, Fluvoxamine, Paroxetine, Duloxetine: Increased serotonergic effect
- Ritonavir: Decreased plasma concentration

PHENOBARBITAL

- Acetazolamide: Increased risk of osteomalacia

- Valproate, Alcohol, Phenytoin: Enhanced sedative effect
- *Chlorpromazine, *Clomipramine, *Amitriptyline: Antagonism of anticonvulsant effect
- Carbamazepine*: Increased toxicity without corresponding increase in antiepileptic effect; plasma concentration of carbamazepine reduced
- Chloramphenicol*, Contraceptives*, Oral, Levonorgestrel*, Norethisterone*, Medroxyprogesterone*, Hydrocortisone*, Prednisolone*, Dexamethasone*, Warfarin*, Doxycycline, Quinidine, Levothyroxine, Metronidazole, Cyclosporin: Metabolism accelerated
- Cyclosporin*: Reduced effect of ciclosporin
- Fluphenazine*, Haloperidol*: Antagonism of anticonvulsant effect
- Griseofulvin, Mebendazole: Reduced plasma concentration

PHENOXYMETHYLPENICILLIN

- Methotrexate: Reduced excretion of methotrexate (increased risk of toxicity)

PHENYTOIN

- Acetazolamide: Increased risk of osteomalacia
- Acetylsalicylic acid: Enhancement of effect of phenytoin
- Alcuronium: Antagonism of muscle relaxant effect (accelerated recovery from neuromuscular blockade)
- Chloramphenicol*: Plasma-phenytoin concentration increased (increased risk of toxicity)
- Chlorpromazine*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Cyclosporin*, Contraceptives Oral*, Dexamethasone*, Levonorgestrel*, Norethisterone*, Levothyroxine, Hydrocortisone*, Warfarin*, Prednisolone*, Quinidine*, Rifampicin*, Methadone: Accelerated metabolism
- Ciprofloxacin: Plasma-phenytoin concentration can be increased or decreased by ciprofloxacin
- Cisplatin, Nelfinavir, Alcohol, Carbamazepine*, Antacids (Aluminum hydroxide; Magnesium hydroxide), Methotrexate, Cytarabine, Lopinavir: Reduced absorption of phenytoin
- Pyrimethamine*, Amitriptyline*, Clomipramine*: Antagonism of anticonvulsant effect (convulsive threshold lowered); possibly reduced plasma-clomipramine concentration
- Doxycycline: Increased metabolism of doxycycline (reduced plasma concentration)
- Fluconazole*: Plasma concentration of phenytoin increased (consider reducing dose of phenytoin)
- Mefloquine*, Haloperidol*, Fluphenazine*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Metronidazole*, Isoniazid*: Metabolism of phenytoin inhibited (enhanced effect)
- Lithium: Neurotoxicity may occur without increased plasma-lithium concentration
- Mebendazole: Reduced plasma-mebendazole concentration (possibly increase mebendazole dose for tissue infections)

- Phenobarbital: May be enhanced toxicity without corresponding increase in antiepileptic effect; plasma concentration of phenytoin often lowered but may be raised; plasma concentration of phenobarbital often raised
- Procarbazine, Praziquantel, Verapamil: Reduced concentration
- Sulfamethoxazole +Trimethoprim*, Trimethoprim*: Antifolate effect and plasma-phenytoin concentration increased
- Vaccine, Influenza: Enhanced effect of phenytoin
- Vecuronium: Antagonism of muscle relaxant effect (accelerated recovery from neuromuscular blockade)
- Zidovudine: Plasma-phenytoin concentration increased or decreased by zidovudine

PHYTOMENADIONE

- Warfarin*: Antagonism of anticoagulant effect by phytomenadione

PILOCARPINE

- Propranolol, Atenolol, Timolol: Increased risk of arrhythmias
- Biperiden, Atropine: Antagonism of effects of pilocarpine

POLIOMYELITIS, ORAL VACCINE: *See Vaccine, live*

POTASSIUM CHLORIDE: *See Potassium salts*

POTASSIUM FERRIC HEXACYANOFERRATE

- There are no known significant interactions
- Tetracycline: Decreased bioavailability of tetracycline

POTASSIUM SALTS

- Amiloride*, Cyclosporin*, Enalapril*, Spironolactone*, Captopril, Losartan: Increased risk of hyperkalaemia

POVIDONE IODINE

- Amlodipine: Enhanced hypotensive effect
- Hydrogen peroxide, Silver: reacts to form inactive compounds

PRALIDOXIME CHLORIDE

- Atropine: Increase the action of atropine

PRAZIQUANTEL

- Albendazole: Increased plasma concentration of active metabolite of albendazole
- Phenytoin, Dexamethasone, Chloroquine, Carbamazepine: Plasma-praziquantel concentration reduced

PREDINOSOLONE

- Salbutamol, Hydrochlorothiazide, Furosemide, Digoxin, Amphotericin B*, Acetazolamide, Spironolactone, Amiloride: Increased risk of hypokalaemia; antagonism of diuretic effect
- Ibuprofen, Aspirin: Increased risk of gastrointestinal bleeding and

- ulceration; prednisolone reduces plasma salicylate concentration
- Calcium salts: Reduced absorption of calcium salts
- Contraceptives, Oral, Ciclosporin: Increased plasma concentration of prednisolone
- Metformin, Glibenclamide, Insulins: Antagonism of hypoglycaemic effect
- Hydralazine, Glyceryl trinitrate, Enalapril, Atenolol, Amlodipine, Verapamil, Nifedipine, Sodium nitroprusside,
- Propranolol, Methyldopa, Isosorbide dinitrate: Antagonism of hypotensive effect
- Methotrexate*: Increased risk of haematological toxicity
- Carbamazepine*, Rifampicin*, Phenytoin*, Phenobarbital*: Metabolism of prednisolone accelerated (reduced effect)
- Vaccine, Influenza Vaccine*, Live: High doses of prednisolone impair immune response; avoid use of live vaccines

PRIMAQUINE

- Artemether*+Lumefantrine: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Mepacrine: increases the concentration of primaquine

PROCAINAMIDE

- Alcuronium*: Enhanced muscle relaxant effect
- Artemether +Lumefantrine*, Amitriptyline*, Lidocaine*: Increased risk of ventricular arrhythmias
- Quinidine*, Propranolol*, Timolol* Atenolol*, Bupivacaine: Increased myocardial depression
- Haloperidol*, Fluphenazine*, Clomipramine*, Chlorpromazine*: Increased risk of ventricular arrhythmias
- Neostigmine: Antagonism of effect of neostigmine
- Pyridostigmine: Antagonism of effect of pyridostigmine
- Trimethoprim, Sulfamethoxazole +Trimethoprim: Increased plasma-procainamide concentration
- Vecuronium*, Suxamethonium* (Succinyl-choline): Enhanced muscle relaxant effect

PROCAINE BENZYL PENICILLIN *see* Benzylpenicillin

PROCAINE PENICILLIN

- Probenecid: prolongs the half-life of benzylpenicillin by competing with it for renal tubular secretion and may be used therapeutically for this purpose.
- Chloramphenicol and tetracyclines:
- Ampicillin: Prolonged bleeding time after oral treatment
- Methotrexate: Increase the action of methotrexate

PROCARBAZINE

- Alcohol: Disulfiram-like reaction
- Phenytoin: Reduced absorption of phenytoin
- Vaccine, Live: Avoid use of live vaccines with procarbazine (impairment of immune response)

PROGUANIL

- Artemether +Lumefantrin*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Pyrimethamine: Increased antifolate effect
- Warfarin: Isolated reports of enhanced anticoagulant effect

PROPOFOL

- Suxamethonium (Succinyl-choline): Increased risk of myocardial depression and bradycardia
- Selegiline: Can cause hypotension or hypertension
- Baclofen: Increase the risk of seizures and cardiovascular disturbances, and prolong the duration of anesthesia.

PROMETHAZINE

- Diazepam, Alcohol: Increased sedative effect
- Clomipramine, Biperiden, Atropine, Amitriptyline: Increased antimuscarinic and sedative effects

PROPRANOLOL

- Methyldopa, Nifedipine*, Thiopental, Sodium nitroprusside, Spironolactone, Nitrous oxide, Levodopa, Ketamine, Isosorbide dinitrate, Hydrochlorothiazide, Hydralazine, Halothane, Glyceryl trinitrate, Furosemide, Fluphenazine, Enalapril, Diazepam, Amlodipine, Amiloride, Alcohol, Acetazolamide: Enhanced hypotensive effect
- Alcuronium: Enhanced muscle relaxant effect
- Bupivacaine*: Increased risk of bupivacaine toxicity
- Chlorpromazine*: Concomitant administration may increase plasma concentration of both drugs; enhanced hypotensive effect
- Contraceptives, Oral: Antagonism of hypotensive effect by estrogens
- Hydrocortisone, Ibuprofen, Dexamethasone: Antagonism of hypotensive effect
- Digoxin: Increased risk of AV block and bradycardia
- Epinephrine*: Severe hypertension
- Metformin, Glibenclamide: Propranolol may mask warning signs of hypoglycaemia such as tremor
- Insulins: Enhanced hypoglycaemic effect; propranolol may mask warning signs of hypoglycaemia such as tremor
- Quinidine*, Procainamide*, Lidocaine*: Increased myocardial depression; increased risk of lidocaine toxicity (interaction less likely when lidocaine used topically)
- Mefloquine: Increased risk of bradycardia
- Neostigmine: Antagonism of effect of neostigmine
- Pilocarpine: Increased risk of arrhythmias
- Prednisolone: Antagonism of hypotensive effect
- Pyridostigmine: Antagonism of effect of pyridostigmine
- Rifampicin: Metabolism of propranolol accelerated
- Vecuronium, Suxamethonium (Succinyl-choline): Enhanced muscle relaxant effect
- Verapamil*: Asystole, severe hypotension and heart failure

PYRIDOSTIGMINE

- Suxamethonium (Succinyl-choline), Vecuronium, Alcuronium: Antagonism of muscle relaxant effect
- Streptomycin*, Quinidine, Propranolol, Procainamide, Lithium, Gentamicin*, Clindamycin, Biperiden, Atropine,
- Amikacin*: Antagonism of effect of pyridostigmine
- Chloroquine: Chloroquine has potential to increase symptoms of myasthenia gravis and thus diminish effect of pyridostigmine

