Formulary
2009-2011

An Essential Medicines Dosing Guide Based on the WHO Model Formulary
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PREFACE

The Mercy Ships Formulary Medicines Book and List is compiled through the collaboration of pharmacy, nursing, medical, surgical and other healthcare volunteers of Mercy Ships, with the collective experience of over 30 years of international humanitarian medical service, through its fleet of hospital ships and at its US International Operations Centre and land bases around the world. First published in 2003, this third edition is based on the recommendations of the World Health Organization (WHO) 16th Model Essential Medicines List 2009 and WHO Model Formulary 2008. The dosing recommendations in this book serve as a guide and should be adjusted according to the needs of the individual patient.

All Medicines listed are Formulary items (F) unless otherwise indicated. Formulary items are critical medicines meant to be consistently available and should not be substituted without prior consultation of the formulary committee. The current Mercy Ships Formulary list (Dec 2009) contains 391 items, of which 336 are F items and 55 are D items (see below). Mercy Ships also advocates the use of generics and purchases F items as far as possible from the International Dispensary Association www.idafoundation.org. In this edition, these medicines are denoted IDA items according to availability on the 2009 IDA Catalogue.

Donation (D) items are donation-dependent medicines which may not be consistently available.

EML items denote medicines listed also on the WHO Essential Medicines List 2009 (Core or Complementary). Currently 60% of the Mercy Ships Formulary list items are WHO EML listed items. For further information on the EML concept see the chapter “Introduction on Essential Medicines” or www.who.int/medicines/.

MSL items are medicines on the Mandatory Sailing List, required by international maritime laws to be on stock in determined quantities during sailing.

N/CD denotes narcotics/controlled drugs and PS denotes psychotropic substances, both requiring specific record keeping and storage according to international laws under the Single Convention on Narcotic Drugs and Psychotropic Substances (1961, 1971 and 1988).
How to use this book ☺☺ -

Because of the diverse backgrounds and experiences of the medical volunteers of Mercy Ships, this book has been produced for the following usage:

1. As a guide on what medicines are generally available with Mercy Ships. Mercy Ships advocates generic prescribing and the use of generics. The trade/brand names mentioned in this book are meant only as examples to help volunteers from trade name prescribing backgrounds and are NOT indicative of the stock on board;

2. As a pocket-size bedside rapid reference for common dosages and administration recommendations. Complete drug monographs are not included, since full references such as the WMF, BNF or product leaflets are available in the wards or offices or surgical theatres, as well as access to Micromedex online. The comment/caution notes in this book are intended to prompt users to read up further when needed;

3. As a basic educational tool providing WHO recommendations and notes on the use of essential medicines. The listing by pharmaceutical categories is intended to enable rapid placement of medicines in therapeutic use and alternatives available. A complete index based on generic name, trade name examples and disease states at the end of the book enables searching by alphabetical order.

A table of conversions and units as well as common abbreviations are included at the end of the book, along with appendices on prescribing in children, pregnancy, breastfeeding and the elderly.

Please forward any feedback and recommendations for additions, deletions and alterations to the current pharmacist or crew physician on board, or directly to the formulary editor at kae.trouilloud@mercyships.org.

All feedback is submitted for consideration by a committee on a six-monthly basis to the formulary list and on a bi-yearly basis to the formulary book.
BIBLIOGRAPHY & ACKNOWLEDGEMENTS

FOR THE 3rd EDITION

The Mercy Ships Formulary Medicines List and Book third edition is built on the experience and advice of the previous editions mentioned below. In addition, I would like to acknowledge the following organisations and individuals for their specific help in this edition.

Again, I thank the World Health Organisation, especially Mr Claude Da Re, Kathleen Susan Hurst and Dr Susanne Hill at the WHO Geneva office, along with the dosage recommendations in the WHO Model Formulary 2008 and the 16th Model Essential Medicines List 2009.

Again, I would like to acknowledge the professional information and discussion of members and moderators of the email list E-DRUG, on essential drugs and its related policies and activities (www.essentialdrugs.org/edrug), sponsored by the global health information network AED-SATELLIFE (www.healthnet.org).

I would also like to acknowledge the help of the International Pharmaceutical Federation www.fip.org through the coordination of Mr Xuan Hao Chan, for the review of this edition of the formulary.

I would like to thank the following Mercy Ships volunteers for their direct help in the review of the 2009 formulary list: On the hospital ship M/V Africa Mercy: pharmacist Miriam Reeve, crew physicians Dr Craig Albrecht and Dr Alan Budd, hospital doctor Dr Wolfgang Edele, chief dental officer Dr Dag Tvedt, hospital manager Bill Martin, ICU nurse Julie Westergaard, optometrist Woody Hopper, radiology technician Erwin Stuka, x-ray technician Linda Vicalvi, lab technologist Sarah Louden, nurse anaesthetist Raymond Broadbent, maxillofacial surgeon & chief medical officer Dr Gary Parker, eye surgeon & senior VP of Health Care Initiatives Dr Glenn Strauss; At the International Operation Centre US medical supplies manager Becky Bynum for advice on procurement, Mila Hightower, Shannon Schott and Jill Paterson for their help in design/printing, Mark Anderson and Jeff Sivers for its availability online at www.mercyships.org.

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I would also like to acknowledge the professional help and advice of Kinko’s Netherlands in Rotterdam, through the coordination and patient perseverance of Nanny Holtkamp, for the printing work and preparation.

Other references for the dosage recommendations of this edition include:

1. The Micromedex Healthcare Series Online with its wide clinical and drug information database (www.micromedex.com), whose access was kindly provided to Mercy Ships.

2. The British National Formulary, 50\textsuperscript{th} edition published September 2005 (www.bnf.org), along with the assistance of Rachel Ryan, Assistant Editor BNF/WMF of the Royal Pharmaceutical Society of Great Britain.

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1. The Drug Formulary 3\textsuperscript{rd} edition of the National University Hospital of Malaysia or HUKM (www.hukm.ukm.my), which provided the format and base for the first edition of this Formulary, along with 6 years of experience in implementation, courtesy of Faridah Yusof and her team at the Pharmacy Department, and resources of its Drug Information Centre.

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Following the example of Jesus, for hope and healing,

Kae Ting Trouilloud
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INTRODUCTION TO ESSENTIAL MEDICINES

From the WHO website http://www.who.int/medicines/:

The Concept of Essential Medicines

Essential medicines are those that satisfy the priority health care needs of the population. Essential medicines are selected with due regard to disease prevalence, evidence on efficacy and safety, and comparative cost-effectiveness. Essential medicines are intended to be available within the context of functioning health systems at all times in adequate amounts, in the appropriate dosage forms, with assured quality, and at a price the individual and the community can afford.

Essential medicines are one of the most cost-effective elements in modern health care and their potential health impact is remarkable. This year alone, there will be over 40 million deaths in developing countries, one-third among children under age five. Ten million will be due to acute respiratory infections, diarrhoeal diseases, tuberculosis, and malaria -- all conditions for which safe, inexpensive, essential drugs can be life-saving. Simple iron-folate preparations can reduce maternal and child mortality from anaemia of pregnancy; treatment of sexually transmitted diseases reduces transmission of the AIDS virus; and treatment of hypertension reduces heart attacks and strokes.

The concept of essential medicines is forward-looking. It incorporates the need to regularly update medicines selections to reflect new therapeutic options and changing therapeutic needs; the need to ensure drug quality; and the need for continued development of better medicines, medicines for emerging diseases, and medicines to meet changing resistance patterns.

Access, Quality and Rational Use of Medicines and Essential Medicines

The economic impact of pharmaceuticals is substantial -- especially in developing countries. While spending on pharmaceuticals represents less than one-fifth of total public and private health spending in most developed countries, it represents 15 to 30% of health spending in transitional economies and 25 to 66% in developing countries. In most low income countries pharmaceuticals are the largest public expenditure on health after personnel costs and the largest household health expenditure. And the expense of serious family illness, including drugs, is a major cause of household impoverishment. Despite the potential health impact of essential drugs and despite substantial spending on drugs, lack of access to essential drugs, irrational use of drugs, and poor drug quality remain serious global public health problems.
Lists of Essential Medicines also guide the procurement and supply of medicines in the public sector, schemes that reimburse medicine costs, medicine donations, and local medicine production. Many international organizations, including UNICEF and UNHCR, as well as nongovernmental organizations and international non-profit supply agencies, have adopted the essential medicines concept and base their medicine supply system mainly on the Model List.

The WHO Model List of Essential Medicines

When WHO published the first Model List of Essential Drugs in 1977, it identified 208 individual medicines which together could provide safe, effective treatment for the majority of communicable and non-communicable diseases.

The Model List is a guide for the development of national and institutional essential medicine lists. It was not designed as a global standard. However, for the past 28 years the Model List has led to a global acceptance of the concept of essential medicines as a powerful means to promote health equity. By the end of 1999, 156 Member States had official essential medicines lists, of which 127 had been updated in the previous five years. Most countries have national lists and some have provincial or state lists as well. National lists of essential medicines usually relate closely to national guidelines for clinical health care practice which are used for the training and supervision of health workers.

Current List

The 14th is the current Model List of Essential Medicines, prepared by the WHO Expert committee in March 2005. It contains 312 individual medicines, including antiretroviral medicines for the prevention and treatment of HIV-AIDS. The Mercy Ships Formulary 2006-2007 is based on this list, and medicines from the Model List are noted in the Ships Formulary by the abbreviation ‘EML’.

Advantages

Careful selection of a limited range of essential medicines results in a higher quality of care, better management of medicines (including improved quality of prescribed medicines), and more cost-effective use of health resources. Numerous studies have documented the impact of clinical guidelines and lists of essential medicines on the availability and proper use of medicines within health care systems. All of this is even more important in resource-poor settings where the availability of drugs in the public sector is often erratic. Under such circumstances measures to ensure a regular supply of essential medicines will result in real health gains and in increased public confidence in the health services.
Selection Criteria for Essential Medicines

Which treatment is recommended and which medicines are selected depend on many factors, such as the pattern of prevalent diseases, treatment facilities, the training and experience of available personnel, financial resources, and genetic, demographic and environmental factors. The following criteria are used by the WHO Expert Committee on the Selection and Use of Essential Medicines:

- Only medicines for which sound and adequate evidence of efficacy and safety in a variety of settings is available should be selected.

- Relative cost-effectiveness is a major consideration for choosing medicines within the same therapeutic category. In comparisons between medicines, the total cost of the treatment – not only the unit cost of the medicine – must be considered, and be compared with its efficacy.

- In some cases, the choice may also be influenced by other factors such as pharmacokinetic properties or by local considerations such as the availability of facilities for manufacture and storage.

- Each medicine selected must be available in a form in which adequate quality, including bioavailability, can be ensured; its stability under the anticipated conditions of storage and use must be determined.

- Most essential medicines should be formulated as single compounds. Fixed dose combination products are selected only when the combination has a proven advantage in therapeutic effect, safety, and adherence; or in decreasing the emergence of drug resistance in malaria, tuberculosis and HIV/AIDS.
Introduction from the WHO Model Formulary 2008:

In 1995 the WHO Expert Committee on the Use of Essential Drugs recommended that WHO develop a Model Formulary which would complement the *WHO Model List of Essential Drugs* (the ‘Model List’). It was considered that such a Model Formulary would be a useful resource for countries wishing to develop their own national formulary. The first edition of the Model Formulary was issued in August 2002; it was based on the 12th Model List (revised 2002).

In this edition, we have revered to the structure and sections used in the Model List. Although this may not always reflect ideal therapeutic categories, it has been done as part of the process of updating the entire WHO Medicines Library, which now has one interlinked structure that includes the formulary information as well as other information about the medicines. Countries or organizations which choose to adapt the formulary for their own purposes may wish to reorder the structure to suit their needs. The Model List and the Model Formulary are available electronically on the WHO Essential Medicines Library web site ([http://healthtech.who.int/emlib/](http://healthtech.who.int/emlib/)); search facilities provide easy access to relevant information.

The electronic version of the Model Formulary is also available on CD-ROM, intended as a starting point for developing national or institutional formularies. National or institutional committees can use the text of the Model Formulary for their own needs by adapting the text, or by adding or deleting entries to align the formulary to their own list of essential medicines.

This edition of the Model Formulary is fully compatible with the 15th WHO Model List of Essential Medicines as recommended by the WHO Expert Committee on the Selection and Use of Essential Medicines at its meeting of March 2007.

Comments and suggestions for corrections or changes are very welcome and should be sent to:

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PRESCRIPTION WRITING GUIDELINES

As a volunteer with Mercy Ships, you may from time to time be puzzled by the flurry of different brand names for medicines in stock on board (with patient information leaflets in unknown-to-you languages); the various dosage regimens due to different medical experiences, as well as seemingly unknown codes and abbreviations used in prescriptions. Do not fear, help is near ☺!

The Mercy Ships motto: IF IN DOUBT, ASK!

Whilst the legal responsibility for prescribing lies with the doctor who signs the prescription, note that in many countries the pharmacist/dispenser shares liability and responsibility in preventing harm to the patient.

In Mercy Ships, computer generated prescriptions or standing orders may be used. In such cases the prescriber must be clearly identified, the prescription clearly printed and any username and password safe guarded to avoid abuse.