PYRIDOXINE

- Levodopa: Antagonism of levodopa unless carbidopa also given

PYRIMETHAMINE

- Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Phenytoin*, Methotrexate*, Proguanil, Silver sulfadiazine*, Sulfamethoxazole +Trimethoprim*, Zidovudine,
- Trimethoprim*: Increased antifolate effect

PYRIMETHAMINE + SULFADOXINE: see Sulfadoxine + Pyrimethamine

QUINIDINE

- Hydrochlorothiazide*, Furosemide*, Acetazolamide*: Cardiac toxicity of quinidine increased if hypokalaemia occurs; acetazolamide possibly reduces excretion of quinidine (increased plasma concentration)
- Antacids (Aluminium hydroxide; Magnesium hydroxide): Reduced quinidine excretion in alkaline urine (plasma-quinidine concentration occasionally increased)
- Bupivacaine, *Atenolol: Increased myocardial depression
- Artemether +Lumefantrine*, Nelfinavir*, Mefloquine*, Amitriptyline*, Haloperidol*, Ritonavir*, Fluphenazine*, Erythromycin*, Clomipramine*, Chloroquine, Chlorpromazine*: Increased risk of ventricular arrhythmias
- Digoxin*: Plasma concentration of digoxin increased (halve dose of digoxin)
- Lidocaine*: Increased myocardial depression (interaction less likely when lidocaine used topically)
- Neostigmine: Antagonism of effect of neostigmine
- Nifedipine: Reduced plasma-quinidine concentration
- Rifampicin*, Phenytoin*, Phenobarbital: Metabolism accelerated
- Propranolol*, Procainamide*: Increased myocardial depression
- Pyridostigmine: Antagonism of effect of pyridostigmine
- Alcuronium*, *Vecuronium, *Suxamethonium(Succinyl-choline) : Enhanced muscle relaxant effect
- Timolol*: Increased myocardial depression
- Verapamil*: Increased plasma-quinidine concentration (extreme hypotension may occur)
- Warfarin*: Anticoagulant effect may be enhanced

QUININE

- Artemether +Lumefantrine*: Risk of ventricular arrhythmias (manufacturer

of artemether with lumefantrine advises avoid concomitant use)

- Chloroquine, Moxifloxacin, Haloperidol, Droperidol: Increased risk of ventricular arrhythmias
- Digoxin*: Plasma concentration of digoxin increased
- Mefloquine*: Increased risk of convulsions, but should not prevent the use of intravenous quinine in severe cases
-

RABIES VACCINE

- Hydrocortisone, Methylprednisolone, Triamcinolone, Betamethasone, Dexamethasone: Associated with a diminished or suboptimal immunologic response due to antibody inhibition
- Chloroquine: Reduces the antibody response to primary immunization with intradermally administered rabies vaccine.

RANITIDINE

- Tolazoline: Antagonizes the effect of ranitidine
- Posaconazole, Azatanavir: Reduces the concentration
- Loperamide: enhance the gastrointestinal absorption or inhibit the metabolism of loperamide
- Theophylline, Glipizide: Increases the concentration
- Metformin: Decreases the excretion of metformin

RIFAMPICIN

- Antacids (Aluminium hydroxide; Magnesium hydroxide): Reduced absorption of rifampicin
- Contraceptives*, Oral, Propranolol, Prednisolone*, Phenytoin*, Nifedipine*, Methadone, Haloperidol*, Verapamil* Warfarin*, Medroxyprogesterone*, Quinidine*, Levothyroxine, Norethisterone*, Levonorgestrel*, Indinavir*, Hydrocortisone*, Fluconazole*, Diazepam, Dexamethasone*, Cyclosporin*, Chloramphenicol: Accelerated metabolism
- Saquinavir*, Nevirapine*, Nelfinavir*, Lopinavir*, Efavirenz, Dapsone: Reduced plasma-dapsone concentration: Reduced plasma concentration
- Zidovudine: Avoidance of rifampicin advised by manufacturer of zidovudine

RISPERIDONE

- Carbamazepine: Increases metabolism of carbamazepine (reduced plasma concentration).
- Clozapine: With risperidone increases neutropenia.
- Aripiprazole, Clonazepam and Zolpidem: increases side effects such as drowsiness, blurred vision, dry mouth, heat intolerance, flushing, decreased sweating, difficulty urinating, constipation and irregular heartbeat.
- Tricyclic antidepressants can cause increased antimuscarinic side-effects.
- Escitalopram* increases the risk of an irregular heart rhythm that may be serious and potentially life-threatening.

RITONAVIR

- Contraceptives*, Oral: Increases metabolism of estrogens (reduced contraceptive effect)
- Efavirenz: Increased risk of toxicity (monitor liver function tests)

- Fluconazole: Increases plasma concentration
- Indinavir: Increases plasma concentration of indinavir
- Levonorgestrel*: Increases metabolism of levonorgestrel (reduced contraceptive effect)
- Medroxyprogesterone*: Increases metabolism of Medroxy-progesterone
- Methadone: Reduced plasma concentration of methadone
- Norethisterone*: Increases metabolism of norethisterone (reduced contraceptive effect)
- Quinidine*: Increased plasma-quinidine concentration (increased risk of ventricular arrhythmias)
- Saquinavir*: Increases plasma concentration of saquinavir

RITONAVIR+ SAQUANAVIR

- Loperamide, Methylprednisolone Ritonavir may significantly increase the blood levels
- Atorvastatin: Combining these medications may significantly increase the blood levels of atorvastatin.
- *Azithromycin: Combining these medications can increase the risk of an irregular heart rhythm that may be serious and potentially life-threatening.
- Budesonide: Saquinavir may significantly increase the absorption of budesonide into the blood stream.

ROTAVIRUS

- Hydrocortisone: The administration of live, attenuated viral or bacterial vaccines during immunosuppressant or intense antineoplastic therapy may be associated with a risk of disseminated infection due to enhanced replication of vaccine virus or bacteria in the presence of diminished immune competence
- Etanercept, leflunomide, Methotrexate: risk for developing an infection from the vaccine or have a reduced response to the vaccine.

RUBELLA VIRUS

- Betamethasone: The administration of live, attenuated viral or bacterial vaccines during immunosuppressant or intense antineoplastic therapy may be associated with a risk of disseminated infection due to enhanced replication of vaccine virus or bacteria in the presence of diminished immune competence
- Bleomycin, Methotrexate: risk for developing an infection from the vaccine or have a reduced response to the vaccine.

RUBELLA VACCINE

- Betamethasone: The administration of live, attenuated viral or bacterial vaccines during immunosuppressant or intense antineoplastic therapy may be associated with a risk of disseminated infection due to enhanced replication of vaccine virus or bacteria in the presence of diminished immune competence
- Bleomycin, Methotrexate: risk for developing an infection from the vaccine or have a reduced response to the vaccine.

SALBUTAMOL

- Acetazolamide, Dexamethasone, Prednisolone, Furosemide, Hydrochlorothiazide, Hydrocortisone: Increased risk of hypokalaemia with high doses of salbutamol
- Methyldopa*: Acute hypotension reported with salbutamol infusion

SAQUINAVIR

- Artemether +Lumefantrine*, Darifenacin: Manufacturer of artemether with lumefantrine and darifenacin advises avoid concomitant use
- Cyclosporin*: Plasma concentration of both cyclosporin and saquinavir increased
- Efavirenz: Efavirenz significantly reduces plasma concentration of saquinavir
- Indinavir: Indinavir increases plasma concentration of saquinavir
- Ritonavir*, Lopinavir: Increased plasma concentration of saquinavir
- Nelfinavir: Combination may lead to increased plasma concentration of either drug (or both)
- Rifampicin*, Nevirapine, Phenytoin, *Phenobarbital: Plasma concentration of saquinavir reduced

SILVER SULFADIAZINE

Note: Interactions may apply when silver sulfadiazine is used to treat large areas of skin

- Calcium salts: Reduced absorption of sodium fluoride
- Cyclosporin*: Increased risk of nephrotoxicity; possibly reduced plasma concentration of ciclosporin
- Glibenclamide: Effects of glibenclamide rarely enhanced
- Methotrexate: Increased risk of methotrexate toxicity
- Pyrimethamine*: Increased antifolate effect
- Thiopental: Enhanced effects of thiopental
- Warfarin*: Enhanced anticoagulant effect

SODIUM BICARBONATE

- Lithium: Increased excretion of lithium (reduced plasma-lithium concentration)

SODIUM LACTATE COMPOUND SOLUTION: see Potassium salts; Sodium bicarbonate

SODIUM NITROPRUSSIDE

- Hydrochlorothiazide, Hydralazine, Halothane, Glyceryl trinitrate, Furosemide, Fluphenazine, Enalapril, Diazepam, Chlorpromazine, Atenolol, Amlodipine, Amiloride, Alcohol, Acetazolamide, Isosorbide dinitrate, Ketamine, Levodopa, Methyldopa, Nifedipine, Nitrous oxide, Propranolol, Spironolactone, Thiopental, Timolol, Verapamil: Enhanced hypotensive effect
- Contraceptives, Oral: Antagonism of hypotensive effect by estrogens
- Dexamethasone: Antagonism of hypotensive effect
- Ibuprofen, Prednisolone: Antagonism of hypotensive effect

SODIUM VALPROATE: see Valproate

SOLUBLE INSULIN: see Insulins

SPIRONOLACTONE

- Alcohol, Amlodipine, Atenolol, Chlorpromazine, Diazepam, Fluphenazine, Glycerol trinitrate, Halothane, Hydralazine, Isosorbide dinitrate, Ketamine, Levodopa, Methyldopa, Nifedipine, Nitrous oxide, Propranolol, Thiopental, Sodium nitroprusside, Timolol, Verapamil: Enhanced hypotensive effect
- Amitriptyline: Increased risk of postural hypotension
- Aspirin: Antagonism of diuretic effect
- Carbamazepine: Increased risk of hyponatraemia
- Cyclosporin*: Increased risk of hyperkalaemia
- Cisplatin: Increased risk of nephrotoxicity and ototoxicity
- Clomipramine: Increased risk of postural hypotension
- Contraceptives, Oral: Antagonism of diuretic effect by estrogens
- Dexamethasone, Hydrocortisone, Prednisolone: Antagonism of diuretic effect
- Digoxin*: Plasma concentration of digoxin increased
- Enalapril*: Enhanced hypotensive effect; increased risk of severe hyperkalaemia (monitor plasma-potassium concentration with low-dose spironolactone in heart failure)
- Ibuprofen: Risk of nephrotoxicity of ibuprofen increased; antagonism of diuretic effect; possibly increased risk of hyperkalaemia
- Lithium*: Reduced lithium excretion (increased plasma-lithium concentration and risk of toxicity)
- Potassium salts: Risk of hyperkalaemia