All prescriptions must include the following information:

- **Prescriber Name**, with contact details (perhaps incorporated as header/footer of prescription);
- **Date** of prescription;
- **Patient Name** and/or **registration number (R/N)**,
  **Date of Birth** and/or **Age**, especially for children under 12 yo and elderly over 75 yo;
- **Approved medicine name** (avoid abbreviations, prefer generic name, see details below);
- **Dosage strength** (with appropriate units, see details below);
- **Route of administration** or **dosage form** e.g. tablet;
- **Frequency of administration** or **dosing interval** e.g. three times a day or every 6 hours;
- **Duration of therapy** or **duration of supply**;
- **Signature and initials of prescriber**.

When prescribing narcotics/controlled drugs, the strength, directions and the quantity of the controlled drug to be dispensed should be stated clearly, with all quantities written in words as well as in figures to prevent alteration. Other details such as patient particulars and date should also be filled in carefully to avoid alteration (WHO recommendation).
PRESCRIPTION WRITING – POINTS TO NOTE:

- Please prescribe using **generic names** at all times. Please keep in mind that brand names often differ widely in different countries for the same medicine, so brand name prescribing can only lead to confusion at best and dispensing/dosing errors at worst. Unless otherwise specified, generically equivalent brand will be dispensed for medication ordered by proprietary (brand) name.

- Please **state frequency of administration or dosing intervals clearly** e.g. “3 times daily”, avoiding abbreviations like “tds” or “1-1-1”.

**NOTE:** In the UK, the abbreviation 'QD' may mean 4 times a day (as well as QDS or QID). In the US it may be interpreted as “once a day”. In some countries, 1-1-1 means three times daily. 1-0-0 means take one in the morning; 1/2-1/2-0 means half in the morning, half at noon; 1-0-0-1 means take one in the morning, one at night before going to bed. 1-X-1 may mean 1 in morning and 1 in night (X stands for no drugs in between), or 0-0-0 may be used to denote three tablets in a day (0 symbolises for a tablet). Please see the chapter ‘Abbreviations’ at the end of the book for other prescribing shorthand in use.

- Avoid unnecessary use of **decimal points** e.g. 3mg, not 3.0mg. If unavoidable, a zero should be written in front of the decimal point where there is no other figure, e.g. 0.5ml, not .5ml.

- Quantities of 1 gram or more should be written 1g etc. Quantities less than 1 gram should be written in milligrams e.g. 500mg, not 0.5g. Quantities less than 1mg should be written in micrograms (spelt fully instead of ‘mcg’), or as ‘ug’; e.g. 100 micrograms or 100ug, not 0.1mg.

- ‘Millilitre’ (ml) is used in medicine and pharmacy. Avoid cubic centimetre (c.c. or cm$^3$). If ‘litre’ is used, spell it fully or use capital ‘L’ to avoid confusion with the number ‘1’.

- Dose and dose frequency should be stated. Avoid ‘prn’, ‘as required’, ‘take as directed’ or ‘take as before’, otherwise a minimum dose interval should be specified with, where relevant, the maximum daily dose. It is good practice to qualify such prescriptions with the purpose of the medication e.g. ‘every 6 hours as required for pain’, ‘at night as required to sleep’.

- The names of drugs/preparations should be written clearly and NOT abbreviated. For example, ‘AZT’ may be confused as zidovudine or azathioprine. ‘Nanograms’ and ‘units’ should not be abbreviated.

WHO MODEL FORMULARY 2008 NOTES (edited):

ADHERENCE (COMPLIANCE) WITH DRUG TREATMENT

It is often assumed that once the appropriate drug is chosen, the prescription correctly written and the medication correctly dispensed, that it will be taken correctly and treatment will be successful. Unfortunately this is very often not the case, and physicians overlook one of the most important reasons for treatment failure—poor adherence (compliance) with the treatment plan.

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. Failure to adhere with such a prescription has been described as ‘intelligent non-compliance’. 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. Factors may be related to the patient, the disease, the doctor, the prescription, the pharmacist or the health system and can often be avoided.

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, e.g. 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 counselling and helping the patient.
- Involve the partner or another family member.
- Listen to the patient.

[For full notes please refer to the WHO Model Formulary 2008.]
1 GASTROINTESTINAL SYSTEM

1.01 ANTACIDS, ANTIULCER MEDICINES

WHO MODEL FORMULARY 2008 NOTES:

DYSPEPSIA & PEPTIC ULCER. [Edited] Patients with non-ulcer dyspepsia & peptic ulceration (involving the stomach, duodenum and lower oesophagus) should be advised to avoid smoking, alcohol and aggravating foods, and to eat small regular meals to aid digestion. Consider possibility of malignant disease in all patients over 40 years old. Gastric and duodenal ulcers are healed by 4–8 weeks treatment with H₂-receptor antagonists but there is a high rate of relapse (greater than 70% over 2 years) requiring maintenance therapy. Relapses can be prevented very successfully by eradicating Helicobacter pylori which is causally associated with most peptic ulcers (except those related to NSAID use). Eradication of H. pylori reduces the relapse rate to about 4-8%. This is undoubtedly cost-effective compared to the alternatives of long-term maintenance therapy with low-dose H₂-receptor antagonists or repeated treatment of recurrent ulcers. It is recommended that the presence of H. pylori is confirmed before starting eradication treatment, particularly for gastric ulcers. The urea breath test is used widely to test for H. pylori, but it may produce false negative results if used soon after proton pump inhibitors or antibacterials. [See Section below for a regimen example; consult local/national guidelines as well].

NSAID-ASSOCIATED ULCERS. Gastrointestinal bleeding and ulceration may occur with NSAID use. Stop NSAID use if possible, if not consider a proton pump inhibitor for protection against NSAID-associated gastric and duodenal ulcers (or an H₂-receptor antagonist, but effective for protection against NSAID-associated duodenal ulcers only). Patients who must continue NSAID therapy after ulcer development may take high-dose H₂-receptor antagonists concomitantly (but healing is slower). A proton-pump inhibitor e.g. omeprazole is more effective but more expensive. In patients who can discontinue NSAID therapy after ulcer development, treat with an H₂-receptor antagonist (may need to treat up to 8 weeks), or a proton pump inhibitor (more rapid healing). After healing, continued prophylaxis is required.

GASTRO-OESOPHAGEAL REFLUX DISEASE (GORD). Symptoms include heartburn, acid regurgitation, sometimes difficulty in swallowing (dysphagia); oesophageal inflammation (oesophagitis), ulceration, stricture formation and there is an association with asthma. Management includes drug treatment, lifestyle changes and sometimes surgery. Treat according to severity of symptoms and adjust to response [mild – antacids, moderate – H₂-receptor antagonist, severe - proton-pump inhibitor (short course)].
1.01a **Antacids**

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Aluminium Magnesium Complex Tab 400mg &amp; 800mg, Gel Sachet 800mg/10g (Magaldrate)</td>
<td>MSL</td>
<td><em>By mouth</em> Adult 400-800mg 3 times daily (chew tab with a glass of water or dilute sachet as indicated), when needed between meals and at bedtime, max 2g/DAY.</td>
</tr>
<tr>
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<td>EML</td>
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<tr>
<td>Aluminium Hydroxide 66mg/ Magnesium Carbonate 27.5mg per ml Liquid</td>
<td>MSL IDA</td>
<td><em>By mouth</em> Adult 10ml up to 3 times daily.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Magnesium Carbonate 80mg /Calcium Carbonate 680mg Tab (Rennie’s Antacid)</td>
<td>MSL</td>
<td><em>By mouth</em> adult 1-2 tablets to be sucked or chewed, max 16 tablets daily, between meals and at bedtime. Child 6-12 yo, one tablet taken as above, max 8 tablets daily. Not recommended for child &lt; 6 yo.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Magnesium Trisilicate Compound Tab - Magnesium Trisilicate 250mg/ Aluminium Hydroxide 120mg</td>
<td>MSL IDA</td>
<td><em>By mouth</em> adult 1-2 tablets to be sucked or chewed, when needed.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **Adverse effects:** Magnesium salts may cause diarrhoea and Aluminium salts may cause constipation.
- **Antacids** may interfere with absorption of other drugs and should preferably not be taken at the same time with the following (list not exclusive): azithromycin, bisphosphonates, captopril, cefaclor, chloroquine, digoxin, dipyridamole, enalapril, fexofenadine, iron (oral), isoniazid, itraconazole, ketoconazole, lithium, nitrofurantoin, phenothiazines (e.g. prochlorperazine), phenytoin, proguanil, quinidine, quinolones (e.g. ciprofloxacin), rifampicin, tetracyclines; they may also damage enteric coatings of tablets.
### 1.01b H₂-ANTAGONISTS, PROTON PUMP INHIBITORS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Omeprazole Cap 20mg (Losec/Mopral)</td>
<td>IDA</td>
<td>Benign gastric/duodenal ulcers and reflux oesophagitis not responding to H₂ antagonist or NSAID-associated: <em>By mouth</em> adult 20mg once daily, max 40mg daily, for at least 4 weeks for duodenal ulcers, or for 8 weeks for gastric ulcers/reflux oesophagitis. <em>Helicobacter pylori</em> eradication (with adjunct antibiotics, see Comment): 20mg twice daily for one week.</td>
</tr>
<tr>
<td>Proton Pump Inhibitor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ranitidine Tab 150mg, Oral Solution 75mg/5ml, Injection 50mg/2ml (Azantac/Zantac/Raniplex)</td>
<td>MSL IDA</td>
<td>Benign gastric/duodenal ulceration, reflux oesophagitis: <em>By mouth</em> adult 150mg twice daily or 300mg at night for 4-8 weeks, max in duodenal ulcer 300mg twice daily for 4 weeks; maintenance, 150 mg at night. Oral liquid for child use, 2-4mg/kg twice daily, max 300mg/DAY. <em>By IM inj</em>, Adult 50 mg every 6-8 hours or <em>by slow IV inj</em>, 50 mg diluted to 20 ml and given over at least 2 minutes, may be repeated every 6-8 hours or <em>by IV infusion</em> 25mg/hour for 2 hours may be repeated every 6-8 hours. Prophylaxis of stress ulceration: Adult initial <em>slow IV inj</em> 50 mg diluted to 20 ml and given over at least 2 minutes <em>then by continuous IV infusion</em>, 125–250 micrograms/kg per hour (may be followed by 150 mg twice daily <em>by mouth</em> when oral feeding commences).</td>
</tr>
</tbody>
</table>

### COMMENT/CAUTIONS:
- **HELICOBACTER PYLORI**: Nearly all duodenal ulcers and most gastric ulcers not associated with NSAIDs are caused by *Helicobacter pylori*. Suggested one week eradication regimen for adults (WHO): Omeprazole 20mg twice daily + Amoxicillin 500mg 3 times daily + Metronidazole 400mg 3 times daily.
## 1.02 ANTIEMETICS

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<th>GENERIC (TRADE) NAME</th>
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</table>
| **Cinnarizine Tab 15mg**  
(Stugeron)  
Antihistamine | | Antiemetic: *By mouth* Adult 30mg, 5-12 yo 15mg, up to 3 times daily. Motion sickness: *By mouth* Adult 30mg 2 hours before travel/sail then 15mg every 8 hours if necessary, child 5-12 yo 15mg 2 hours before travel/sail then 7.5mg every 8 hours during journey if needed. |
| **Meclozine Tab 25mg**  
[Meclizine]  
Antihistamine | | Antiemetic: *By mouth* Adult 25-50mg daily, Child > 12 yo 25mg daily. Motion sickness: *By mouth* Adult 25-50mg once daily, taken 1 hour before travel/sail. |
| **Metoclopramide HCl Tab 10mg,**  
Suspension 5mg/5ml,  
Injection 10mg/2ml,  
Suppository 5mg & 10mg  
(Maxolon/Anausin/Primperan)  
Motility Stimulant | IDA | By oral/IM/IV/rectal routes: Gastroesophageal reflux/antiemetic, Adult 10mg 3 times daily (5mg in 15-19 yo and <60kg); Child < 1yo (<10kg) 1mg twice daily; 1-3 yo (10-14kg) 1mg 2-3 time daily; 3-5 yo (15-19kg) 2mg 2-3 time daily; 5-9 yo (20-29kg) 2.5mg 3 time daily; 9-14 yo (30kg+) 5mg 3 times daily; max 0.5mg/kg/DAY. Aid to gastrointestinal intubation or diagnostic procedures, a single dose 5-10 minutes before examination: Adult 10-20mg (10mg in 15-19 yo); Child < 3 yo 1mg, 3-5 yo 2mg, 5-9 yo 2.5mg, 9-14 yo 5mg.  
Inject IM undiluted into a large muscle mass; inject IV undiluted slowly over 2 minutes. IV infusion dilute 10mg with 50ml of D5/NS/RL and infuse over 15-30 minutes (max 5mg/minute at conc 0.2-5mg/ml). |

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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Prochlorperazine Maleate Tab 5mg (Stemetil)</td>
<td>MSL</td>
<td>Acute nausea/vomiting: <strong>By mouth</strong> Adult 20mg initially, then 10mg after 2 hours. Prevention: Adult 5-10mg 2-3 times daily; Child &gt; 10kg 250 micrograms/kg given 2-3 times daily.</td>
</tr>
<tr>
<td>Phenothiazine</td>
<td>EML</td>
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<tr>
<td>Promethazine HCl Tab 25mg (Phenergan) Antihistamine</td>
<td>IDA</td>
<td>Motion sickness: <strong>By mouth</strong> Adult 25mg 0.5-1 hour before travel/sail, repeat 8-12 hours after as needed, then 25mg twice daily on succeeding days of travel/sailing as needed; Child 5-10 yo half adult dose.</td>
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<td>EML</td>
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**COMMENT/CAUTIONS:**

- Antiemetic treatment is best administered prophylactically at least 30 minutes before the emetic stimulus. Parenteral/rectal preps may be useful if vomiting has started. Give at the very beginning of a migraine attack to relieve nausea.
- Routine pre-op use of antiemetics is not justified except in patients with history of post-op nausea/vomiting, or where emesis would endanger the result of surgery or harm the patient.
- Vertigo is often a self-limiting condition, and more commonly caused by drug therapy rather than treated by medications.
- **Metoclopramide** and **phenothiazines** may induce extrapyramidal side effects such as acute dystonic reactions with facial and skeletal muscle spasms and oculogyric crises. These are more common in the young (esp. females) and the very old. They occur soon after starting treatment and subside within 24 hours of stopping the medicine. Although **metoclopramide** is preferred when sedation is not required, restrict its use in under 20 yo for severe intractable vomiting of known cause, radio/chemotherapy, aid to gastrointestinal intubation, and as premedication, dose based on body weight.
- Motion sickness/Seasickness treatment: **Cinnarizine** is generally slightly less sedating and **promethazine** may be preferred if a sedating effect is desired.
1.03 ANTIHAEMORROIDALS

<table>
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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Antihaemorrhoidal Suppository (various)</td>
<td>MSL IDA</td>
<td>Adult insert one suppository into the rectum at night and/or in the morning, and/or after a bowel movement; please refer to product leaflets of current options in stock.</td>
</tr>
<tr>
<td>Antihaemorrhoidal Ointment (various)</td>
<td>MSL IDA</td>
<td>Adult apply 2-3 times daily; please refer to product leaflets of current options in stock.</td>
</tr>
</tbody>
</table>

COMMENT/CAUTIONS:
- Suppositories containing steroid should be for short-term use unless otherwise indicated.
- Haemorrhoids are enlarged or varicose veins of the tissues at the anus or rectal outlet. They are the most frequent cause of rectal bleeding, other symptoms (also for fistulas & proctitis) include anal and perianal pruritus, soreness and excoriation. Careful local toilet with attention to any minor faecal soiling, dietary adjustments and using bran for example may be helpful.

1.04 ANTISPASMODICS

<table>
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<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Hyoscine N-Butylbromide Tab 10mg &amp; Inj 20mg/ml (Buscopan) [Butylscopolamine]</td>
<td>MSL IDA</td>
<td>Acute spasm or spasm in diagnostic procedures: By IM/IV inj Adult 20mg, repeated after 30 minutes if needed. By mouth Adult 20mg 4 times daily, Child 6-12 yo 10mg 3 times daily. Inject IM 20mg undiluted into a large muscle mass or dilute 20mg with D5/NS and inject IV slowly.</td>
</tr>
</tbody>
</table>

COMMENT/CAUTIONS:
- Consider dietary modification/counselling as primary treatment of irritable bowel syndrome (IBS). Antispasmodics may be useful adjuncts as smooth muscle relaxants in dyspepsia, IBS and diverticular disease.

Cont. next page
COMMENT/CAUTIONS (CONT.):

- **Adverse effects**: Constipation, dry mouth, urinary retention, blurred vision. Use cautiously in Down's syndrome, children and elderly, reflux oesophagitis, diarrhoea, ulcerative colitis, acute myocardial infarction, hypertension, tachycardia, pyrexia, pregnancy and breast-feeding.
- **Contraindications**: Closed angle glaucoma, myasthenia gravis, paralytic ileus, pyloric stenosis and prostatic enlargement.

### 1.05 LAXATIVES

**WHO MODEL FORMULARY 2008 NOTES:**

A balanced diet with adequate fluid intake and fibre is of value in preventing constipation. Before prescribing laxatives, it is important to be sure that the patient is constipated and that the constipation is not secondary to an underlying undiagnosed complaint. It is also important that the patient understands that bowel habit can vary considerably in frequency without doing harm. For example some people consider themselves constipated if they do not have a bowel movement each day. A useful definition of constipation is the passage of hard stools less frequently than the patient’s own normal pattern and this should be explained to the patient since misconceptions about bowel habits have led to excessive laxative use which in turn has led to hypokalaemia.

Laxatives should generally be avoided except where straining will exacerbate a condition such as angina or increase the risk of rectal bleeding as in haemorrhoids. Laxatives are of value in drug-induced constipation, for the expulsion of parasites after anthelminthic treatment and to clear the alimentary tract before surgery and radiological procedures. Prolonged treatment of constipation is rarely necessary except occasionally in the elderly.

There are many different laxatives. These include **bulk-forming laxatives** which relieve constipation by increasing faecal mass and stimulating peristalsis, **stimulant laxatives** which increase intestinal motility and often cause abdominal cramp, **faecal softeners** which lubricate and soften impacted faeces and **osmotic laxatives** which act by retaining fluid in the bowel by osmosis. **Bowel cleansing solutions** are used before colonic surgery, colonoscopy or radiological examination to ensure that the bowel is free of solid contents; they are **not** a treatment for constipation.
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<th>GENERIC (TRADE) NAME</th>
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| Bisacodyl Tab 5mg (Dulcolax)  
(onset 10-12 hours)  
Stimulant laxative | IDA | Constipation: *By mouth* Adult 5-10mg at night, max 20mg; Child < 10 yo 5mg at night. |
| Bisacodyl Suppository 10mg  
(Dulcolax/Fleet Bisacodyl)  
(onset 20-60 minutes)  
Stimulant laxative | EML | Constipation or VVF patient: Adult insert one 10mg suppository *into the rectum* in the morning or as needed. |
| Fibre, Ispaghula/Psyllium Husk Powder  
(Metamucil)  
(onset 12-24 hours)  
Bulk-forming laxative | MSL | *By mouth,* Adult/Child > 12 yo, 1 rounded teaspoonful (12g) mixed in around 250ml (1 glass) of water, taken 1-3 times daily; 6-12 yo, half adult dose above in 250ml of water, up to 3 times daily. Note: not suitable for VVF patients. |
| Glycerol BP Suppository 4g  
[Glycerin]  
(onset 15-30 minutes)  
Stimulant laxative | EML | To promote faecal evacuation: Adult insert one suppository *into the rectum* in the morning or as needed, retained for at least 15 minutes. |
| Lactulose Liquid 3.35g/5ml  
(Duphalac)  
(onset may take up to 48 hours)  
Osmotic laxative | MSL | Constipation: *by mouth* Adult 15-30ml twice daily for at least 2-3 days; Child <1 yo 2.5ml, 1-5 yo 5ml, 5-10 yo 10ml, taken twice daily. VVF patients 15-30ml twice daily. |
| Sodium Phosphate Oral Saline Solution, 45ml  
(Fleet Phospho-Soda Oral)  
(onset 30 minutes-6 hours)  
Osmotic laxative  
Contains 217mmol Na per 45ml. | MSL | Bowel-cleansing solution: *By mouth,* Adult/Child > 15 yo 45ml diluted with half a glass of water (120ml), followed by one full glass of water (240ml). For morning procedure, give first dose at 7a.m. and second dose at 7 p.m. on day before procedure. For afternoon procedure, give first dose at 7 p.m. day before and next dose at 7 a.m. on day of procedure. |
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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Sodium Phosphate Rectal Enema Solution, 133ml (Fleet Phosphates Enema) [onset 2-5 minutes] Osmotic laxative</td>
<td>Rectal use, note 133ml pack delivers 118ml dose; Adult/Child &gt; 12 yo 118ml, child 3-12 yo on doctor’s advice only, see product leaflet for detail, give on day of surgery.</td>
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</tr>
<tr>
<td>Senna Tablets (total sennosides content 7.5mg) (Senokot) [onset 8-12 hours] Stimulant laxative</td>
<td>Constipation: By mouth Adult 2-4 tablets usually at night; initial dose should be low then gradually increased, max 4 tabs twice daily; Child (on doctor’s advice only) 2-6 yo half a tablet once daily, max 1 tab twice daily; 6-12 yo 1 tab once daily, max 2 tabs twice daily.</td>
<td>EML</td>
</tr>
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**COMMENT/CAUTIONS:**
- Constipation may be defined as the passage of hard stools less frequently than the patient’s own normal pattern. Drug therapy should only be used where dietary changes were insufficient (see WHO notes above).
- **Lactulose** takes 1-3 days to take effect, counsel patients to take regularly for at least 3 days for constipation treatment.
- **Bulk-forming laxatives** MUST be taken with plenty of water to avoid obstruction. They are NOT suitable for acute relief. Contraindication: gastrointestinal obstruction, colonic atony and faecal impaction.
- **Stimulant laxatives** may cause abdominal cramps, avoid if there is intestinal obstruction. Prolonged use may precipitate atonic colon and hypokalaemia.
- **DRUG-INDUCED CONSTIPATION.** The following drugs commonly cause constipation: calcium antagonists, anticholinergics, iron, opioid analgesics, phenothiazine/tricyclic antidepressants. Laxatives should be routinely prescribed for all patients on regular opiate therapy e.g. morphine.
- **VVF patients:** Note that Lactulose is the drug of choice for VVF patients; see current standing orders and current guidelines for dosing.
1.06 MEDICINES USED IN DIARRHOEA

TREATMENT OF DEHYDRATION: WHO RECOMMENDATIONS

Replacement of fluid and electrolytes orally can be achieved by giving oral rehydration salts (ORS)—solutions containing sodium, potassium, citrate and glucose. [Note: WHO 2008 recommends zinc supplements for diarrhoea treatment in children but as zinc is not on the Mercy Ships list, WHO 2006 notes are used here.] Acute diarrhoea in children should be treated with ORS as below:

Plan A: no dehydration. Nutritional advice and increased fluid intake are sufficient (soup, rice, water and yoghurt, or even water). For infants aged under 6 months who have not yet started taking solids, oral rehydration solution must be presented before offering milk. Mother’s milk or dried cow’s milk must be given without any particular restrictions. In the case of mixed breast-milk/formula feeding, the contribution of breastfeeding must be increased.

Plan B: moderate dehydration. Whatever the child’s age, apply a 4-hour treatment plan to avoid short-term problems. Show parents how to give approximately 75 ml/kg of oral rehydration solution with a spoon over a 4-hour period, and it is suggested that parents should be watched to see how they cope at the beginning of the treatment. A larger amount of solution can be given if the child continues to have frequent stools. In case of vomiting, rehydration must be discontinued for 10 minutes and then resumed at a slower rate (about one teaspoonful every 2 minutes). The child’s status must be re-assessed after 4 hours to decide on the most appropriate subsequent treatment. Oral rehydration solution should continue to be offered once dehydration has been controlled, for as long as the child continues to have diarrhoea.

Plan C: severe dehydration. Hospitalization is necessary, but most urgent priority is to start rehydration. In hospital (or elsewhere), if the child can drink, oral rehydration solution must be given pending, and even during, intravenous infusion (20 ml/kg every hour by mouth before infusion, then 5 ml/kg every hour by mouth during intravenous rehydration).

For intravenous supplementation, it is recommended that compound solution of sodium lactate (or, if this is unavailable, sodium chloride 0.9% intravenous infusion) is administered at a rate adapted to the child’s age (infant under 12 months: 30 ml/kg over 1 hour then 70 ml/kg over 5 hours; child over 12 months: the same amounts over 30 minutes and 2.5 hours respectively). If the intravenous route is unavailable, a nasogastric tube is also suitable for administering oral rehydration solution, at a rate of 20 ml/kg every hour. If the child vomits, the rate of administration of the oral solution should be reduced. Reassess the child’s status after 3 hours (6 hours for infants) and continue treatment as appropriate with plan A, B or C.
The solution may be prepared either from prepackaged sugar/salt mixtures or from bulk substances and water. Solutions must be freshly prepared, preferably with recently boiled and cooled water. Accurate weighing and thorough mixing and dissolution of ingredients in the correct volume of clean water is important. Administration of more concentrated solutions can result in hypernatraemia.

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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Loperamide Cap 2mg (Imodium)</td>
<td>MSL</td>
<td><strong>By mouth</strong> Adult 4mg followed by 2mg after each loose stool, max 16mg/DAY max 5 days.</td>
</tr>
<tr>
<td>Oral Rehydration Salts (ORS) WHO new standard: NaCl 2.6g, trisodium citrate 2.9g, KCl 1.5g, glucose anhydrous 13.5g, per litre (L) of clean water.</td>
<td>MSL</td>
<td>Dilute OR salts with one litre of clean water (see notes above), give by mouth according to patient needs, usually adult 200-400ml after each loose stool (or 20-40ml/kg/DAY). Infant &amp; Child refer above to Plans A, B or C for recommendations first, usually Child 200ml after each loose stool, Infant 1-1.5 times of the usual feed volume after each loose stool (or 100-150ml/kg/DAY).</td>
</tr>
<tr>
<td>alternative: sucrose (common sugar) 27g (5-6 teaspoonfuls), sodium bicarbonate 2.5g (half teaspoon), per litre clean water. or 1 teaspoon salt, 8 teaspoons sugar per litre clean water.</td>
<td>EML</td>
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**COMMENT/CAUTIONS:**

- First line treatment in acute diarrhoea is management of fluid and electrolyte depletion – drug therapy is thus NOT indicated in ACUTE DIARRHOEA.
- Bloody diarrhoea is usually a sign of invasive enteric infection and should be treated with an appropriate anti-infective agent.
- Diarrhoea persisting for longer than a month is known as chronic diarrhoea. A mild malabsorption syndrome, tropical enteropathy, is apparent in most healthy indigenous populations of tropical countries. However the majority of cases of chronic diarrhoea have non-infectious causes including gluten-sensitivity, inherited metabolic disorders or inflammatory bowel disease.
- **Loperamide** should be avoided in young children, and when paralytic ileus is present or when abdominal distension develops, and in acute ulcerative colitis or pseudomembranous colitis associated with broad spectrum antibiotics. Discontinue use if no clinical improvement is observed within 48 hours in patients with acute diarrhoea.