STAVUDINE

- Didanosine*: Increased risk of adverse effects
- Doxorubicin: Doxorubicin may inhibit effect of stavudine
- Zidovudine*: May inhibit effect of stavudine (avoid concomitant use)

STREPTOMYCIN

- Alcuronium*: Enhanced muscle relaxant effect
- Amphotericin B, Cyclosporin*: Increased risk of nephrotoxicity
- Capreomycin, Vancomycin: Increased risk of nephrotoxicity and ototoxicity
- Cisplatin*: Increased risk of nephrotoxicity and possibly of ototoxicity
- Furosemide*: Increased risk of ototoxicity
- Neostigmine*: Antagonism of effect of neostigmine
- Pyridostigmine*: Antagonism of effect of pyridostigmine
- Suxamethonium*, Vecuronium*: Enhanced muscle relaxant effect

SULFADIAZINE

- Methotrexate: Risk of methotrexate toxicity increased
- Pyrimethamine, Sulfadoxine + Pyrimethamine*: Increased antifolate effect
- Thiopental: Enhanced effects of thiopental
- Warfarin*: Enhanced anticoagulant effect

SULFADOXINE + PYRIMETHAMINE

- Artemether +Lumefantrine*: Manufacturer of artemether with lumefantrine advises avoid concomitant use
- Cyclosporin*: Increased risk of nephrotoxicity
- Methotrexate*: Antifolate effect of methotrexate increased; risk of methotrexate toxicity increased
- Trimethoprim*, Sulfadiazine*, Sulfamethoxazole +Trimethoprim*: Increased antifolate effect
- Thiopental: Enhanced effects of thiopental
- Warfarin*: Enhanced anticoagulant effect

SULFAMETHOXAZOLE + TRIMETHOPRIM

- Azathioprine*: Increased risk of hematological toxicity
- Cyclosporin*: Increased risk of nephrotoxicity
- Dapsone: Plasma concentration of both dapsone and trimethoprim may increase with concomitant use
- Lamivudine: Plasma concentration of lamivudine increased (avoid concomitant use of high-dose sulfamethoxazole +trimethoprim)
- Mercaptopurine*: Increased risk of hematological toxicity
- Pyrimethamine*, *Methotrexate, *Sulfadoxine +Pyrimethamine: Antifolate effect of methotrexate increased (avoid concomitant use); risk of methotrexate toxicity increased
- Phenytoin*: Antifolate effect and plasma-phenytoin concentration increased
- Procainamide: Increased plasma-procainamide concentration
- Thiopental: Enhanced effects of thiopental
- Warfarin*: Enhanced anticoagulant effect

SULFASALAZINE

- Digoxin: Absorption of digoxin possibly reduced
- Mercaptopurine: Increased risk of leukopenia
- Folates: Reduces the absorption of sulfasalazine

SEVOFLURANE

- Epinephrine: Can cause symptoms of irregular heartbeat, chest tightness, blurred vision, nausea, and seizures.
- Amiodarone*, Moxifloxacin, Citalopram, Clozapine: Can increase the risk of an irregular heart rhythm that may be serious and potentially life-threatening

SODIUM BICARBONATE + GLYCERINE

- Dolutegravir: Coadministration with medications containing polyvalent cations such as aluminum, calcium, iron, or magnesium may decrease the oral bioavailability of dolutegravir
- Aspirin, Tetracycline, Cefopodoxime: Decrease the effects of aspirin

SODIUM CALCIUM EDETATE

- Insulin: Decrease blood sugar
- Warfarin: Decrease the effectiveness of warfarin, can increase the risk of

clotting.

- Furosemide, Hydrochlorothiazide: Can decrease potassium levels in the body.

SODIUM CHLORIDE

- Lithium: Decreases the concentration of sodium chloride
- Tolvaptan: Increase the concentration of sodium chloride

SODIUM NITRITE

- Benzocaine, Lidocaine, Prilocaine, chloroquine, primaquine, quinine, nitrates and nitrites, sulfonamides, acetaminophen, aminosalicic acid, dapsone, dimethyl sulfoxide, flutamide, metoclopramide: Coadministration with other agents that are associated with methemoglobinemia
- Rasburicase: Increased incidence of methemoglobinemia

SOFOSBUVIR

- Phenobarbital, Carbamazepine, Rifampicin: Decreases the concentration of sofosbuvir
- Amiodarone: Can cause bradycardia

STAVIDUNINE + LAMIVUDINE + NEVIRAPINE

- Amprenavir, Artemether: Decrease the concentration of nevirapine
- Leflunomide, Adalimumab: Increase the risk of serious infections

SUXAMETHONIUM (SUCCINYLCHOLINE)

- Amikacin*, Clindamycin*, Cyclophosphamide, Halothane: Enhanced effects of suxamethonium (Succinylcholine)
- Digoxin: Risk of ventricular arrhythmias
- Gentamicin*, Lithium, Magnesium (parenteral), Metoclopramide, Neostigmine, Pyridostigmine: Enhanced muscle relaxant effect
- Lidocaine: Neuromuscular blockade enhanced and prolonged (interaction less likely when lidocaine used topically)
- Procainamide*, Propranolol, Quinidine*, Streptomycin*, Vancomycin*, Verapamil: Enhanced muscle relaxant effect

TAMOXIFEN

- Warfarin*: Enhanced anticoagulant effect
- Fluoxetine, paroxetine: Inhibits metabolism of tamoxifen
- Rifampicin: Reduced plasma concentration

TAMSULOSIN

- Ketoconazole: Increases the concentration of Tamsulosin
- Verapamil, Clarithromycin, Ritonavir, Itraconazole, Ketoconazole, Nelfinavir : Increases the concentration

TESTOSTERONE

- Warfarin*: Enhanced anticoagulant effect

TETANUS ANTITOXIN

- Hydrocortisone, Triamcinolone: Can be associated with a diminished or suboptimal immunologic response due to antibody inhibition.
- Bleomycin, Vinblastine: Reduced response to the vaccine

TETANUS ANTIGLOBULIN (HUMAN)

- Vaccines (Live): Immune Globulins may diminish the therapeutic effect of Vaccines (Live). Exceptions: Influenza Virus Vaccine (Live/Attenuated); Rotavirus Vaccine; Yellow Fever Vaccine; Zoster Vaccine.

TETANUS TOXOID

- Hydrocortisone, Methylprednisolone, leflunomide, Betamethasone, Triamcinolone, Doxorubicin : Associated with a diminished or suboptimal immunologic response due to antibody inhibition - reduced response to the vaccine

THIOPENTAL

- Acetazolamide, Amiloride, Amlodipine, Atenolol, Chlorpromazine*, Diazepam, Enalapril, Fluphenazine*, Furosemide, Glyceryl trinitrate, Haloperidol*, Droperidol, Hydralazine, Hydrochlorothiazide, Methyldopa, Nifedipine, Propranolol, Isosorbide dinitrate, Sodium nitroprusside, Spironolactone, Timolol: Enhanced hypotensive effect
- Amitriptyline, Clomipramine: Increased risk of arrhythmias and hypotension
- Silver sulfadiazine, Sulfadiazine, Sulfadoxine +Pyrimethamine, Sulfamethoxazole +Trimethoprim: Enhanced effects of thiopental
- Vancomycin: Hypersensitivity-like reactions can occur with concomitant intravenous vancomycin
- Verapamil*: Enhanced hypotensive effect and AV delay

TIMOLOL

Note: Systemic absorption may follow topical application of timolol to the eye

- Acetazolamide, Alcohol, Amiloride, Amlodipine, Chlorpromazine, Diazepam, Enalapril, Fluphenazine, Furosemide, Halothane, Glyceryl trinitrate, Hydralazine, Hydrochlorothiazide, Isosorbide dinitrate, Ketamine, Levodopa, Methyldopa, Nitrous oxide, Spironolactone, Sodium nitroprusside, Thiopental: Enhanced hypotensive effect
- Digoxin : Increased AV block and bradycardia
- Epinephrine*: Severe hypertension
- Glibenclamide, Metformin: Timolol may mask warning signs of hypoglycaemia such as tremor
- Insulins: Enhanced hypoglycaemic effect; timolol may mask warning signs of hypoglycaemia such as tremor
- Mefloquine: Increased risk of bradycardia
- Nifedipine*: Enhanced hypotensive effect. Possible severe hypotension and heart failure
- Pilocarpine: Increased risk of arrhythmias
- Lidocaine*, Procainamide*, Quinidine*: Increased myocardial depression
- Verapamil*: Asystole, severe hypotension and heart failure

TINIDAZOLE

- Alcohol: Disulfiram like reaction
- Rifampicin: Reduces the concentration
- Phenobarbital: Decreases the concentration
- Chloroquine: Risk of peripheral neuropathy increased

TRANEXEMIC ACID

- Estrogen, Levonorgesterel, Medroxyprogesterone: Increases the risk of thrombotic events

TRIMETHOPRIM

- Azathioprine*: Increased risk of haematological toxicity
- Cyclosporin*: Increased risk of nephrotoxicity; plasma-cyclosporin concentration possibly reduced by intravenous trimethoprim
- Dapsone: Plasma concentration of both dapsone and trimethoprim may increase with concomitant use
- Mercaptopurine*: Increased risk of haematological toxicity
- Methotrexate*: Antifolate effect of methotrexate increased (avoid concomitant use)
- Phenytoin*: Antifolate effect and plasma-phenytoin concentration increased
- Procainamide: Increased plasma-procainamide concentration
- Sulfadoxine +Pyrimethamine*, Pyrimethamine*: Increased antifolate effect
- Warfarin: Possibly enhanced anticoagulant effect

URODEOXYCHOLIC ACID

- Colestyramine, Colestimide and Colestipol: Interfere with the absorption
- Aluminium hydroxide: Forms complexes which are not absorbed

VACCINE, INFLUENZA

- Dexamethasone, Hydrocortisone, Prednisolone: High doses of dexamethasone impair immune response
- Phenytoin: Enhanced effect of phenytoin
- Warfarin: Effect of warfarin occasionally enhanced