NOTE. For Throat and Mouth Preparations, see Chapter 10 Ear, Nose & Throat.
2 CARDIOVASCULAR SYSTEM

2.01 DIURETICS

WHO MODEL FORMULARY 2008 NOTES:

Diuretics increase urinary excretion of water and electrolytes and are used to relieve oedema associated with heart failure, nephrotic syndrome or hepatic cirrhosis. Some diuretics are used at lower doses to reduce raised blood pressure. Osmotic diuretics are mainly used to treat cerebral oedema, and also to lower raised intraocular pressure. Most diuretics increase urine volume by inhibiting the reabsorption of sodium and chloride ions in the renal tubule; they also modify renal handling of potassium, calcium, magnesium and urate. Osmotic diuretics act differently; they cause an increase in urine volume by an osmotic effect. Although loop diuretics are the most potent their duration of action is relatively short, whilst thiazide diuretics are moderately potent but produce diuresis for a longer period. Potassium-sparing diuretics have a relatively weak diuretic effect. Carbonic anhydrase inhibitors are weak diuretics which are rarely used for their diuretic effect and are principally used to lower intraocular pressure in glaucoma (See Chapter 09 Eye Section 9.03 Miotics & Antiglaucoma Meds).

LOOP DIURETICS. Loop diuretics or high-ceiling diuretics, such as furosemide, are the most potent and rapidly produce an intense dose-dependent diuresis of relatively short duration. Oral furosemide produces diuresis within 30-60 minutes of administration, with max diuretic effect in 1-2 hours. The diuretic action lasts for 4-6 hours. IV furosemide produces diuresis with in 5 minutes, with the maximum diuretic effect in 20–60 minutes and diuresis complete within 2 hours.

Loop diuretics inhibit reabsorption from the ascending loop of Henlé in the renal tubule and are useful, particularly in situations where rapid and effective diuresis is needed such as reduction of acute pulmonary oedema due to left ventricular failure. They are also used to treat oedema associated with renal and hepatic disorders and are used in high doses in the management of oliguria due to chronic renal insufficiency. Loop diuretics may be effective in patients unresponsive to thiazide diuretics. Because of their shorter duration of action, the risk of hypokalaemia may be less with loop diuretics than with thiazide diuretics; if required, potassium-sparing diuretics may be used for prevention of hypokalaemia. Loop diuretics may cause hypovolaemia and excessive use can produce severe dehydration with the possibility of circulatory collapse. Furosemide may cause hyperuricaemia and precipitate attacks of gout. Rapid high-dose injection or infusion of furosemide may cause tinnitus and even permanent deafness.
THIAZIDE DIURETICS. Thiazide diuretics, such as hydrochlorothiazide, are moderately potent and act by inhibiting sodium and chloride reabsorption at the beginning of the distal convoluted tubule. They produce diuresis within 1-2 hours of oral administration and most have a duration of action of 12-24 hours.

Thiazide diuretics are used in the management of oedema associated with mild to moderate congestive heart failure, renal dysfunction or hepatic disease (but not effective in poor renal function with creatinine clearance of less than 30 ml per minute). In severe fluid retention a loop diuretic may be necessary. In hypertension, a thiazide diuretic is used at a low dose to lower blood pressure with very little biochemical disturbance; the maximum therapeutic effect may not be seen for several weeks. Higher doses should not be used because they do not necessarily increase the hypotensive response but may cause marked changes in plasma potassium, magnesium, uric acid, glucose and lipids. If a thiazide alone does not lower blood pressure adequately, it may be combined with another antihypertensive such as a beta-adrenoceptor antagonist. Urinary excretion of calcium is reduced by thiazide diuretics and this property is occasionally utilized in the treatment of idiopathic hypercalciuria in patients with calcium-containing calculi. Paradoxically, thiazide diuretics are used in the treatment of diabetes insipidus, since in this disease they reduce urine volume.

High dose thiazide diuretics produce a marked increase in potassium excretion which may cause hypokalaemia; this is dangerous in patients with severe coronary artery disease and those being treated with cardiac glycosides. In hepatic failure hypokalaemia can precipitate encephalopathy, particularly in alcoholic cirrhosis. Potassium-sparing diuretics are used as a more effective alternative to potassium supplements for prevention of hypokalaemia induced by thiazide diuretics; however supplementation with potassium in any form is seldom necessary with the smaller doses of diuretics used to treat hypertension.

POTASSIUM-SPARING DIURETICS. Potassium-sparing diuretics include amiloride [not on Mercy Ships list] and spironolactone; they are weak diuretics and reduce potassium excretion and increase sodium excretion in the distal tubule. Spironolactone, which acts by antagonising aldosterone, has a relatively slow onset of action requiring 2-3 days to achieve maximum diuretic effect, and a similar period of 2-3 days for diuresis to cease after discontinuation of treatment.

Spironolactone is used in the treatment of refractory oedema due to heart failure, hepatic cirrhosis (with or without ascites), nephrotic syndrome and ascites associated with malignancy. It is frequently given with a thiazide or a loop diuretic, helping to conserve potassium in those at risk from hypokalaemia. A low dose of spironolactone is beneficial in severe heart failure in patients who are already taking an ACE inhibitor and a diuretic. Spironolactone is used in the diagnosis and treatment of primary hyperaldosteronism; presumptive evidence for diagnosis is provided by correction of hypokalaemia and of hypertension.
The most dangerous adverse effect of potassium-sparing diuretics is hyperkalaemia, which can be life-threatening. These diuretics are thus best avoided or used very carefully in patients who have or may develop hyperkalaemia, such as those with renal failure, patients receiving other potassium-sparing diuretics or taking ACE inhibitors or potassium supplements.

OSMOTIC DIURETICS. Osmotic diuretics such as mannitol are administered in sufficiently large doses to raise the osmolarity of plasma and renal tubular fluid. Osmotic diuretics are used to reduce or prevent cerebral oedema, to reduce raised intraocular pressure or to treat disequilibrium syndrome. Mannitol is also used to control intraocular pressure during acute attacks of glaucoma. Reduction of cerebrospinal and intraocular fluid pressure occurs within 15 minutes of the start of infusion and lasts for 3-8 hours after the infusion has been discontinued; diuresis occurs after 1-3 hours. Circulatory overload due to expansion of extracellular fluid is a serious adverse effect of mannitol; as a consequence, pulmonary oedema can be precipitated in patients with diminished cardiac reserve, acute water intoxication may occur in patient with inadequate urine flow.

ELECTROLYTE IMBALANCE. The adverse effects of diuretic therapy are mainly due to the fluid and electrolyte imbalance induced by the drugs. Hyponatraemia is an adverse effect of all diuretics. The risk of hypokalaemia, which may occur with both thiazide and loop diuretics, depends more on the duration of action than on potency and is thus greater with thiazides than with loop diuretics (when given in equipotent doses). Potassium-sparing diuretics can cause hyperkalaemia. Other electrolyte disturbances include hypercalcaemia (thiazides) hypocalcaemia (loop diuretics) and hypomagnesaemia (thiazide and loop diuretics). Symptoms of fluid and electrolyte imbalance include dry mouth, thirst, gastrointestinal disturbances (including nausea, vomiting), weakness, lethargy, drowsiness, restlessness, seizures, confusion, headache, muscle pains or cramps, hypotension (including postural hypotension), oliguria, arrhythmias. The elderly are more susceptible to electrolyte imbalance than younger patients. Treatment should begin with a lower initial dose of the diuretic (commonly about 50% of the adult dose) and then adjusted carefully according to renal function, plasma electrolytes and diuretic response.
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
</table>
| **Furosemide Tab 40mg** *(Lasix)*  
*Frusemide*  
Loop diuretic | MSL  
EML | Oedema: *By mouth* Adult initially 40mg in the morning; maintenance 20-40mg daily, resistant oedema up to 80mg daily. Child 1-3mg/kg/DAY (max 40mg daily). |
| **Furosemide Inj 10mg/ml, 2ml** *(Lasix)*  
*Frusemide*  
Loop diuretic | MSL  
IDA  
EML | Acute pulmonary oedema: *By slow IV inj* Adult 20-50mg, if needed increase by 20mg steps every 2 hours, if effective single dose is more than 50mg consider slow IV infusion at max rate 4mg/minute; Child 0.5-1.5mg/kg/DAY (max 20mg daily). For IV inj: if single effective dose < 50mg inject undiluted slowly over 1-2 minutes at max rate 0.5mg/kg/minute, if single dose > 50mg dilute each 20mg amp in 20-100ml WFI/NS depending on hydration of patient, infuse over 30-60 minutes at max rate of 4mg/minute. |
| **Hydrochlorothiazide Tab 25mg** *(Esidrex)*  
Thiazide diuretic | IDA  
EML | Oedema: *By mouth* Adult 25-50mg daily in the morning; max 100mg daily, elderly initially 12.5mg daily. Hypertension: 12.5-25mg daily in the morning; elderly initially 12.5mg daily. |
| **Mannitol Inj 20% 20g/100ml, 500ml**  
Osmotic diuretic | IDA  
EML | Test dose: *By IV infusion* as a 20% solution, 200mg/kg over 3-5 minutes, repeat if urine output less than 30-50ml/hour; re-evaluate patient if response still inadequate. Raised intracranial/ocular pressure: *By IV infusion* as a 20% solution, 0.25-2g/kg over 30-60 minutes. Cerebral oedema: *By rapid IV infusion* as a 20% solution, 1g/kg. |
| **Spironolactone Tab 25mg** *(Aldactone)*  
Potassium-sparing diuretic | IDA  
EML | Oedema: *By mouth* Adult 100-200mg daily, increased to 400mg daily if required, usual maintenance dose 75-200mg daily; Child initially 3mg/kg/DAY in divided doses. |
COMMENT/CAUTIONS:

- **Loop diuretics** act within 1 hour and diuresis is complete within 6 hours. **Thiazide diuretics** act within 1-2 hours and last 12-24 hours. Administer in the morning. May cause postural hypotension especially in the elderly.
- High doses of **thiazides** and **loop diuretics** can cause hypokalaemia (see WHO notes above). **IV furosemide** in large bolus doses may cause ototoxicity, so doses > 50mg should be diluted in 100ml NS and given at a rate not exceeding 4mg/minute.
- **Mannitol**: Solutions >15% concentration may crystallize during storage, crystals must be redissolved by warming solution before use, DO NOT use if any crystals remain; IV sets must have a filter; DO not administer with whole blood or passed through the same transfusion set as blood.
- **Potassium-sparing diuretics** such as spironolactone should be used cautiously in patients on ACE inhibitors as they may cause severe hyperkalaemia. Do not give concurrently with potassium supplements.

WHO MODEL FORMULARY 2008 NOTES:

MANAGEMENT OF ANGINA:

The three main types of angina are: **stable angina** (angina of effort), where atherosclerosis restricts blood flow in the coronary vessels; attacks are usually caused by exertion and relieved by rest; **unstable angina** (acute coronary insufficiency), which is considered to be an intermediate stage between stable angina and myocardial infarction; and **Prinzmetal angina** (variant angina), caused by coronary vasospasm, in which attacks occur at rest. Management depends on the type of angina and may include drug treatment, coronary artery bypass surgery, or percutaneous transluminal coronary angioplasty.

STABLE ANGINA Drugs are used both for the relief of acute pain and for prophylaxis to reduce further attacks; they include organic nitrates, beta-adrenoceptor antagonists (beta-blockers), and calcium-channel blockers.

NITRATES. Organic nitrates have a vasodilating effect and are sometimes used alone, especially in elderly patients with infrequent symptoms. Tolerance leading to reduced antianginal effect is often seen in patients taking prolonged action nitrate formulations. Evidence suggests that patients should have a ‘nitrate-free’ interval to prevent the development of tolerance. Adverse effects such as flushing, headache, and postural hypotension may limit nitrate therapy but tolerance to these effects also soon develops. The short-acting sublingual formulation of **glyceryl trinitrate** is used both for prevention of angina before exercise or other stress and for rapid treatment of chest pain. A sublingual tablet of **isosorbide dinitrate** is more stable in storage than glyceryl trinitrate and is useful in patients who require nitrates infrequently; it has a slower onset of action, but effects persist for several hours.
BETA-BLOCKERS. Beta-adrenoceptor antagonists (beta-blockers), such as atenolol, block beta-adrenergic receptors in the heart, and thereby decrease heart rate and myocardial contractility and oxygen consumption, particularly during exercise. Beta-blockers are first-line therapy for patients with effort induced chronic stable angina; they improve exercise tolerance, relieve symptoms, reduce the severity and frequency of angina attacks, and increase the anginal threshold. Beta-blockers should be withdrawn gradually to avoid precipitating an anginal attack; they should not be used in patients with underlying coronary vasospasm (Prinzmetal angina).