VACCINE, LIVE

- Note: Vaccine, Live includes BCG, Measles, MMR, Poliomyelitis (oral), Rubella, and Yellow fever vaccines
- Asparaginase: Avoid use of live vaccines with asparaginase (impairment of immune response)
- Azathioprine*: Avoid use of live vaccines with azathioprine (impairment of immune response)
- Bleomycin: Avoid use of live vaccines with bleomycin (impairment of immune response)
- Chlorambucil, Cyclosporin*, Chlormethine, Cisplatin, Cyclophosphamide, Cytarabine, Dacarbazine, Dactinomycin, Daunorubicin, Doxorubicin, Etoposide, Fluorouracil, Mercaptopurine, Methotrexate, Procarbazine, Vinblastine, Vincristine: Avoid use of live vaccines (impairment of immune response)

- Dexamethasone*, Hydrocortisone*, Prednisolone*: High doses of dexamethasone impair immune response; avoid use of live vaccines
- Immunoglobulin*, Anti-D: Avoid use of live virus vaccine during 4 weeks before or during 3 months after injection of anti-D immunoglobulin (impairment of immune response) but rubella vaccine (either as MMR or single antigen rubella vaccine) may be given at the same time as anti-D immunoglobulin

VALPROIC ACID: see Valproate

VALPROATE

- Amitriptyline*, Fluphenazine*, Haloperidol*, Mefloquine*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Aspirin: Enhancement of effect of valproate
- Carbamazepine: May be enhanced toxicity without corresponding increase in antiepileptic effect; plasma concentration of valproate reduced; plasma concentration of active metabolite of carbamazepine increased
- Chlorpromazine*, Clomipramine*: Antagonism of anticonvulsant effect (convulsive threshold lowered)
- Phenobarbital: May be enhanced toxicity without corresponding increase in antiepileptic effect; plasma concentration of valproate reduced; Phenobarbital concentration increased
- Phenytoin: May be enhanced toxicity without corresponding increase in antiepileptic effect; plasma concentration of valproate reduced; plasma concentration of phenytoin increased or possibly reduced

VANCOMYCIN

- Amikacin, Capreomycin, Cisplatin, Gentamicin, Streptomycin: Increased risk of nephrotoxicity and ototoxicity
- Cyclosporin*: Increased risk of nephrotoxicity
- Furosemide*: Increased risk of ototoxicity
- Halothane, Ketamine, Nitrous oxide, Thiopental: Hypersensitivity-like reactions can occur with concomitant intravenous vancomycin
- Suxamethonium*: Enhanced effects of suxamethonium
- Cyclosporine: Concentration of vancomycin increases

VECURONIUM

- Amikacin*: Enhanced effects of vecuronium
- Carbamazepine: Antagonism of muscle relaxant effect (recovery from neuromuscular blockade accelerated)
- Clindamycin*, Gentamicin*, Lithium, Magnesium (parenteral), Nifedipine, Procainamide*, Propranolol, Quinidine*, Streptomycin*, Verapamil: Enhanced muscle relaxant effect
- Halothane: Enhanced effects of vecuronium
- Neostigmine, Phenytoin, Pyridostigmine: Antagonism of muscle relaxant effect
- Acetazolamide: Enhanced hypotensive effect

VERAPAMIL

- Alcohol, Amiloride, Chlorpromazine, Diazepam, Enalapril, Fluphenazine, Furosemide, Glyceryl trinitrate, Haloperidol, Hydralazine, Hydrochlorothiazide, Isosorbide dinitrate, Levodopa, Methyl dopa, Spironolactone, Sodium nitroprusside : Enhanced hypotensive effect
- Alcuronium: Enhanced muscle relaxant effect
- Atenolol*: Asystole, severe hypotension and heart failure
- Carbamazepine*: Enhanced effect of carbamazepine
- Cyclosporin*: Increased plasma-cyclosporin concentration
- Contraceptives, Oral: Antagonism of hypotensive effect by estrogens
- Dexamethasone, Prednisolone: Antagonism of hypotensive effect
- Digoxin*: Increased plasma concentration of digoxin; increased AV block and bradycardia
- Grapefruit juice: Increased plasma-verapamil concentration
- Halothane*, Ketamine*, Nitrous oxide*, Thiopental*: Enhanced hypotensive effect and AV delay
- Hydrocortisone, Ibuprofen: Antagonism of hypotensive effect
- Lidocaine*: Increased risk of myocardial depression (interaction less likely when lidocaine used topically)
- Lithium: Neurotoxicity may occur without increased plasma-lithium concentration
- Phenytoin: Reduced effect of verapamil
- Propranolol*: Asystole, severe hypotension and heart failure
- Quinidine*: Increased plasma-quinidine concentration (extreme hypotension may occur)
- Rifampicin*: Accelerated metabolism of verapamil (plasma concentration significantly reduced)
- Suxamethonium: Enhanced effects of suxamethonium
- Timolol*: Asystole, severe hypotension and heart failure
- Vecuronium: Enhanced muscle relaxant effect

VINBLASTINE

- Bleomycin*: Increased risk of cardiovascular toxicity
- Erythromycin*: Increased toxicity of vinblastine (avoid concomitant use)
- Vaccine, Live: Avoid use of live vaccines with vinblastine (impairment of immune response)

VINCRISTINE

- Vaccine, Live: Avoid use of live vaccines with vincristine (impairment of immune response)

VITAMIN D: see Ergocalciferol

WARFARIN

Note: Major changes in diet (especially involving salads and vegetables) and in alcohol consumption may affect anticoagulant control

- Amitriptyline*, Alcohol*, Chloramphenicol*, Ciprofloxacin*, Clomipramine*, Contraceptives* Oral, Doxycycline*, Erythromycin*, Griseofulvin*, Fluconazole*, Levothyroxine, Mercaptopurine*, Metronidazole*,

Miconazole*, Ofloxacin*, Quinidine*, Silver sulfadiazine*, Sulfadiazine*, Sulfadoxine+Pyrimethamine*, Sulfamethoxazole*+Trimethoprim, Tamoxifen*, Testosterone*, Trimethoprim, Proguanil: Enhanced anticoagulant effect

- Ampicillin, Amoxicillin: Studies have failed to demonstrate an interaction, but common experience in anticoagulant clinics is that INR can be altered by a course of amoxicillin
- Aspirin*: Increased risk of bleeding due to antiplatelet effect
- Hydrocortisone*, Nevirapine*, Prednisolone*: Anticoagulant effect possibly enhanced or reduced
- Levonorgestrel*, Medroxyprogesterone*, Norethisterone*, Phytomenadione*: Antagonism of anticoagulant effect
- Paracetamol: Prolonged regular use of paracetamol possibly enhances anticoagulant effect
- Phenobarbital*, Phenytoin*, Rifampicin*: Metabolism of warfarin accelerated (reduced anticoagulant effect)
- Vaccine, Influenza: Effect of warfarin occasionally enhanced

YELLOW FEVER VACCINE: see Vaccine, live

ZIDOVUDINE

Note: Increased risk of toxicity with nephrotoxic and myelosuppressive drugs

- Fluconazole*: Increased plasma concentration of zidovudine (increased risk of toxicity)
- Ibuprofen: Increased risk of hematological toxicity
- Phenytoin: Plasma-phenytoin concentration increased or decreased by zidovudine
- Pyrimethamine: Increased antifolate effect
- Rifampicin: Avoidance of rifampicin advised by manufacturer of zidovudine
- Stavudine*: May inhibit effect of stavudine (avoid concomitant use)

ZIDOVUDINE + LAMIVUDINE

- Leflunomide, Adalimumab: Increase the risk of serious infections
- Clozapine: Can cause neutropenia or agranulocytosis
- Ganciclovir, Eterncept: increase the risk of infections

ZINC SULPHATE

- Calcium salts: Reduced absorption of zinc sulfate
- Ciprofloxacin, Ferrous salts, Ofloxacin, Levofloxacin: Reduced absorption
- Penicillamine: Absorption of both drugs reduced

Section III - Appendix 2
National List of Essential Medicines, 2016

S.N.	Main list	Complementary list	Dosage form
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I Anaesthetics

1.1 General Anaesthetics and Oxygen

Halothane		inhalation	
Isoflurane		inhalation	
Ketamine		injection, 50 mg/ml (as hydrochloride) in 10-ml vial	
Nitrous oxide		inhalation	
Oxygen		inhalation (medicinal gas)	
Thiopental		powder for injection, 0.5g, 1.0g (sodium salt) in ampoule	
	Propofol	injection, 10mg/ml in 20-ml ampoule	
	Sevoflurane	inhalation	

1.2 Local Anaesthetics

Bupivacaine		injection, 0.25%, 0.5% (hydrochloride) in vial	
Lidocaine (lignocaine)		injection, 1%, 2% (hydrochloride) in vial; injection for spinal anaesthesia, 5% (hydrochloride) in 2-ml ampoule to be mixed with 7.5% glucose solution	
	Lidocaine (lignocaine) + epinephrine (adrenaline)	injection, lignocaine 2% (hydrochloride) + epinephrine 1:200 000, in vial	
	Ephedrine*	injection, 30 mg (hydrochloride)/ml in 1-ml ampoule	

*For use in spinal anaesthesia during delivery, to prevent hypotension

1.3 Preoperative Medication and Sedation for Short-term Procedures

Atropine		injection, 1 mg (sulfate) in 1-ml ampoule	
Diazepam		injection, 5mg/ml in 2-ml ampoule	
Midazolam		injection, 1mg/ml, 5mg/ml with/out preservative	

S.N.	Main list	Complementary list	Dosage form
	Morphine		injection, 10 mg (sulfate or hydrochloride) in 1-ml ampoule
<i>2 Medicines for Pain and Palliative Care</i>			
2.1 Non-opioid Analgesics & NSAIMs			
	Ibuprofen		tablet, 200 mg, 400 mg, Oral liquid, 100 mg/5ml
	Paracetamol		tablet, 500mg; injection, 150 mg/ml in 2-ml ampoule; Oral drops, 100 mg/ml; suspension, 125 mg/5ml
	Aspirin		tablet, 500 mg
	Diclofenac Sodium		tablet, 50 mg, injection 25 mg/ml
2.2 Opioid Analgesics			
	Codeine		tablet, 30 mg (as phosphate)
	Fentanyl		injection, 50mcg/ml
	Morphine		injection, 10 mg (sulfate or hydrochloride) in 1-ml ampoule; tablet, 10 mg; prolonged release tablet, 10 mg, 30 mg, 60 mg (sulfate); oral liquid 10 mg/5ml (sulfate)
	Pethidine		injection, 50 mg (hydrochloride) in 1-ml ampoule
<u>3 Antihistaminics and Medicines Used in Anaphylaxis</u>			
	Cetirizine		tablet 10 mg,
	Dexamethasone		injection, 4 mg dexamethasone phosphate (as disodium salt) in 1-ml ampoule
	Epinephrine (adrenaline)		injection, 1mg (as hydrochloride or acid tartrate) in 1-ml ampoule
	Hydrocortisone		powder for injection, 100 mg (as sodium succinate) in vial
	Pheniramine		tablet, 25, 50 mg, injection, 22.75 mg (maleate) /ml