Beta-blockers may precipitate asthma and should not be used in patients with a history of asthma or bronchospasm. Some, including atenolol, have less effect on beta2 (bronchial) receptors and are therefore relatively cardioselective. Although the cardioselective beta-blockers have less effect on airways resistance they are not free of this effect and should be avoided in patients with asthma or bronchospasm (or in rare situations be given with extreme caution under specialist supervision). Beta-blockers should not be given to patients who have incipient ventricular failure, second- or third-degree atrioventricular block, or peripheral vascular disease. Beta-blockers should be used with caution in diabetes. Beta-blockers can produce hyperglycaemia or they can enhance the hypoglycaemic effect of insulin and may precipitate hypoglycaemia.

CALCIUM-CHANNEL BLOCKERS. A long-acting dihydropyridine calcium channel blocker (such as amlodipine, section 12.3) can be added to beta-blocker treatment if necessary for control of moderate stable angina. For those in whom a beta-blocker is inappropriate, verapamil may be given as an alternative to treat stable angina. Calcium-channel blockers interfere with the inward movement of calcium ions through the slow channels in heart and vascular smooth muscle cell membranes, leading to relaxation of vascular smooth muscle. Myocardial contractility may be reduced, the formation and propagation of electrical impulses within the heart may be depressed and coronary or systemic vascular tone may be diminished. Calcium-channel blockers are used to improve exercise tolerance in patients with chronic stable angina due to coronary atherosclerosis or with abnormally small coronary arteries and limited vasodilator reserve. Calcium-channel blockers can also be used in patients with unstable angina with a vasospastic origin, such as Prinzmetal angina, and in patients in whom alterations in cardiac tone may influence the angina threshold.

UNSTABLE ANGINA requires prompt aggressive treatment to prevent progression to myocardial infarction. Initial treatment is with acetylsalicylic acid to inhibit platelet aggregation, followed by heparin. Nitrates and beta-blockers are given to relieve ischaemia; if beta-blockers are contraindicated, verapamil is an alternative, provided left ventricular function is adequate.

PRINZMETAL ANGINA. Treatment is similar to that for unstable angina, except that a calcium-channel blocker is used instead of a beta-blocker.
MANAGEMENT OF HYPERTENSION:

Treatment of hypertension should be integrated into an overall program to manage factors that increase the risk of cardiovascular events (such as stroke and myocardial infarction). Treatment is often life-long. Hypertension was formerly classified as mild, moderate or severe, but a grading system is now preferred. Grade 1 hypertension is defined as 140–159 mmHg systolic blood pressure and 90–99 mmHg diastolic blood pressure, Grade 2 hypertension 160–179 mmHg systolic and 100–109 mmHg diastolic and Grade 3 hypertension more than 180 mmHg systolic and more than 110 mmHg diastolic. The aim of treatment in most patients is an optimal target systolic blood pressure less than 140 mmHg and diastolic blood pressure less than 85 mmHg. For patients with diabetes the aim is systolic blood pressure less than 130 mmHg and diastolic blood pressure less than 80 mmHg. In some patients these targets are not possible despite adequate treatment; however, any decrease in blood pressure reduces the risk of cardiovascular disease.

Lifestyle changes should be introduced for all patients; they include weight reduction, reduction in alcohol intake, reduction of dietary sodium, stopping tobacco smoking, and reduction in saturated fat intake. The patient should eat a healthy nutritious diet including adequate fruit and vegetables and should exercise regularly. These measures alone may be sufficient in mild hypertension, but patients with moderate to severe hypertension will also require specific antihypertensive therapy.

There are no significant differences between the major groups of antihypertensive drugs in terms of efficacy, side-effects and quality of life although some differences in response are seen related to age or ethnic group. Therefore, antihypertensive treatment should be selected according to the individual's clinical needs, any conditions that render certain drugs less suitable for the individual, and the availability and cost of drugs.

In the absence of compelling indications for another class of drug, thiazide diuretics, such as hydrochlorothiazide should usually be considered for antihypertensive therapy; they are particularly indicated in the elderly. They have few adverse effects in low doses, but in large doses they may cause a variety of unwanted metabolic effects (principally potassium depletion), reduced glucose tolerance, ventricular ectopic beats and impotence; they should be avoided in gout. These effects can be reduced by keeping the dose as low as possible; higher doses do not produce an increased reduction in blood pressure. Thiazides are inexpensive and, when used in combination, can enhance the effectiveness of many other classes of antihypertensive drug. Beta-adrenoceptor antagonists (beta-blockers) such as atenolol are effective in all grades of hypertension, and are particularly useful in angina and following myocardial infarction; they should be avoided in asthma, chronic obstructive pulmonary disease, and heart block. Beta-blockers, especially in combination with a thiazide, are best avoided in
patients with diabetes or those at high risk of developing diabetes. Angiotensin-converting enzyme inhibitors (ACE inhibitors) such as enalapril are effective and well tolerated by most patients. They can be used in heart failure, left ventricular dysfunction and diabetic nephropathy, but should be avoided in renovascular disease and in pregnancy. The most common adverse affect is a dry persistent cough. Dihydropyridine calcium-channel blockers such as amlodipine are useful for isolated systolic hypertension, in populations unresponsive to other antihypertensives (for example Africans). Drugs acting on the central nervous system are also effective antihypertensive drugs. In particular, methyldopa [not on Mercy Ships list] is effective in the treatment of hypertension in pregnancy. A single antihypertensive drug is often not adequate and other antihypertensive drugs are usually added in a stepwise manner until blood pressure is controlled.

HYPERTENSIVE EMERGENCIES. In situations where immediate reduction of blood pressure is essential and treatment by mouth is not possible, IV infusion of sodium nitroprusside is effective. Over-rapid reduction in blood pressure is hazardous and can lead to reduced organ perfusion and cerebral infarction.

HYPERTENSION IN PREGNANCY. This is defined as sustained diastolic blood pressure of 90 mmHg or more. Drug therapy for chronic hypertension during pregnancy remains controversial. If diastolic blood pressure is > 95 mmHg, methyldopa [not on Mercy Ships list] is the safest drug. Beta-blockers should be used with caution in pregnancy, since they can restrict fetal growth if used for an extended period; intrauterine growth restriction is minimized if use is limited to the third trimester. ACE inhibitors are contraindicated in pregnancy since they may damage fetal and neonatal blood pressure control and renal function. Women who are taking these drugs and become pregnant should have their antihypertensive therapy changed immediately.

Pre-eclampsia and eclampsia. If pre-eclampsia or severe hypertension occurs after week 36 of pregnancy, delivery is the treatment of choice. For acute severe hypertension in pre-eclampsia or eclampsia, IV hydralazine can be used. Magnesium sulfate is the treatment of choice to prevent eclamptic convulsions in eclampsia and severe pre-eclampsia.

MANAGEMENT OF HEART FAILURE:

Treatment of heart failure aims to relieve symptoms, improve exercise tolerance, reduce incidence of acute exacerbations, and reduce mortality. Drugs used to treat heart failure due to left ventricular systolic dysfunction include ACE inhibitors, diuretics, cardiac glycosides and vasodilators. In addition, measures such as weight reduction, moderate salt restriction, and appropriate exercise should be introduced.
The primary treatment of heart failure is with angiotensin-converting enzyme inhibitors (ACE inhibitors) such as enalapril which can be used in all stages of chronic heart failure to prevent further deterioration and progression of heart disease. A thiazide diuretic such as hydrochlorothiazide is used in the management of mild to moderate heart failure when the patient has mild fluid retention and severe pulmonary oedema is not present; however thiazides are ineffective if renal function is poor. In these patients, and in more severe fluid retention, a loop diuretic such as furosemide is required. See Section 2.01 Diuretics for more notes on using diuretics in heart failure. Note that spironolactone may be considered for severe heart failure patients already receiving an ACE inhibitor and a diuretic (low dose spironolactone 25 mg daily reduces symptoms and mortality rate). Close monitoring of serum creatinine and potassium is necessary with any change in treatment or in the patient's clinical condition. The beta-blockers bisoprolol and carvedilol [not included on WHO Model List] can be used in stable heart failure and left-ventricular systolic dysfunction. Treatment with beta-blockers should only be undertaken by those experienced in the management of heart failure. Digoxin, a cardiac glycoside, increases the strength of cardiac muscle contractions and increases cardiac output. In mild heart failure, digoxin inhibits the sympathetic nervous system and produces arterial vasodilation. It produces symptomatic improvement, increases exercise tolerance, and reduces hospitalization, but it does not reduce mortality. It is considered for patients with atrial fibrillation and for selected patients who remain symptomatic despite treatment with an ACE inhibitor, a diuretic, and a suitable beta-blocker. Vasodilators are used in heart failure to reduce systemic vascular resistance. Isosorbide dinitrate (Section 2.06) produces mainly venous dilatation, which reduces left ventricular preload, leading to a reduction in pulmonary congestion and dyspnoea. Hydralazine produces mainly arterial vasodilation, which reduces left ventricular afterload, and increases stroke volume and cardiac output. Isosorbide dinitrate and hydralazine can be used in combination when an ACE inhibitor cannot be used, but this combination may be poorly tolerated. Dopamine, an inotropic sympathomimetic, may be given for short periods in the treatment of severe heart failure. Dosage is critical; at low doses it stimulates myocardial contractility and increases cardiac output, however, higher doses (more than 5 micrograms/kg per minute) cause vasoconstriction, with a worsening of heart failure.
2.02 ANGIOTENSIN CONVERTING ENZYME (ACE) INHIBITORS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Enalapril Maleate Tab 10mg</td>
<td>IDA</td>
<td>Hypertension: By mouth Adult initially 2.5-5mg in the morning (first dose at night), usual maintenance 10-20mg daily, max 40mg daily.</td>
</tr>
<tr>
<td>(Renitec)</td>
<td>EML</td>
<td></td>
</tr>
</tbody>
</table>

COMMENT/CAUTIONS:
- **ACE Inhibitors** may cause very rapid falls of blood pressure in volume-depleted patients. Discontinue or reduce diuretic dose 2-3 days before ACE inhibitor initiation. Administer first dose at bedtime. Diuretics may be resumed if needed after a few weeks. If diuretics cannot be stopped, supervise medically for 2 hours after first dose/until stable blood pressure.
- **Renal function**: Monitor baseline creatinine and assess within 1 week of initiating therapy. If >10% increase in creatinine levels review therapy. Reassess regularly (3-4 times during the year). Concomitant treatment with NSAIDs increases the risk of renal damage.

2.03 BETA-BLOCKERS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
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<tbody>
<tr>
<td>Atenolol Tab 50mg (Tenormin)</td>
<td>MSL</td>
<td>Hypertension: By mouth Adult 50mg daily (higher dose rarely necessary). Angina: 100mg daily in 1 or 2 doses. Arrhythmias: 50-100mg daily.</td>
</tr>
<tr>
<td>IDA</td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Labetalol HCl Inj 100mg/20ml</td>
<td></td>
<td>Hypertension: by IV Inj 50mg, repeat after 5 minutes if needed; by IV infusion at a max rate of 2mg/minute titrated to patient response; max total dose 200mg both routes.</td>
</tr>
<tr>
<td>(Trandate)</td>
<td></td>
<td>Inject slow IV undiluted over 1-2 minutes, for IV infusion further dilute 100mg with 100-200ml of D5/NS and infuse over 50-60 minutes.</td>
</tr>
<tr>
<td>Metoprolol Tab 100mg (Betaloc/Lopressor)</td>
<td>EML</td>
<td>Hypertension, angina or arrhythmia: By mouth Adult 50-100mg twice daily, max 300mg daily. Adjunct in hyperthyroidism: 50mg 4 times daily.</td>
</tr>
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**Propranolol Tab 40mg** *(Inderal/Avlocardyl)*

- Hypertension: *by mouth* 80mg twice daily, max 320mg daily (half dose for portal hypertension). Angina: 40mg 2-3 times daily to 240mg/DAY. Arrhythmia, anxiety tachycardia, thyrotoxicosis (adjunct): 10-40mg 3-4 times daily. Child, arrhythmia 2-6mg/kg/DAY, hypertension 0.5-1mg/kg/DAY, in divided doses every 6-12 hours. Max: 16mg/kg/DAY.

**Propranolol HCl Inj 1mg/ml** *(Inderal/Avlocardyl)*

- Arrhythmias, thyrotoxic crisis: *by IV inj* 1mg (undiluted over 1 minute); repeat every 2-4 minutes if needed according to response; max 10mg (5mg in anaesthesia).

**COMMENT/CAUTIONS:**
- **Beta-blockers** are effective in all grades of hypertension and are particularly useful in angina and following myocardial infarction. See WHO notes above under Treatment of Angina for cautions about use in asthma, incipient ventricular failure, peripheral vascular disease and diabetes.
- Avoid using with **verapamil** since risk of precipitating heart failure.
- **Labetolol**: Severe hepatocellular damage reported, monitor liver function.
- **Propranolol IV**: Excessive bradycardia can be countered with IV injection of atropine sulphate 0.6-2.4mg in divided doses of 600 micrograms.

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### 2.04 CALCIUM CHANNEL BLOCKERS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Amlodipine Tab 5mg &amp; 10mg <em>(Istin, Amlostin)</em></td>
<td>IDA</td>
<td>Angina, hypertension: <em>By mouth</em> initially 5mg once daily; max 10mg once daily.</td>
</tr>
<tr>
<td>Diltiazem HCl Cap modified-release 240mg <em>(Adizem XL)</em></td>
<td>D</td>
<td>Angina, mild/moderate hypertension: <em>by mouth</em> modified-release 240mg once daily. Non modified-release formulations: 60mg 3 times daily (elderly initially twice daily); max 360mg daily in divided doses.</td>
</tr>
</tbody>
</table>

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**COMMENT/CAUTIONS:**

- The general first-line medicines for hypertension treatment are **thiazide diuretics**, **beta-blockers** & **ACE inhibitors**. However, **calcium-channel blockers** may be considered first-line in specific populations e.g. Africans, Afro-Caribbeans or the elderly, who respond less well to the former drugs.