S.N.	Main list	Complementary list	Dosage form
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	Prednisolone		
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		tablet, 5mg	
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	Fexofenadine		
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		oral Solution, 30mg/5 ml	
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4 Antidotes and Other Substances Used in Poisonings

4.1 Non-Specific

	Charcoal, activated		
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		powder; oral liquid (sorbitol-base slurry)	
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4.2 Specific

	Atropine		
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		injection, 0.6 mg (sulfate) in ampoule; powder for injection 50 mg (sulfate) in vial	
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	Dimercaprol		
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		injection in oil, 50 mg/ml in 2-ml ampoule	
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	Naloxone		
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		injection, 400 mcg (hydrochloride) in 1-ml ampoule	
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	Pralidoxime		
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		injection, 500 mg or 1 g (mesilate, chloride or iodide) in ampoule	
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	Acetylcysteine		
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		injection, 200 mg/ml in 10-ml ampoule	
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	Calcium gluconate		
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		injection, 100 mg/ml in 10-ml ampoule	
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	Deferoxamine		
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		powder for injection, 500 mg (mesilate) in vial	
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	Methylthioninium chloride (Methylene blue)		
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		injection, 10 mg/ml in 10-ml ampoule	
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	Potassium ferric		
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		powder for oral administration	
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	hexacyano-ferrate		
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	(II).2H ₂ O (Prussian		
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	blue)		
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	Sodium calcium		
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		injection, 200 mg/ml in 5 ml ampoule	
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	edetate		
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	Sodium nitrite		
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		injection, 30 mg/ml in 10-ml ampoule	
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S.N.	Main list	Complementary list	Dosage form
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5. Antiepileptics / Anticonvulsants

Carbamazepine

Diazepam

Magnesium sulfate*

* For use in eclampsia and severe pre-eclampsia and not for other convulsant disorders.

Phenobarbital

Phenytoin

Valproic acid

tablet, 100, 200 mg, 400 mg, Oral liquid 100mg/5ml injection, 5mg/ml in 2- ml ampoule (intravenous or rectal) injection, 500 mg/ml in 2-ml ampoule.

tablet, 15 mg, 30 mg, 60 mg; Oral liquid 20mg/5ml; injection 200mg/ml capsule or tablet, 25 mg, 50 mg, 100 mg (sodium salt); injection, 50 mg /ml (sodium salt) in 5-ml vial
tablet (enteric coated), 200 mg (sodium salt), Oral liquid 200mg/5ml

6 Anti-infective Medicines

6.1 Anthelmintics

6.1.1 Intestinal Anthelmintics

Albendazole

Nicosamide

Praziquantel

6.1.2 Antifilarials

Diethylcarbamazine

6.2 Antibacterials

6.2.1 Beta-lactam medicines

Amoxicillin

tablet (chewable), 400 mg

tablet (chewable), 500 mg

tablet, 150 mg, 600 mg

tablet, 50 mg, 100 mg (dihydrogen citrate)

capsule or tablet, 250 mg, 500 mg (as trihydrate); dispersible tablet 125 mg, 250 mg (as trihydrate), powder for oral liquid, 125 mg/ml

S.N.	Main list	Complementary list	Dosage form
	Ampicillin		powder for injection, 500 mg (sodium salt)
	Benzathinebenzylpenicillin		powder for injection, 600 000 IU, 1200 000 IU, 2400 000 IU in vial
	Benzylpenicillin (Penicillin G)		powder for injection, 300 mg (0.5 million IU), 600 mg (1 million IU) (as sodium or potassium salt) in vial
	Cephalexin		Capsule 250 mg (as monohydrate), Oral liquid 125/5 ml, 250/5 ml (anhydrous)
	Cefixime		tablet, 200,400* mg
	<i>*only listed for single-dose treatment of uncomplicated ano-genital gonorrhoea</i>		
	Cloxacillin		
	Phenoxyethylpenicillin (Penicillin V)		capsule, 250 mg, 500 mg; powder for oral liquid, 125 mg / 5ml; powder for injection, 500 mg (as sodium salt) in vial
	Procaine benzylpenicillin		tablet, 250 mg (as potassium salt); powder for oral liquid, 250 mg/5 ml (as potassium salt)
			powder for injection, 300,000 IU in vial
			powder for injection, 1g (as sodium salt) in vial
		Cefazolin*	
		<i>*For surgical prophylaxis</i>	
		Ceftriaxone	powder for injection, 250 mg (as sodium salt) in vial

6.2.2 Other Antibacterials

Azithromycin

Chloramphenicol

Ciprofloxacin

Doxycycline

Gentamicin

capsule or tablet 250 mg, 500 mg; oral liquid, 200 mg /5ml.

capsule, 250 mg, 500 mg; oral liquid, 125 mg / 5ml (as palmitate); powder for injection, 1g (as sodium succinate) in vial

tablet, 250 mg, 500 mg (as hydrochloride)

capsule, 100 mg (as hydrochloride)

injection, 10 mg, 40 mg / ml (as sulfate) in 2-ml vial

S.N.	Main list	Complementary list	Dosage form
	Metronidazole		tablet, 200 mg, 400 mg; injection, 500 mg in 100-ml bottle; oral liquid, 100 mg, 200 mg (as benzoate) / 5ml tablet, 100 mg
	Nitrofurantoin		
	Sulfamethoxazole+Trimethoprim		dispersible tablet, 100mg+20 mg, 200 mg+40 mg; tablet 400 mg + 80 mg, 800 mg + 160 mg; oral liquid, 200mg + 40mg /5ml
	Erythromycin		tablet, 250 mg (stearate); oral liquid, 250 mg / 5ml (stearate)
	Nalidixic acid		tablet, 250 mg, 500 mg
	Tetracycline		capsule 250 mg, 500 mg (as hydrochloride)
	Vancomycin		powder for inj. 250 mg (as hydrochloride) in vial
6.2.3 Antileprosy Medicines			
	Clofazimine		capsule, 50 mg, 100 mg
	Dapsone		tablet, 50 mg, 100 mg
	Rifampicin		capsule or tablet 150 mg, 300 mg
<i>(For the treatment of leprosy, combination therapy is essential to prevent the emergence of drug resistance)</i>			
6.2.4 Antitubercular Medicines			
	Ethambutol		tablet, 100 mg, 400 mg, 600 mg (hydrochloride)
	Ethambutol + Isoniazid		tablet, 400mg + 150mg
	Ethambutol + Rifampicin + Isoniazid		tablet, 275 mg + 150 mg+ 75 mg
	Ethambutol + Rifampicin + Isoniazid+ Pyrazinamide		tablet, 275 mg+150 mg+ 75 mg + 400 mg
	Isoniazid		tablet, 50mg, 100 mg, 300 mg
	Isoniazid + Rifampicin		tablet, 60 mg+60 mg, 50 mg+75mg, 75 mg + 150mg
	Isoniazid + Rifampicin + Pyrazinamide		tablet, 30 mg+ 60 mg+150 mg, 50 mg+75 mg+150 mg

S.N.	Main list	Complementary list	Dosage form
	Rifampicin		capsule or tablet, 150mg, 300mg, 450 mg
	Streptomycin		powder for injection, 1 g (as sulfate) in vial
	Complementary list: Second-line medicines for the treatment of multi-drug resistant tuberculosis (MDR-TB) – to be made available only in specialised centres adhering to standard treatment protocol.		
	Amoxicillin + Clavulanic acid		tablet, 500 mg + 125 mg, 875 mg+125 mg
	Bedaquiline		tablet, 100mg
	Capreomycin		powder for injection, 1 g in vial
	Clofazimine		capsule, 100 mg
	Cycloserine		capsule, 250 mg
	Ethionamide		tablet, 125, 250 mg
	Kanamycin		powder/solution for injection 1 g in vial/ ampoule
	Levofloxacin*		tablet, 250 mg, 500 mg
	Linezolid		tablet 300 mg
	Moxifloxacin*		tablet, 400 mg
	Ofloxacin*		tablet, 200 mg
	<i>*To be decided based on availability and programme considerations.</i>		
	P-aminosalicylic acid (PAS)		granules, 4 g, 9.2 g in sachet; tablet 500 mg
	Pyrazinamide		tablet, 150 mg, 400 mg, 500 mg

6.3 Antifungal Medicines

S.N.	Main list	Complementary list	Dosage form
	Clotrimazole		cream, 1%; pessary, 100 mg, mouth paint 1%w/v
	Fluconazole		capsule or tablet, 150 mg
	Nystatin		oral liquid 50 mg/5 ml, 100000IU/mlmouth paint
	6.4 Antiviral Medicines		
	6.4.1 Antih herpes Medicines		
	Aciclovir		powder for injection 250 mg (as sodium salt) in vials; tablet 200/400/800 mg
	6.4.2 Antiretrovirals		
	6.4.2.1 Nucleoside/Nucleotide Reverse Transcriptase		
	Inhibitors		
	Abacavir (ABC)		tablet, 300 mg (as sulfate); oral liquid, 100 mg (as sulfate)/5ml
	Lamivudine (3TC)		tablet, 150 mg; oral liquid 50 mg/5ml
	Stavudine (d4T)		capsule, 15 mg, 20 mg, 30 mg; powder for oral liquid, 5 mg/5ml
	Tenofovir disoproxil fumarate (TDF)		tablet, 300 mg (equivalent to 245 mg tenofoviridisoproxil)
	Zidovudine (ZDV or AZT)		capsule, 100 mg; tablet 300 mg; oral liquid 50 mg/ 5ml
	6.4.2.2 Non-nucleoside Reverse Transcriptase		
	Inhibitors		
	Efavirenz (EFV or EFZ)		capsule, 200 mg; tablet, 600 mg
	Nevirapine (NVP)		tablet, 200 mg; oral liquid, 50 mg/5ml, 50 mg
	6.4.2.3 Protease Inhibitors		
	Indinavir (IDV)		capsule, 400 mg (as sulfate)
	Lopinavir + Ritonavir (LPV/r)		capsule 200 mg + 50 mg
	Nelfinavir (NFV)		tablet, 250 mg (as mesilate)
	Ritonavir		tablet, 100 mg

S.N.	Main list	Complementary list	Dosage form
	Saquinavir (SQV) +Ritonavir		oral dosage form, 1g+100 mg
6.4.2.4 Fixed-dose Combination	Abacavir + Lamivudine		tablet, 60mg + 30 mg
	Emtricitabine + Tenofovir		tablet, 200mg + 300 mg
	Lamivudine + Stavudine		tablet, 150 mg + 30 mg
	Lopinavir + Ritonavir		tablet, 100 mg + 25 mg
	Stavudine + Lamivudine + Nevirapine		tablet, 30 mg + 150 mg + 200 mg
	Zidovudine + Lamivudine		tablet, 60 mg + 30 mg, 300 mg + 150 mg
	Zidovudine + Lamivudine + Nevirapine		tablet, 60 mg + 30 mg + 50 mg, 300 mg + 150 mg + 200 mg
6.4.3 Other antiviral	Entecavir		tablet 0.5, 1 mg
	Oseltamivir		Capsule, 30/45/75 mg as phosphate, Oral powder 6 mg/ml
	Sofosbuvir		tablet 400 mg
6.5 Antiprotozoal Medicines			
6.5.1 Antiamoebic and Antigiardiasis Medicines			
	Metronidazole		tablet, 200mg, 400mg; oral liquid, 200 mg (as benzoate) / 5 ml. tablet, 500mg
6.5.2 Antileishmaniasis Medicines			
	Miltefosine		capsule, 50 mg powder for injection, 50 mg in vial (as deoxycholate or liposomal) injection, 100mg/ml
6.5.3 Antimalarial Medicines			
	Amphotericin B		
	Sodium stibogluconate		

S.N.	Main list	Complementary list	Dosage form
	Artemether*		oily injection, 80 mg/ml in 1-ml ampoule.
	* For use in the management of severe malaria.		
	Artemether+lumefantrine*	* Not recommended in the first trimester of pregnancy or in children below 5 kg.	tablet, 20 mg+ 120 mg
	Artesunate		injection, ampoules, containing 60 mg anhydrous artesunic acid with a separate ampoule of 5% sodium bicarbonate solution; tablet 50 mg
	(To be used in combination with Sulfadoxine + Pyrimethamine.)		tablet, 150 mg base (as phosphate or sulfate); oral liquid, 50 mg / 5ml (as phosphate or sulfate); injection, 40mg /ml in 5- ml ampoule (as phosphate, sulfate or hydrochloride)
	Chloroquine		tablet, 7.5 mg, 15 mg (as diphosphate)
	Primaquine		tablet, 500 mg + 25 mg
	Sulfadoxine + Pyrimethamine		
	(To be used only in combination with Artesunate.)		
	Quinine		tablet, 300 mg (as bisulfate or sulfate); injection, 300 mg (as dihydrochloride)/ ml in 2-ml ampoule.

7 Antimigraine Medicines

7.1 For Treatment of Acute Attack

Paracetamol

tablet, 500 mg

S.N.	Main list	Complementary list	Dosage form
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7.2 For Prophylaxis

Propranolol

tablet 20 mg, 40 mg (hydrochloride)

8 Antineoplastic, Immunosuppressives and Medicines Used in Palliative Care

8.1 Immunosuppressive Medicines

Cyclosporin

capsule 25 mg

8.2 Cytotoxic Medicines

Calcium folinate (Calcium leucovorin)

tablet, 15 mg

Chlorambucil

tablet, 2 mg, 5 mg

Cisplatin

powder for injection, 10 mg, 50 mg in vial.

Cyclophosphamide

tablet, 25 mg; powder for injection, 200 mg, 500 mg, 1 g in vial

Cytarabine

injection 100 mg, 500 mg in vial

Dacarbazine

powder for injection, 100 mg in vial

Dactinomycin

powder for injection, 500 mcg in vial

Daunorubicin

powder for injection 20 mg (as hydrochloride) in vial

Doxorubicin

powder for injection, 10 mg, 50 mg in vial

Epirubicin

injection, 10 mg, 50 mg (hydrochloride) in vial

Etoposide

tablet, 100 mg, injection 20 mg/ml in 5-ml ampoule

Fluorouracil

injection 50 mg/ml in 5-ml, 10-ml ampoule

Hydroxy urea

capsule 500 mg

Ifosfamide + Mesna

injection, 1g + 200 mg, in vial

Lomustine

capsule, 40 mg

S.N.	Main list	Complementary list	Dosage form
	Melphalan		tablet, 2 mg, 5 mg; powder for injection, 50mg in vial
	Mercaptopurine		tablet, 50 mg
	Methotrexate		tablet, 2.5/5/10 mg (as sodium salt); powder for injection 15 mg, 50 mg (as sodium salt) in vial
	Mitomycin		powder for injection, 2mg, 10mg, 20mg in vial
	Mitoxantrone		injection, 2 mg/ml in 10ml ampoule
	Procarbazine		capsule 50 mg (as hydrochloride)
	Vinblastine		powder for injection 10 mg (sulfate) in vial
	Vincristine		powder for injection, 1 mg (sulfate) in vial
		Bleomycin	powder for injection, 15mg (as sulfate) in vial
		Carboplatin	injection 150 mg, 450 mg in vial
			powder for injection, 100 mg (as sodium succinate) in vial
			tablet, 20 mg (as citrate)
			tablet or capsule 50 mg
		Dexamethasone	Dexamethasone phosphate 4 mg /ml (as sodium salt) in 2-ml ampoule
		Prednisolone	tablet, 5 mg, 10 mg, 20 mg
			injection, 30 million unit in vial
			injection, 5 million units/ml in vial
			injection, 5 000 IU, 10 000 IU in vial
			injection, 2 mg/ml (as hydrochloride) in 2-ml, 4-ml vial; tablet 2mg, 4mg (as hydrochloride)
8.3 Hormones and Antihormones			
	Hydrocortisone		
	Tamoxifen		
		Bicalutamide	
		Dexamethasone	
		Prednisolone	
8.4 Miscellaneous			
	Granulocyte Colony Stimulating Factor (GCSF)		
	Interferon		
	L-Asparaginase		
	Ondansetron		

S.N.	Main list	Complementary list	Dosage form
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9 Antiparkinsonism Medicines

Levodopa + Carbidopa

Trihexyphenidyl (benzhexol)

tablet, 100 mg + 10 mg, 250 mg + 25 mg

tablet, 2 mg (hydrochloride)

10 Medicines Affecting the Blood

10.1 Antianaemia Medicines

Ferrous sulfate*

Ferrous sulfate*+Folic acid

*Ferrous fumarate may be used

Folic acid

Iron Dextran

tablet, equivalent to 60 mg iron; oral liquid, equivalent to 25 mg iron/ml

tablet, equivalent to 60 mg Iron+ 400 mcg Folic acid, oral drop.

tablet, 5mg

injection, equivalent to 50 mg iron/ml in 2-ml ampoule

10.2 Medicines Affecting Coagulation

Enoxaparin

Heparin sodium

Phytomenadione

Protamine sulfate

Warfarin

injection 30mg/0.3ml, 60mg/0.6ml, 80mg/0.8ml

injection, 1000 IU/ml, 5000 IU/ml, 20000IU/ml in 1-ml ampoule

injection, 10mg/ml in 5-ml ampoule; tablet 10 mg

injection, 10mg/ml in 5-ml ampoule

tablet, 1 mg, 2 mg, 5 mg (sodium salt)

Acenocoumarol

tablet, 1mg

11 Blood Products and Plasma Substitutes

11.1 Plasma Substitutes

Albumin, human

injectable solution, 20 or 25%

S.N.	Main list	Complementary list	Dosage form
	Polygeline		injectable solution, 3.5%
11.2 Plasma Fractions For Specific Use	Factor VIII Concentrate		dried concentrate
	Factor IX complex		dried concentrate
<u>12 Cardiovascular Medicines</u>			
12.1 Antianginal Medicines	Glyceryl trinitrate		tablet (sublingual), 500 mcg
	Isosorbide dinitrate		tablet (sublingual), 5 mg, 10 mg
	Metoprolol		tablet, 12.5,25,50 mg
	Verapamil		tablet, 40 mg, 80 mg (hydrochloride); injection, 2.5 mg / ml in 2-ml ampoule
12.2 Antiarrhythmic Medicines			
	Amiodarone		tablet 100 mg, injection 50mg/ml
	Digoxin		tablet, 62.5 mcg, 250 mcg; oral liquid, 50 mcg / ml; injection, 250 mcg / ml in 2-ml ampoule
	Epinephrine (Adrenaline)		100 mcg/ml (as acid tartrate or hydrochloride) in 10 ml ampoule
	Isoprenaline		injection, 1 mg (hydrochloride)/ml in vial
	Lidocaine (Lignocaine preservative free)		injection 2 % (hydrochloride) in vial
	Metoprolol		tablet, 12.5,25,50 mg
	Disopyramide		capsule, 100 mg, 150 mg
	Procainamide		tablet, 250 mg (hydro-chloride); injection, 100 mg /ml in 10-ml ampoule
12.3 Antihypertensive Medicines			

S.N.	Main list	Complementary list	Dosage form
	Amlodipine		tablet 2.5, 5 mg
	Atenolol		tablet 25, 50, 100 mg
	Enalapril		tablet, 5 mg, 10 mg, 20 mg
	Hydralazine		injection 20 mg
	Hydrochlorothiazide		tablet, 25 mg, 50 mg
	Labetalol		injection 5 mg/ml 20 ml
	Losartan		tablet, 25, 50mg
	Methyldopa*		tablet, 250 mg
	<i>* Listed for the use in the management of pregnancy induced hypertension only</i>		
	Nifedipine		sustained release tablet, 10 mg, 20 mg
	Prazosin		sustained release tablet 500 mcg, 1mg (mesylate)
	Sodium nitroprusside		powder for infusion, 50 mg in ampoule
12.4 Medicines Used in Heart Failure			
	Digoxin		tablet, 62.5 mcg, 250 mcg; oral liquid, 50 mcg / ml; injection, 250 mcg / ml in 2-ml ampoule
	Furosemide		injection, 10 mg/ml in 2ml ampoule. tablet, 20, 40 mg
	Ramipril		tablet 2.5, 5 mg
	Spiroonolactone		tablet, 25 mg
		Dobutamine	injection, 12.5 mg/ml (as hydrochloride) in 20-ml ampoule
		Dopamine	injection 40mg/ml (hydrochloride) in 5- ml vial
12.5 Antithrombotic Medicines			
	Aspirin		tablet, 50mg, 75 mg, 150mg, 300 mg