- **Adverse effects:** Flushing and headache (less obtrusive after a few days), ankle swelling (may respond only partially to diuretics), hypotension. Constipation is more common with **verapamil**. Avoid abrupt withdrawal which may induce hypertensive crisis or rebound.

- **Diltiazem** and **verapamil** should be avoided in heart failure as they may further depress cardiac function causing clinically significant deterioration.

- **Nifedipine:** Short-acting formulations should be avoided as they may evoke reflex tachycardia and cause large variations in blood pressure.
### 2.05 VASODILATOR ANTIHYPERTENSIVES

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydralazine HCl Inj 20mg/ml (Apresoline) [Vasodilator]</td>
<td>IDA</td>
<td>Hypertensive crisis: by slow IV inj, Adult 5-10mg diluted with 10ml NS if needed repeat after 20-30 minutes; or by IV infusion, Adult initially 200-300 micrograms/minute, maintenance usually 50-150 micrograms/minute; or by IM inj, Adult 12.5mg every 2 hours as necessary.</td>
</tr>
<tr>
<td>Sodium Nitroprusside Inj 50mg/5ml [Vasodilator]</td>
<td>EML</td>
<td>Hypertensive crisis: by IV infusion, initially 0.3 micrograms/kg/minute titrate slowly according to response; maintenance 0.5-6 micrograms/kg per minute; max 8 micrograms/kg per minute; stop infusion if response unsatisfactory after 10 minutes at max dose; lower doses in patients already treated with antihypertensive Use IV pump, monitor closely blood pressure. Dilute 50mg in 2-3 ml D5 then immediately with 250-1000 ml D5 to give 25-100 micrograms/ml.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **Sodium Nitroprusside:** Avoid using for over 72 hours to prevent cyanide metabolite accumulation (may cause arrhythmias, sweating, tachycardia, hyperventilation). Reduce infusion over 15-30 minutes to avoid rebound effect. Protect solution from light during storage and when in use. NOTE: over-rapid reduction in blood pressure is hazardous and can lead to reduced organ perfusion and cerebral infarction.
### 2.06 NITRATES

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isosorbide Dinitrate Tab modified-release 20mg (Isoket Retard)</td>
<td></td>
<td>Prophylaxis of angina by mouth modified-release: 20-40mg 12 hourly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non modified-release: angina 30-120mg, left ventricular failure 40-160mg (max 240mg), given daily in divided doses.</td>
</tr>
<tr>
<td>Nitroglycerin Sublingual Spray 400 microgram/dose, 200 doses (Glytrin/Nitrolingual) [Glyceryl trinitrate (GTN)]</td>
<td>MSL</td>
<td>Angina: treatment or prophylaxis, spray 1-2 doses under tongue and then close mouth.</td>
</tr>
<tr>
<td>Nitroglycerin Inj 1mg/ml (Nitrocine/Nitronal) [Glyceryl trinitrate (GTN)]</td>
<td></td>
<td>Angina, left ventricular failure, myocardial infarction: By IV infusion 10-200 micrograms/minute titrated to patient response. If using PVC IV sets start at 25 micrograms/minute (higher initial dose to offset drug loss through PVC absorption). Non-PVC IV sets and glass parenteral bottles are preferred, avoid use of filters. Dilute 1mg in 10ml D5/NS to give 100 micrograms/ml, for dose 10 micrograms/minute run at 6 ml/hour. Max conc 400 micrograms/ml.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **Adverse effects:** flushing, headache, and postural hypotension.
- Glyceryl Trinitrate sublingual tablets should be supplied in glass containers of not more than 100 tablets, closed with a foil-lined cap, containing no cotton wool wadding, and discarded after 8 weeks in use.
- Patients taking isosorbide dinitrate for the long-term management of angina may often develop tolerance to the antianginal effect; this can be avoided by giving the second of 2 daily doses of longer-acting oral presentations after an 8-hour rather than a 12-hour interval, thus ensuring a nitrate-free interval each day.
WHO MODEL FORMULARY 2008 NOTES:

MANAGEMENT OF ARRHYTHMIAS:

Treatment of arrhythmias requires precise diagnosis of the type of arrhythmia, and electrocardiography is essential; underlying causes such as heart failure require appropriate treatment. Antiarrhythmic drugs must be used cautiously since most drugs that are effective in treating arrhythmias can provoke them in some circumstances; this arrhythmogenic effect is often enhanced by hypokalaemia. When antiarrhythmic drugs are used in combination, their cumulative negative inotropic effects may be significant, particularly if myocardial function is impaired.

ATRIAL FIBRILLATION. The increased ventricular rate in atrial fibrillation can be controlled with a beta-adrenoceptor antagonist (beta-blocker) or verapamil. Digoxin slows the ventricular response and is particularly appropriate if atrial fibrillation is accompanied by congestive heart failure. Intravenous digoxin is rarely of value for rapid control of the ventricular rate because response may take many hours. If adequate control at rest or during exercise cannot be achieved readily verapamil may be introduced with digoxin, but it should be used with caution if ventricular function is impaired. Anticoagulants are indicated especially in valvular or myocardial disease, and in the elderly. Warfarin is preferred to acetylsalicylic acid in preventing emboli. If atrial fibrillation began within the previous 48 hours and there does not appear to be a danger of thromboembolism, antiarrhythmic drugs, such as procainamide or quinidine [not on Mercy Ships list], may be used to terminate the fibrillation or to maintain sinus rhythm after cardioversion.

ATRIAL FLUTTER. Digoxin will sometimes slow the ventricular response. Reversion to sinus rhythm is best achieved by direct current electrical shock. If the arrhythmia is long-standing, treatment with an anticoagulant should be considered before cardioversion to prevent emboli. IV verapamil reduces ventricular fibrillation during paroxysmal (sudden onset and intermittent) attacks of atrial flutter. An initial IV dose may be followed by oral treatment; hypotension may occur with high doses. It should not be used for tachyarrhythmias where the QRS complex is wide unless a supraventricular origin has been established beyond doubt. If the flutter cannot be restored to sinus rhythm, antiarrhythmics such as quinidine not on Mercy Ships list] can be used.

PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIA. In most patients this remits spontaneously or can revert to sinus rhythm by reflex vagal stimulation. Failing this, IV injection of a beta-adrenoceptor antagonist (beta-blocker) or verapamil may be effective. Verapamil and a beta-blocker should never be administered concomitantly because of the risk of hypotension and asystole.
VENTRICULAR TACHYCARDIA. Very rapid ventricular fibrillation causes profound circulatory collapse and must be treated immediately with direct current shock. In more stable patients intravenous lidocaine or procainamide may be used. After sinus rhythm is restored, drug therapy to prevent recurrence of ventricular tachycardia should be considered; a beta-adrenoceptor antagonist (beta-blocker) or verapamil may be effective.

*Torsades de pointes* is a special form of ventricular tachycardia associated with prolongation of the QT interval; it may be congenital but is often drug induced. Initial treatment with IV infusion of magnesium sulphate (usual dose 2 g over 10–15 minutes, repeated once if necessary) together with temporary pacing is usually effective. Prolonged QT interval may be treated with a beta-adrenoceptor antagonist (beta-blocker) (but not sotalol) and pacing; antiarrythmic drugs (including lidocaine) should be avoided as they can further prolong QT interval.

BRADYARRHYTHMIAS. Sinus bradycardia (less than 50 beats/minute) associated with acute myocardial infarction may be treated with atropine. Temporary pacing may be required in unresponsive patients. Drugs are of limited value for increasing the sinus rate long term in the presence of intrinsic sinus node disease and permanent pacing is usually required.

CARDIAC ARREST. In cardiac arrest, epinephrine (adrenaline) is given by intravenous injection in a dose of 1 mg (10 ml of 1 in 10 000 solution) as part of the procedure for cardiopulmonary resuscitation.

[Mercury Ships note: IV Amiodarone is available and may be considered for paroxysmal, supraventricular, nodal and ventricular tachycardias, atrial fibrillation and flutter, and ventricular fibrillation. IV Adenosine is available for emergency use for terminating paroxysmal supraventricular tachycardia. See also current local and national standard treatment guidelines.]
2.07 CARDIAC GLYCOSIDES

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<tr>
<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td><strong>Digoxin Tab 250 micrograms</strong></td>
<td>IDA</td>
<td><strong>Atrial fibrillation:</strong> <em>By mouth</em> Adult 1-1.5mg in divided doses over 24 hours for rapid digitalisation; less urgent digitalisation 250 micrograms 1-2 times daily; maintenance 62.5-500 micrograms daily (higher doses may be divided) according to renal function and heart rate response; usual range 125-250 micrograms daily. Lower dose may be more appropriate in elderly.</td>
</tr>
<tr>
<td><em>(Lanoxin)</em></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td><strong>Digoxin Inj 500micrograms/2ml</strong></td>
<td>IDA</td>
<td><strong>Emergency control by IV infusion</strong> 0.75-1mg diluted in 100-500ml D5/NS/WFI given over 2 hours. Reduce dose if cardiac glycosides had been given in previous 2 weeks.</td>
</tr>
<tr>
<td><em>(Lanoxin)</em></td>
<td>EML</td>
<td></td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**

- **Digoxin:** avoid hypokalaemia which predisposes to digoxin toxicity. Use with caution in pregnancy, elderly and renal impairment, avoid rapid IV administration. Excessive dosage may cause nausea/vomiting, gastrointestinal/visual disturbances, drowsiness, confusion, arrhythmias.
### OTHER ANTIARRHYTHMIAS

<table>
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<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td><strong>Adenosine Inj 3mg/ml, 2ml (Adenocor)</strong></td>
<td></td>
<td>Emergency use, rapid reversion to sinus rhythm of paroxysmal supraventricular tachycardia: <em>By rapid IV injection into central or large peripheral vein</em> 6mg over 2 seconds with cardiac monitoring; if necessary followed by 12mg after 1-2 minutes, and then by 12mg after a further 1-2 minutes; increments should not be given if high level AV block develops at any dose.</td>
</tr>
</tbody>
</table>
| **Amiodarone Inj 50mg/ml, 3ml (Cordarone)** | EML | Advanced cardiac life support (ACLS): *by slow IV injection* 300mg over at least 3 minutes; if necessary supplementary doses of 150mg may be considered; max 2g in 24 hours. Arrhythmias: *By IV infusion* via caval catheter, initially 5mg/kg over 20-120 minutes with ECG monitoring, subsequent infusion given if needed according to response up to max 1.2g in 24 hours.  
Dilute 300mg in 300ml of D5 to give 1mg/ml solution. Max IV infusion rate 30mg/minute, usual conc 1-6mg/ml; for > 2mg/ml give via central line. |

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| **Lidocaine Hydrochloride Inj**  
2% 20mg/ml, 10ml Minijet, &  
20 or 50ml vials  
(Xylocard/Xylocaine)  
[Lidocaine = Lignocaine] | IDA  | Ventricular arrhythmias especially after myocardial infarction: by slow IV inj loading dose 50-100mg (or 1-1.5mg/kg) given over 2-4 minutes, followed immediately by IV infusion of 1-4mg/minute with ECG monitoring (reduce infusion dose if required for longer than 24 hours). NOTE. IV injection lidocaine has a short duration of action (of 15-20 minutes). If it cannot be given by IV infusion immediately, the initial IV injection of 50-100mg can be repeated if needed, once or twice at intervals of not less than 10 minutes.  
Inject IV undiluted over 2-4 minutes. For IV infusion, dilute 1g (50ml of 2% solution) with D5/NS to make up to 500-1000ml, giving conc 1-2mg/ml. |
| **Magnesium Sulphate Inj**  
50% 5g/10ml  
[elemental Mg = 500mg/10ml = 20mmol/10ml = 40 mEq/10ml ] | IDA  | Serious arrhythmia, emergency, in the presence of hypomagnesaemia:  
*By slow IV inj* 1-2g (4-8mmol Mg or 2-4ml) in 50-100ml D5 over 10-15 minutes repeated once if needed; *or by IV infusion* 2.5g (10mmol or 5ml) in 100ml D5/NS infused over 1 hour.  
Hypomagnesaemia, emergency:  
*By IV infusion* 1-2g (4-8mmol Mg or 2-4ml) in 100ml D5 over 1-2 minutes. Severe deficiency: *By IV infusion* 5g (20mmol Mg or 10ml) in 1000ml D5/NS, given over 3 hours.  
For IV inj or infusion dilute dose in 50-100ml D5, max conc 200mg/ml.  
An IV calcium solution (e.g.10% calcium gluconate) should be readily available when magnesium sulphate injection is administered. |

*Cont. next page*
**Procainamide Inj 100mg/ml (Pronestyl)**

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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td></td>
<td></td>
<td>Ventricular arrhythmias: <em>by slow IV injection</em> Adult 100mg diluted, given at max rate 50mg/minute with ECG monitoring, repeat at 5-minute intervals until arrhythmia is controlled, max total dose 1g; maintenance dose <em>by IV infusion</em> dilute and give at rate 2-6mg/minute. For IV injection, dilute 100mg with 25-50 ml of D5 and inject slowly over 2-5 minutes. For IV infusion, dilute 200mg with 50-100 ml of D5, give over 30-100 minutes.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- All anti-arrhythmics are potentially pro-arrhythmic. If using more than one antiarrhythmic care is needed as fatal interactions can occur. Avoid rapid changes and combinations.
- *IV Amiodarone* is intended for use only in patients with life-threatening arrhythmias because of substantial toxicity. See product leaflet for detail of its adverse effects and monitoring requirements in longer term therapy.