S.N.	Main list	Complementary list	Dosage form
	Clopidogrel		tablet 75 mg
	Streptokinase		injection 750000 IU, 1500 000 IU in vial
12.6	Lipid Lowering Agent		
	Atorvastatin		tablet, 10 mg, 20 mg (as calcium trihydrate)
	Fenofibrate		tablet, 80, 160 mg
13	<u>Dermatological Medicines</u>		
13.1	Antifungal Medicines		
	Benzoic acid + Salicylic acid		ointment or cream, 6% + 3%
	Clotrimazole		cream, 1%
	Fluconazole		capsule 150 mg
13.2	Anti-infective Medicines		
	Mupirocin		2 % cream/ont
	Povidone iodine		solution, 5%
	Silver sulfadiazine		cream, 0.2%
	Gentian violet		
	(Methylrosanilinium chloride)		aqueous solution 1%
13.3	Anti-inflammatory and Antipruritic Medicines		
	Betamethasone		ointment or cream, 0.1% (as valerate)
	Calamine lotion		lotion
	Hydrocortisone		ointment or cream, 1% (acetate)

S.N.	Main list	Complementary list	Dosage form
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13.4 Medicines Affecting Skin Differentiation and Proliferation

Benzoyl peroxide
Salicylic acid

cream or lotion, 5%
cream 2% to 40%

13.5 Scabicides and Pediculicides

Permethrin

lotion 1%, cream 5%

14 Diagnostic Agents

14.1 Ophthalmic Medicines

Fluorescein

eye drops, 1%, 2% (sodium salt); injection, 10%, 20% (sodium salt) in 5-ml ampoule

14.2 Radiocontrast Media

Amidotrizoate
Barium sulfate
Iohexol

injection, 140-420 mg iodine/ml (as sodium or meglumine salt) in 20,50ml ampoule
100-250% w/v in aqueous suspension
injection, 140-350 mg iodine/ml in 10/20ml ampoule
solution, 5-8 g iodine in 100-250 ml
Meglumine eiotroxate

15 Disinfectants and Antiseptics

15.1 Antiseptics

Chlorhexidine

*Only for umbilical cord stump care

Gentian violet (Methylrosanilinium chloride)

solution, 5% (digluconate) for dilution, solution* or ointment, 4 %

aqueous solution, 1%

S.N.	Main list	Complementary list	Dosage form
	<i>(Powder may be supplied for preparation of solution at the health facility)</i>		
	Povidone iodine		solution, 5%, 10 % w/v
	Rectified spirit		liquid (90 % v/v)
15.2 Disinfectants	Chlorine based compound		powder, (0.1% available chlorine) for solution
	Glutaraldehyde		solution, 2%
<u>16 Diuretics</u>	Furosemide		tablet, 40 mg; injection, 10 mg/ml in 2-ml ampoule
	Hydrochlorothiazide		tablet, 25mg, 50 mg
	Mannitol		injectable solution, 10%, 20%
	Spironolactone		tablet, 25 mg, 100 mg
<u>17 Gastrointestinal Medicines</u>			
17.1 Antacids and Other Anti-ulcer Medicines	Dried aluminium hydroxide gel + Magnesium hydroxide*		tablet, 250 mg + 250 mg
	(*Tablet containing Magnesium trisilicate 500 mg may be used.)		
	Ranitidine		tablet, 150 mg, 300 mg (as hydrochloride); injection 25 mg/ml in 2-ml ampoule
	Omeprazole		capsule, 20 mg
17.2 Antiemetic Medicines			

S.N.	Main list	Complementary list	Dosage form
	Granisetron		tablet 1, 2 mg
	Metoclopramide		tablet, 10 mg (hydrochloride); injection, 5 mg (hydrochloride)/ml in 2-ml ampoule
	Promethazine		tablet, 25 mg (theoclate); oral liquid, 5 mg (hydrochloride)/ 5 ml; injection, 25 mg (hydrochloride) / ml in 2-ml ampoule
17.3 Anti-inflammatory Medicines			
	Sulfasalazine		tablet, 500 mg
17.4 Laxatives			
	Lactulose		solution, 3.35 mg / 5ml
	Magnesium sulfate		powder, 500 g
		Bisacodyl	tablet, 10 mg
		Ispaghula husk	oral powder
17.5 Medicines Used in Diarrhoea			
17.5.1 Oral Rehydration			
	Oral rehydration salts*		sachet containing: Dextrose, anhydrous 13.5 g, Sodium chloride 2.6 g, Potassium chloride 1.5 g, Trisodium citrate dihydrate 2.9 g, appropriate flavour q.s. Dissolved to produce 1 litre, provides dextrose 75mEq, sodium 75 mEq or mmol/l, chloride 65 mEq or mmol/l, potassium 20 mEq or mmol/l, citrate 10 mmol/l and osmolarity 245 mOsm/l
			dispersible tablet, equivalent to Zinc 10 mg, 20 mg (scored)
* <i>In case of cholera a higher concentration of sodium may be required.</i>			
17.5.2 Medicine for Diarrhoea in Children			
	Zinc sulfate*		
* <i>In acute diarrhoea, zinc sulfate should be used as an adjunct to oral rehydration salts</i>			

S.N.	Main list	Complementary list	Dosage form
17.6 Antispasmodic Medicines			
	Hyoscine butyl bromide	Zinc sulfate	oral solution, 10 mg/5ml in 50- ml bottle
		Drotaverine hydrochloride	tablet, 10 mg, 20 mg; injection, 20 mg/ml in 1-ml ampoule tablet 40/80 mg
18 Hormones, Other Endocrine Medicines and Contraceptives			
18.1 Adrenal Hormones and Synthetic Substitutes			
	Dexamethasone		tablet, 500 mcg; injection, 4 mg/ml dexamethasone phosphate (as sodium phosphate) in 1-ml ampoule powder for injection, 100 mg (as sodium succinate) in vial; tablet, 10 mg, 20 mg tablet, 5 mg, 10 mg tablet, 100 mcg (acetate)
	Hydrocortisone		
	Prednisolone	Fludrocortisone	
18.2 Androgens			
	Testosterone		injection, 200 mg in 1-ml ampoule
18.3 Contraceptives			
18.3.1 Oral Hormonal Contraceptives			
	Ethinylestradiol + Levonorgestrel		tablet, 30 mcg +150 mcg, 20 mcg +1.0 mg.
	Ethinylestradiol + Norethisterone		tablet, 35 mcg + 1.0 mg,
	Levonorgestrel		tablet, 750 mcg (pack of two), 1.5 mg)
18.3.2 Injectable Hormonal Contraceptive			
	Medroxyprogesterone acetate		depot injection, 150 mg / ml in 1-ml vial
18.3.3 Intrauterine Devices			

S.N.	Main list	Complementary list	Dosage form
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	Copper-containing devices		
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18.3.4	Barrier Methods		
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	Condoms		
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18.3.5	Implantable Contraceptives		
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	Hormonal intrauterine device – multiple		
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	advantages		
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	Intrauterine device with progestogen		
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	Levonorgestrel-releasing implant		
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		two-rod levonorgestrel-releasing implant, each rod containing 75 mg of levonorgestrel (150 mg total)	
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18.3.6	Miscellaneous		
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	Ring pessary		
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	Silicon ring pessary		
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18.4	Estrogens		
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	Ethinylestradiol		
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18.5	Insulins and Other Antidiabetic Agents		
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	Gliclazide		
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	Insulin (soluble		
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	Intermediate acting insulin		
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		tablet, 50 mcg	
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		tablet 40,80 mg	
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		injection, 40 IU / ml in 10- ml vial	
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		injection, 40 IU / ml in 10- ml vial (as compound insulin zinc suspension or isophane insulin)	
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		tablet, 500 mg (hydrochloride), 850 mg	
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		tablet, 2.5 mg, 5 mg	
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		tablet, 50 mg (citrate)	
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	Metformin		
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	Glipizide		
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18.6	Ovulation Inducers		
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	Clomifene		
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S.N.	Main list	Complementary list	Dosage form
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18.7 Progestogens

Norethisterone

tablet, 5 mg

Medroxyprogesterone acetate

tablet, 5 mg

18.8 Thyroid Hormones and Antithyroid Medicines

Carbimazole

tablet, 5 mg

Levothyroxine

tablet, 25, 50,75,100 mcg (sodium salt)

Lugol's Iodine

oral solution (Iodine 5%+Potassium iodide 10%)

18.9 Posterior Pituitary Hormone

Desmopressin

injection, 4 mcg/ml; nasal spray 10 mcg / metered spray

19 Immunologicals**19.1 Diagnostic Agents**

Tuberculin, purified protein derivative (PPD)

injection

19.2 Sera and Immunoglobulins

Anti-D immunoglobulin (human)

injection, 250 mcg in single dose vial

Antirabies hyperimmune serum

injection, 1000 IU in 5-ml ampoule

Polyvenum antislake serum

injection in vial

Tetanus antitoxin

injection, 1 000 IU/ml, 3000 IU/ml in vial

Tetanus immunoglobulin (human)

injection, 500 IU in vial

19.3 Vaccines**19.3.1 For Universal Immunization**

BCG

vaccine

S.N.	Main list	Complementary list	Dosage form
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	Diphtheria, Tetanus, Pertussis, Hepatitis B		vaccine
	Diphtheria, Tetanus, Pertussis, Hepatitis B, <i>Haemophilus influenzae</i> type b		vaccine
	Measles		vaccine (live attenuated)
	Poliomyelitis (oral)		vaccine
	Tetanus toxoid		vaccine

19.3.2 For Specific Groups of Individuals

	Diphtheria Antitoxin		vaccine
	Hepatitis A		vaccine
	Hepatitis B		vaccine
	Human papilloma vaccine (HPV)		vaccine
	Influenza		vaccine
	Japanese Encephalitis SA 14-14-2 strain		live attenuated vaccine
	Meningococcal meningitis		vaccine
	Mumps		vaccine
	Pneumococcal		vaccine
	Rotavirus		vaccine
	Rubella		vaccine
	Typhoid		vaccine
	Yellow fever vaccine		vaccine
		Rabies vaccine,	vaccine
		freeze-dried	

S.N.	Main list	Complementary list	Dosage form
20	<i>Muscle Relaxants (Peripherally Acting) and Cholinesterase Inhibitors</i>		
	Neostigmine		tablet, 15 mg (bromide); injection 500 mcg, 2.5 mg (metilsulfate) in 5-ml ampoule
	Pancuronium bromide		injection, 2 mg / ml in 2-ml ampoule
	Suxamethonium chloride		injection, 50mg /ml in 10 vial
	Vecuronium bromide		powder for injection 10 mg in vial
		Atracurium	powder for injection, 25,50, 100 mg injection

21 Ophthalmological, Ear, Nose and Throat Preparations**21.1 Ophthalmological Preparations****21.1.1 Anti-infective Agents**

Aciclovir	ointment, 3%
Fluconazole	0.3% eye drop
Gentamicin	solution (eye drops), 0.3% (sulfate)
	applicap, 1%
Chloramphenicol	eye/ear drops, 0.3% (as hydrochloride); eye ointment, 0.3%
Ciprofloxacin	eye drop 0.3 %
Ofloxacin	eye ointment, 1% (hydrochloride)
Tetracycline	

21.1.2 Anti-inflammatory agents

Prednisolone	solution (eye drops), 0.5%
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21.1.3 Local Anaesthetics

Lidocaine (Lignocaine)	injection, 2%, 4% (topical)
Proparacaine	solution (eye drops), 0.5%

S.N.	Main list	Complementary list	Dosage form
	Zinc oxide		powder
22	<u>Oxytocics and Antioxytocics</u>		
22.1	Oxytocics		
	Methyl ergometrine		injection, 200 mcg (maleate) /ml in ampoule
	Oxytocin		injection, 5 IU/ml in 1-ml ampoule
		Mifepristone*+	tablet, 200mg+200 mcg
		Misoprostol	
	*Combi-pack, containing 1 tablet of mifepristone and 4-tablet of misoprostol. Requires close medical supervision. Approved for abortion services only in listed sites.		
		Misoprostol	tablet, 200 mcg, vaginal tablet, 25 mcg
22.2	Anti-oxytocics		
	Nifedipine		capsule 10 mg injection 0.5 mg/ml
		Terbutaline	
			parenteral solution of appropriate composition
23	<u>Peritoneal Dialysis Solution</u>		
			Intra-peritoneal dialysis solution
24	<u>Psychotherapeutic Medicines</u>		
24.1	Medicines Used in Psychotic Disorders		
	Chlorpromazine		tablet, 50 mg, 100 mg (hydrochloride); oral liquid, 25 mg (hydrochloride) / 5ml;
	Fluphenazine		injection, 25 mg (decanoate or enantate) in 1-ml ampoule.
	Haloperidol		tablet 2 mg, 5 mg; injection, 5 mg in 1-ml ampoule

S.N.	Main list	Complementary list	Dosage form
	Olanzapine		tablet 2.5, 5, 10 mg tablet, 1 mg, 2mg tablet, 10mg, 25mg, 100mg
	Resperidone Thioridazine		
24.2 Medicines Used in Mood Disorders			
24.2.1 Medicines used in depressive disorders	Amitriptyline Fluoxetine		tablet, 10 mg, 25 mg, 75 mg (hydrochloride) capsule or tablet, 20 mg (as hydrochloride)
24.2.2 Medicines Used in Bipolar Disorders	Lithium carbonate		capsule or tablet, 300 mg (sustained release)
24.3 Medicines Used in Generalised Anxiety and Sleep Disorders	Chlordiazepoxide Diazepam Lorazepam		tablet, 10 mg, 25 mg tablet 2 mg, 5 mg tablet, 1, 2 mg
24.4 Medicines Used for Obsessive Compulsive Disorders and Panic Attacks	Clomipramine		capsules, 10 mg, 25 mg (hydrochloride)
24.5 Medicines Used in Substance Dependence Programmes	Methadone*		concentrate for oral liquid, 5 mg/ml, 10 mg/ml (hydrochloride), oral liquid, 5 mg/5ml, 10 mg/5 ml, tablet 5 mg sublingual tablet, 200 mcg

Buprenorphine*
*The medicines should only be used within an established support programme.

S.N.	Main list	Complementary list	Dosage form
		Disulfiram	tablet, 200 mg

25 Medicines Acting on the Respiratory Tract

25.1 Antiasthmatic and Medicines for Chronic

Obstructive Pulmonary Disease

Aminophylline	injection, 25 mg/ml
Epinephrine (Adrenaline)	injection, 1 mg (as hydrochloride or acid tartrate) in 1-ml ampoule.
Hydrocortisone	injection (sodium succinate) 100 mg, 200 mg in vial; tablet, 10 mg
Ipratropium bromide	inhalation, 20 mcg/ dose
Salbutamol	tablet, 2 mg, 4 mg (as sulfate); inhalation 100 mcg/dose, rotacap 200 mcg (as sulfate) per dose; oral liquid, 2mg (as sulfate)/5ml; injection 50mcg /ml in 5-ml ampoule
Beclomethasone	inhalation (aerosol), 50mcg (as dipropionate) per dose

26 Solution Correcting Water, Electrolyte and Acid Base Disturbances

26.1 Oral

Oral rehydration salts

sachet containing: Dextrose, anhydrous 13.5 g, Sodium chloride 2.6 g, Potassium chloride 1.5 g, Trisodium citrate dihydrate 2.9 g, appropriate flavourq.s. Dissolved to produce 1 litre, provides Dextrose 75 mEq, sodium 75 mEq or mmol/l, chloride 65 mEq or mmol/l, potassium 20 mEq or mmol/l, citrate 10 mmol/l and osmolality 245 mOsm/l

S.N.	Main list	Complementary list	Dosage form
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26.2 Parenteral

	Compound solution of Sodium lactate (Ringer's Lactate)		injectable solution
	Glucose		
	Glucose with Sodium chloride		injectable solution, 5% isotonic, 50% hypertonic
	Potassium chloride		injectable solution, 5% glucose, 0.9% sodium chloride injection, 15% in 20ml ampoule
	Sodium chloride		injectable solution, 0.9% isotonic
	Sodium bi-carbonate		injectable solution 7.5 % solution in 10-ml ampoule

26.3 Miscellaneous

	Water for injection		5-ml, 10-ml ampoule
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27 Vitamins and Minerals

	Ascorbic acid		tablet, 500 mg
	Calcium		tablet, 500 mg (Elemental Calcium)
	Calcium gluconate		injection, 100 mg / ml in 10-ml ampoule
	Cynocomalamin		injection 30 mcg/ml
	Ergocalciferol		capsule or tablet, 1.25 mg (50 000 IU) oral solution, 250 mcg/ ml (10000 IU / ml)
	Pyridoxine		tablet, 25 mg (hydrochloride)
	Retinol		tablet (sugar coated), 10000 IU; capsule, 10000 IU, 20000 IU (as palmitate); oral oily solution, 100 000 IU/ ml in multi-dose dispenser; water miscible injection, 100 000 IU (as palmitate) in 2-ml ampoule
	Riboflavin		tablet, 5 mg
	Thiamine		tablet, 100 mg (as hydrochloride)

S.N.	Main list	Complementary list	Dosage form
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28 Specific Medicines for Neonatal Care

28.1 Medicines administered to the neonate

Caffeine citrate

Injection, 20mg/ml (equivalent to 10 mg caffeine base/ml); Oral liquid: 20 mg/ml (equivalent to 10 mg caffeine base/ml)
Solution or gel: 7.1% (digluconate) delivering 4% chlorhexidine (for umbilical cord care)

Chlorhexidine

29 Medicines for Diseases of Joints

29.1. Medicines Used to Treat Gout

Allopurinol

tablet, 100 mg, 300 mg

Colchicine

tablet, 500 mcg

29.2 Disease Modifying Agents Used in Rheumatic

Disorders (DMARDs)

Methotrexate

tablet, 2.5 mg (as sodium salt)

Section III - Appendix 3 Adverse Drug Reaction Reporting Form



SUSPECTED ADVERSE DRUG REACTION REPORTING FORM
(For voluntary reporting of suspected adverse drug reactions by health professionals)
Pharmacovigilance program of Nepal
Department of Drug Administration, Ministry of Health

A. Patient information:

Name (initials) Age/Sex Address (optional)

B. Suspected adverse drug reaction:

Onset (dd/mm/yyyy) / / Recovery (dd/mm/yyyy) / / Complete/partial
Narration of adverse event:

In case of serious adverse event (SAE):

Death / Life-threatening / Hospitalization / Prolongation of hospitalization / Congenital anomaly / Disability / Others (specify)

C. Medications:

Medicines (write suspected medicine first)

Generic/Brand (Manufacturer) Batch no. Dsg form Dose Frequency Starting date Indication Date of stopping/dose reduction

- 1)
- 2)
- 3)
- 4)
- 5)

D. Causality assessment:

Indicate which of the medicines is certain (C), probable (Pr), possible (Po), unlikely (U), unclassified (UI);

Indicate serial no.

1 2 3 4 5

E. Reporter's information:

Doctor/Nurse/Pharmacist Initial
Hospital Contact no. Email

F. Additional information:

Section III - Appendix 4

Contributors

Special Contributors

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IOM : Institute of Medicine

KDC : Kantipur Dental College

MMC : Maharajgunj Medical Campus

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38.	Dr. Saroj Ojha	Psychiatry	TUTH, IOM
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BPKLCOS : BP Koirala Lions Center for Ophthalmic Studies

KDC : Kantipur Dental College

KMCTH : Kathmandu Medical College Teaching Hospital

MCVTC : Manmohan Cardiothoracic & Vascular Transplant Center

NAIHS : Nepal Army Institute of Health Sciences

NAMS : National Academy of Medical Sciences

NCRD : National Center for Rheumatic Diseases

NMA : Nepal Medical Association

NMC : Nepal Medical College

PDC : Peoples Dental College

SBH : Sri Birendra Hospital

TUTH : Tribhuvan University Teaching Hospital

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KMC : Kathmandu Medical College

KUSMS : Kathmandu University School of Medical Sciences

MNC : Maharajgunj Nursing Campus

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DDA : Department of Drug Administration

NML : National Medicine Laboratory

WHO : World Health Organization

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2018

ISBN 978-9937-0-4337-3



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