### 2.09 INOTROPIC & VASOCONSTRICTOR SYMPATHOMIMETICS

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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Dobutamine HCl Inj 250mg/20ml</td>
<td>D</td>
<td>Cardiogenic shock in myocardial infarction: <em>By IV infusion</em> Adult 0.5-1 micrograms/kg/minute initially then adjusted according to response, to 2-20 micrograms/kg/minute. For IV infusion, dilute 250mg/20ml vial in at least 50ml of D5/NS/RL, usually 250mg in 250ml of D5/NS/RL to give 1000 micrograms/ml solution, max conc 5000 micrograms/ml.</td>
</tr>
<tr>
<td>GENERIC (TRADE) NAME</td>
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<td>INDICATION/DOSE</td>
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<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Dopamine HCl Inj 200mg/5ml</td>
<td>IDA</td>
<td>Cardiogenic shock in myocardial infarction: <em>By IV infusion</em> via a large vein (dilute 200mg in 50-100ml D5/NS/RL, max conc 6mg/ml), Adult initially 2-5 micrograms/kg/minute, increase by increments of 5-10 micrograms/kg/minute and titrate according to blood pressure, cardiac output and urine output; max rate 50 micrograms/kg/minute.</td>
</tr>
<tr>
<td>Ephedrine HCl Inj 30mg/ml</td>
<td>IDA</td>
<td>Hypotension prevention in epidural/spinal anaesthesia: <em>by slow IV inj</em> 3-6mg (max 9mg) repeated every 3-4 minutes, max cumulative dose 30mg For slow IV injection dilute 30mg in 10-20ml WFI, max conc 3mg/ml.</td>
</tr>
<tr>
<td>Epinephrine Inj 100micrograms/ml (0.1mg/ml), pre-filled syringe 10ml (1mg/10ml) [Adrenaline 1:10 000]</td>
<td>EML</td>
<td>Cardiac Arrest: <em>by IV inj</em> through a central line, 1mg (in 10ml) repeated at 3-minute intervals if necessary, max 100 micrograms/kg every 3-5 minutes; <em>IM/SC inj</em> 100-500 micrograms (undiluted 1-5ml) every 10-15 minutes; or <em>by IV cont infusion</em> 1 mg diluted in 50-100ml of NS (max conc 64 micrograms/ml), given at a rate of 1-10 micrograms/kg/minute. Anaphylaxis: see chapter 03 pg 41. Caution different dilutions used for different admin routes.</td>
</tr>
<tr>
<td>Norepinephrine Inj 1mg/ml, 4ml [Noradrenaline]</td>
<td>EML</td>
<td>Cardiac Arrest: <em>by IV infusion</em> in a large vein, Adult initially 8-12 micrograms/minute, maintenance 2-4 micrograms/minute adjusted according to response; or 0.5-1 microgram/minute initially, patients with refractory shock may require 8-30 micrograms/minute. For IV infusion dilute 4mg/4ml in 1000ml D5 (NS not recommended).</td>
</tr>
</tbody>
</table>
Phenylephrine Inj 1% 10mg/ml (Neosynephrine)

**Acute hypotension:**
- By SC/IM inj undiluted 2-5mg, repeat doses if needed at 15 minute intervals to max total 10mg; or by slow IV inj of a 1mg/ml solution (diluted in D5/NS), 100-500 micrograms over 3 minutes, repeat if needed after 15 minutes.

**COMMENT/CAUTIONS:**
- **Dopamine** dosage is critical. Low dose stimulates myocardial contractility and increases cardiac output; higher doses (> 5 micrograms/kg/minute) cause vasoconstriction, with a worsening of heart failure.
- **Epinephrine/adrenaline:** Caution as different dilutions are used for different routes of administration. For cardiac arrest, if central line is not in place, give same dose via peripheral vein then flushed through with at least 20ml NS to expedite entry into circulation.
- **Norepinephrine** may be useful in advanced cardiovascular life support (ACLS) as an adjunct to maintain adequate blood pressure when severe hypotension and low total peripheral resistance persist (in those unresponsive to less potent adrenergics e.g. dopamine/phenylephrine) and renal and cerebral perfusion remain inadequate after an effective heartbeat, palpable pulse, and ventilation have been established.
- **Phenylephrine** has a long duration of action, use with caution, excessive vasopressor response may cause prolonged rise in blood pressure.

## 2.10 ANTICOAGULANTS & HAEMOSTATICS

**WHO MODEL FORMULARY 2008 NOTES:**

Anticoagulants are used to prevent thrombus formation or extension of an existing thrombus in the slower-moving venous side of the circulation, where the thrombus consists of a fibrin web enmeshed with platelets and red cells. They are therefore used widely in the prevention and treatment of deep-vein thrombosis in the legs, prophylaxis of embolization in rheumatic heart disease and atrial fibrillation and to prevent thrombi forming on prosthetic heart valves.

**Heparin** is a parenteral anticoagulant that initiates anticoagulation rapidly but has a short duration of action. The low molecular weight heparins have a longer duration of action. For patients at high risk of bleeding, heparin is more suitable than low molecular weight heparin because its effect can be terminated rapidly by stopping the infusion. For the treatment of deep venous thrombosis (DVT) and...
pulmonary embolism (PE) heparin is given as an IV loading dose followed by continuous IV infusion (using an infusion pump) or by intermittent subcutaneous injection. An oral anticoagulant is started at the same time as heparin. The heparin needs to be continued for at least 5 days, until the oral anticoagulant has taken effect and the INR (international normalized ratio) has been in the therapeutic range for 2 consecutive days. Laboratory monitoring is essential, on a daily basis. Heparin is also used in regimens for the management of myocardial infarction, unstable angina, acute peripheral arterial occlusion and in dialysis. In patients undergoing general surgery, low-dose heparin by SC injection is used to prevent postoperative DVT and PE in high risk patients (obesity, malignant disease, history of DVT/PE, over 40 yo, established thrombophilic disorder or undergoing major or complicated surgery). It is also of value in high-risk medical patients e.g. obesity, heart failure, confined to bed. If haemorrhage occurs it is usually sufficient to withdraw heparin, but if rapid reversal of heparin effects is required, protamine sulfate is a specific antidote.

Oral anticoagulants take at least 48-72 hours for the anticoagulant effect to develop fully; if an immediate effect is needed, heparin must be given concomitantly. Warfarin is indicated in DVT, PE, for patients with atrial fibrillation who are at risk of embolization and for those with mechanical prosthetic heart valves (to prevent emboli developing on the valves); oral anticoagulants should not be used in cerebral thrombosis or peripheral arterial occlusion as first-line therapy. The main adverse effect of oral anticoagulants is haemorrhage. Prothrombin time (usually reported as INR should be checked on a daily basis initially then at longer intervals depending on response. If severe haemorrhage occurs, stop warfarin and give phytomenadione (vitamin K) by slow IV injection.

**MANAGEMENT OF MYOCARDIAL INFARCTION:**

Management includes two phases: initial management of acute attacks; then long term management including prevention of further attacks.

**INITIAL MANAGEMENT**

Oxygen (all patients, except in severe chronic obstructive pulmonary disease). Pain and anxiety are relieved by slow IV injection of an opioid analgesic such as morphine (section 5.02). Metoclopramide (section 1.02) may also be given by IM injection to prevent and treat nausea and vomiting caused by morphine. Acetylsalicylic acid 150-300 mg by mouth (preferably chewed or dispersed in water) is given immediately for its antiplatelet effect. Thrombolytic drugs such as streptokinase (section 2.10) help to restore perfusion and thus relieve myocardial ischaemia (give within 1 hour of infarction, use after 12 hours only on specialist advice). Antibodies to streptokinase appear 4 days after use and streptokinase should not be given to the patient again after this time. Nitrates (section 2.06) may also be given to relieve ischaemic pain. Early administration
of beta-blockers such as atenolol (section 2.03) has been shown to reduce both early mortality and MI recurrence rate; initial IV administration is followed by long-term oral treatment (unless the patient has contraindications). ACE inhibitors (section 2.02) have also been shown to be beneficial in initial management (unless patient has contraindications) when given within 24 hours, and if possible continued for 5-6 weeks. If arrhythmias occur, they should be treated aggressively, but the likelihood decreases rapidly over the first 24 hours after infarction. Treat ventricular fibrillation immediately with a defibrillator; if this is ineffective alone, the antiarrhythmic lidocaine (section 2.08) should be given. All patients should be closely monitored for hyperglycaemia; those with diabetes mellitus or raised blood-glucose concentration should receive insulin.

LONG-TERM MANAGEMENT

**Acetylsalicylic acid** (section 2.10) should be given to all patients in a dose of 75-150 mg daily by mouth, unless it is contraindicated. The prolonged antiplatelet effect has been shown to reduce the rate of reinfarction. Treatment with **beta-blockers** (section 2.03) should be continued for at least 2 to 3 years. Verapamil is sometimes useful if a beta-blocker cannot be used. ACE inhibitors such as enalapril (section 2.02) should also be used since they reduce mortality, particularly in patients with left ventricular dysfunction. **Nitrates** (section 2.06) may be required for patients with angina. The use of **statins** (section 2.11) may also be considered in patients with high risk of recurrence.

MANAGEMENT OF STROKE:

Stroke (cerebrovascular accident) may be **ischaemic or haemorrhagic**; precise diagnosis is essential as management for the two types of stroke is quite different. Primary prevention of both types includes reduction of high blood pressure, stopping smoking, weight reduction, and cholesterol reduction. Atrial fibrillation, acute myocardial infarction, and valvular disease may produce embolism and ischaemic stroke. Prophylaxis in patients at risk of **ischaemic stroke** includes antiplatelet drugs such as acetylsalicylic acid or oral anticoagulants such as warfarin (section 2.10). Treatment of acute ischaemic stroke includes use of **acetylsalicylic acid** (aspirin) 150–300 mg as a single dose given within 48 hours of onset, and, in selected patients, anticoagulants such as heparin. Long-term therapy with acetylsalicylic acid 75–150 mg daily reduces the risk of having another stroke. Antiplatelet drugs are **not** used in the management of haemorrhagic stroke, as they can exacerbate bleeding. Treatments include careful lowering of very high blood pressure and surgery where appropriate. Acetylsalicylic acid is normally given for at least one year after coronary artery bypass surgery. It is also given to patients with prosthetic heart valves who have had cerebral embolism despite warfarin treatment.
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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Acetylsalicylic Acid (Aspirin) Tab 100mg, 300mg (various formulations)</td>
<td>IDA</td>
<td>Antiplatelet: <em>by mouth</em> 75-300mg daily (dissolve soluble tablets in a glass of water).</td>
</tr>
<tr>
<td>Heparin Sodium 100 units/ml in Sodium Chloride Injection (Heparin Saline)</td>
<td>D</td>
<td>50-200 units administered as a flush through catheters or IV cannula every 6-8 hours or following protocol.</td>
</tr>
<tr>
<td>Heparin Sodium Inj 1000 units/ml, 5ml 5000 units/ml, 5ml (Heparinol) [NOT FOR IM INJECTION]</td>
<td>IDA</td>
<td>DVT/PE treatment: <em>by IV inj</em> undiluted Adult loading dose 5000 units (10000 units in severe PE, lower dose in small adult &amp; child), then cont IV infusion diluted in 50-1000ml NS at 15-25 units/kg/hour or <em>by SC inj</em> undiluted 15000 units (250 units/kg in small adult &amp; child) given 12 hourly; lab monitoring essential, preferably daily, titrate dose. [Determine dose for maintenance by APTT time of 2-2.5 times of normal.] DVT/PE prophylaxis: <em>by SC inj</em> Adult 5000 units 2 hours before surgery, then every 8-12 hours for 7 days post-op or until patient is ambulant (monitoring not needed).</td>
</tr>
<tr>
<td>Low Molecular Weight Heparin (LMWH) – Dalteparin 5000 IU/0.2ml, 12500 IU/0.5ml (Fragmin) [2 500 AxaIU = 16mg dalteparin]</td>
<td>D</td>
<td>Surgical prophylaxis, for 5-10 days: general <em>by SC inj</em> 2500-5000 IU daily, first injection in the evening pre-surgery or 2500 IU 1-2 hours pre-surgery, a second dose of 5000 IU may be given 4-8 hours after surgery if needed. DVT or PE Treatment: <em>by SC inj</em> every 24 hours with warfarin, 200 IU/kg (max 18000 IU), or &lt; 46kg 7500IU; 46-56kg 10000IU; 57-68kg 12500IU; 69-82kg 15000IU, &gt;82kg 18000IU.</td>
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<tr>
<td>Low Molecular Weight Heparin (LMWH) – Nadroparin 7500AxaICU/0.3ml, 10 000 AxaICU/0.4ml, &amp; 15 000 AxaICU/0.6ml (Fraxiparine)</td>
<td>D</td>
<td>Surgical prophylaxis, for 7 days: general by SC inj 0.3ml daily, first injection 2-4 hours pre-surgery; orthopaedic 100 AxaICU/kg/DAY for 3 days, given 12 hours pre- &amp; post-surgery, then 150AxaICU/kg/DAY from fourth post-op day onwards. DVT Treatment by SC inj 0.1ml/10kg every 12 hours for at least 10 days.</td>
</tr>
<tr>
<td>Low Molecular Weight Heparin (LMWH) – Enoxaparin 20mg/0.2ml, 40mg/0.4ml, 60mg/0.6ml, 80mg/0.8ml, 100mg/ml (Clexane)</td>
<td>D</td>
<td>Surgical prophylaxis: Low/moderate risk 20 mg once daily for 7-10 days, initial dose should be given 2 hours pre-operatively. Higher risk, e.g. orthopaedic surgery, 40 mg daily initial dose administered 12 hours before surgery. DVT Treatment by SC inj 1.5mg/kg once daily for 5 days or 1mg/kg every 12 hours for 5 days.</td>
</tr>
<tr>
<td>Phytomenadione (Vitamin K₁) Inj 10mg/ml [Phytonadione] [ADULT USE ONLY]</td>
<td>MSL IDA EML</td>
<td>Hypoprothrombinaemia, warfarin overdose: no or minor bleeding by slow IV inj Adult 500 micrograms; less severe bleeding IM undiluted 10-20mg; severe haemorrhage by slow IV inj 2.5-5mg, max 50mg (dilute in D5, max rate 1mg/minute).</td>
</tr>
<tr>
<td>Protamine Sulphate Inj 10mg/ml, 5ml (Prosol)</td>
<td>IDA EML</td>
<td>Heparin overdose: By slow IV Inj (undiluted or dilute in D5/NS) over 10 minutes, 1mg neutralises 80-100 units heparin when given within 15 minutes; if longer time, less protamine needed (heparin is rapidly excreted); max total dose 50mg.</td>
</tr>
<tr>
<td>Streptokinase Inj 1 500 000 units vial (Streptase)</td>
<td>EML</td>
<td>MI: By IV infusion 1 500 000 units over 60 minutes. Reconstitute vial with 5ml of D5/NS and further dilute in 45ml of D5/NS. Use reconstituted solution within 8 hours.</td>
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### GENERIC (TRADE) NAME

| **Tranexamic Acid Inj**  
| **100mg/ml, 5ml**  
| **(Transamin/Exacyl)** | **Haemorrhage from excessive fibrinolysis:** By slow IV inj undiluted 0.5-1g (or 10-15mg/kg) 3 times daily, max rate 100mg (1ml) per minute. |

| **Warfarin Sodium Tab**  
| **2mg, 3mg & 5mg**  
| **(Coumadin)** | **IDA**  
| **Loading dose:** By mouth Adult 10mg daily for 2 days, maintenance 3-9mg according to patient, determined by INR values. For rapid effect consider heparin IV/SC inj for first 2-3 days.  
| **NOTE:** See current local or national guidelines for warfarin dosing. |

### COMMENT/CAUTIONS:

- **Aspirin:** contraindicated in peptic ulcers, haemophilia/bleeding disorders.
- **Heparin:** Treatment using full dose unfractionated heparin requires monitoring of coagulation parameters, monitor platelet counts if given for more than 5 days. Adverse effects include thrombocytopenia (withdraw immediately) and haemorrhage (antidote protamine sulphate).

### 2.11 ANTIHYPERLIPIDAEMIC AGENTS

**WHO MODEL FORMULARY 2008 NOTES:**

The primary aim of therapy is to reduce progression of atherosclerosis and to improve survival in patients with established cardiovascular disease, to reduce premature cardiac morbidity and mortality in people at high risk of cardiovascular events and to prevent pancreatitis due to hypertriglyceridaemia. Beta-hydroxy-beta-methylglutaryl-coenzyme A (HMG CoA) reductase inhibitors, often referred to as 'statins', are potent and effective lipid-lowering drugs with a good tolerability profile. Statins have been shown do reduce the incidence of fatal and non-fatal myocardial infarction, stroke and mortality (all causes), as well as the need for coronary bypass surgery. They are recommended for primary and secondary prevention of atherosclerotic cardiovascular disease in high-risk patients.
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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Simvastatin Tab 20mg (Zocor)</td>
<td>IDA</td>
<td>By mouth 10mg at night, adjusted at intervals of not less than 4 weeks; max 80mg/DAY.</td>
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<td></td>
<td>EML</td>
<td></td>
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</tbody>
</table>

**COMMENT/CAUTIONS:**
- Rhabdomyolysis associated with lipid-regulating drugs may be increased in patients with renal impairment, hypothyroidism, and patients on concomitant ciclosporin treatment. Concomitant treatment with a fibrate and a statin may also increase risk of serious muscle toxicity. Advise patients to report promptly unexplained muscle pain, tenderness and weakness.
# RESPIRATORY SYSTEM

TREATMENT OF ACUTE SEVERE ASTHMA:  
(BNF 58 Sep 2009, adapted to Mercy Ships list)

<table>
<thead>
<tr>
<th>SIGNS</th>
<th>TREATMENT</th>
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<tbody>
<tr>
<td><strong>MODERATE ACUTE ASTHMA</strong></td>
<td>Inhaled short-acting beta$_2$-agonist via a large-volume spacer or oxygen-driven nebuliser (if available); give 4-10 puffs of salbutamol 100 micrograms/metered inhalation each inhaled separately, and repeat at 10-20 minute intervals if necessary</td>
</tr>
<tr>
<td>Able to talk</td>
<td>or give nebulised salbutamol 5mg (CHILD under 5 years 2.5mg, 5-12 years 2.5-5mg)</td>
</tr>
</tbody>
</table>
| **Respiration**  
(breaths/minute <25; CHILD 2-5 years ≤ 40, 5-12 years ≥ 30) | **Prednisolone** 40-50mg by mouth for at least 5 days; CHILD 1-2 mg/kg by mouth for 3-5 days. If the child has been taking an oral corticosteroid for more than a few days, give prednisolone 2mg/kg (CHILD under 2 years max. 40 mg; over 2 years max. 50 mg) |
| Pulse (beats/minute)  
Adult <110; CHILD 2-5 yo ≤ 140  
5-12 yo ≤ 125 | Monitor response for 15-30 minutes |
| Arterial oxygen saturation > 92% | If response is poor or a relapse occurs in 3-4 hours, send immediately to hospital for assessment and further treatment |
| Peak Flow > 50% of predicted or best; CHILD 5-12 yo ≥ 50% | **NOTE** Patients with severe or life threatening acute asthma may not be distressed and may not have all these abnormalities; the presence of any of them should alert the doctor or nurse. Regard each emergency consultation as being for severe acute asthma until shown otherwise. |
| Treat at home or in a surgery and assess response to treatment. | **Cont. next page** |
### SIGNS

**SEVERE ACUTE ASTHMA**

Cannot complete sentences in one breath;

CHILD too breathless to talk or feed.

**Respiration**
(breaths/minute) ≥25;
CHILD 2-5 yo >40; 5-12 yo >30

Pulse (beats/minute)
Adult ≥110;
CHILD 2-5 yo > 140; 5-12 yo >125

Arterial oxygen saturation <92%

Peak flow 33-50% of predicted or best;
CHILD 5-12 years 33-50%

Send immediately to hospital

### TREATMENT

High-flow **oxygen** (if available)

Inhaled **short-acting beta_2-agonist** via a large-volume spacer or oxygen-driven nebuliser (if available); give 4-10 puffs of **salbutamol** 100 micrograms/metered inhalation each inhaled separately, and repeat at 10-20 minute intervals or as necessary

**or** give **nebulised salbutamol** 5mg (CHILD under 5 years 2.5 mg, 5-12 years 2.5-5mg)

**Prednisolone** by mouth as for moderate acute asthma **or** intravenous **hydrocortisone** (preferably as sodium succinate) 100 mg every 6 hours until conversion to oral prednisolone is possible;

CHILD 4mg/kg (under 2 years max. 25mg, 2-5 years 50 mg, 6-12 years 100mg)

Monitor response for 15-30 minutes

**If response is poor:**

Inhaled **ipratropium bromide via** oxygen-driven nebuliser (if available) 500 micrograms (CHILD under 12 years 250 micrograms)

Refer those who fail to respond and require ventilatory support to an intensive care or high-dependency unit.

Consider intravenous **beta_2-agonists** (not on Mercy Ships list), **aminophylline** (not on Mercy Ships list), or **magnesium sulphate** (unlicensed indication) only after consultation with senior medical staff.

*Cont. next page*
### LIFE-THREATENING ACUTE ASTHMA

<table>
<thead>
<tr>
<th>SIGNS</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silent chest, feeble respiratory effort, cyanosis</td>
<td>High-flow oxygen (if available)</td>
</tr>
<tr>
<td>Hypotension, bradycardia, arrhythmia, exhaustion, agitation (in children), or reduced level of consciousness.</td>
<td><strong>Short-acting beta₂-agonist</strong> via oxygen-driven nebuliser (if available); give nebulised salbutamol 5mg (CHILD under 5 yo 2.5mg, 5-12 yo 2.5-5mg)</td>
</tr>
<tr>
<td>Arterial oxygen saturation &lt; 92%</td>
<td><strong>Prednisolone</strong> by mouth as for moderate acute asthma or intravenous hydrocortisone (preferably as sodium succinate) 100 mg every 6 hours until conversion to oral prednisolone is possible; CHILD 4mg/kg (under 2 years max 25mg, 2-5 years 50mg, 6-12 years 100mg)</td>
</tr>
<tr>
<td>Peak flow &lt;33% of predicted or best; CHILD 5-12 yo &lt;33%</td>
<td>Inhaled ipratropium bromide via oxygen-driven nebuliser (if available) 500 micrograms (CHILD under 12 years 250 micrograms)</td>
</tr>
<tr>
<td>Send immediately to hospital; consult with senior medical staff and refer to intensive care</td>
<td>Monitor response for 15-30 minutes</td>
</tr>
<tr>
<td>Consider intravenous beta₂-agonists (not on Mercy Ships list), aminophylline (not on Mercy Ships list), or magnesium sulphate (unlicensed indication ) only after consultation with senior medical staff.</td>
<td></td>
</tr>
</tbody>
</table>

### COMMENT/CAUTIONS:

- **Treat promptly and energetically** (do not delay for investigations; do not sedate; consider possibility of pneumothorax), with hospital admission where resuscitation facilities are immediately available.
- When symptoms improved, continue corticosteroid treatment by mouth for 3-5 days according to local protocol and patient age, step up usual treatment (see following pages for chronic asthma treatment guidelines), then follow-up.
- Poorly controlled asthma in pregnant women can have an adverse effect on the fetus, resulting in perinatal mortality, increased prematurity and low birth-weight. Optimal control of asthma in pregnancy is justified (prefer inhalation route), treat acute exacerbations aggressively to avoid fetal hypoxia.
## TREATMENT OF CHRONIC ASTHMA: INFANTS AND YOUNG CHILDREN UNDER 5 YEARS OLD

Preferred treatments are in bold print

<table>
<thead>
<tr>
<th>TREATMENT STEPS</th>
<th>LONG TERM PREVENTIVE DAILY MEDICATIONS</th>
<th>QUICK RELIEF</th>
</tr>
</thead>
</table>
| **STEP 4**  
Severe Persistent | Inhaled corticosteroid, beclomethasone dipropionate MDI with spacer and face mask over 800 micrograms daily in divided doses PLUS long acting inhaled beta<sub>2</sub>-agonist twice daily PLUS if needed leukotriene receptor antagonist (LAR) or modified release theophylline (MRT) or oral corticosteroids in the lowest dose possible, best given as a single morning dose (soluble tablets) | Inhaled short-acting bronchodilator: inhaled beta<sub>2</sub>-agonist or ipratropium bromide as needed for symptoms, not to exceed 3-4 times daily. |
| **STEP 3**  
Moderate Persistent | Inhaled corticosteroid, beclomethasone MDI with spacer and face mask 400-800 micrograms daily PLUS if needed LAR or MRT (see Step 4) or regular inhaled long-acting beta<sub>2</sub>-agonist or high dose inhaled beclomethasone over 800 micrograms daily in divided doses | Inhaled short-acting bronchodilator: inhaled beta<sub>2</sub>-agonist or ipratropium bromide as needed for symptoms, not to exceed 3-4 times daily. |
| **STEP 2**  
Mild Persistent | Either inhaled corticosteroid beclomethasone 400-800 micrograms daily or LAR or MRT (see Step 4) or LAR or MRT (use MDI with spacer and face mask or use a nebulizer) | Inhaled short-acting bronchodilator: inhaled beta<sub>2</sub>-agonist or ipratropium bromide as needed for symptoms, max 3-4 times daily. |
| **STEP 1**  
Intermittent | None needed | Inhaled short-acting bronchodilator: inhaled beta<sub>2</sub>-agonist or ipratropium bromide as needed for symptoms, but not more than once daily. Intensity of treatment will depend on attack severity |

STEP DOWN: review treatment every 3-6 months. If control is sustained for at least 3 months, a gradual stepwise reduction in treatment may be possible.

STEP UP: if control is not achieved, consider step up. But first: review patient medication technique, compliance and environmental control.

[Mercy Ships note: Leukotriene receptor antagonist (LAR), aminophylline, modified release theophylline (MRT) and cromoglicate not available on our list].
### TREATMENT OF CHRONIC ASTHMA:
**ADULTS AND CHILDREN OVER 5 YEARS OLD**
Preferred treatments are in bold print

<table>
<thead>
<tr>
<th>TREATMENT STEPS</th>
<th>LONG TERM PREVENTIVE DAILY MEDICATIONS</th>
<th>QUICK RELIEF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STEP 4</strong></td>
<td><strong>Severe Persistent</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Inhaled corticosteroid</strong>, beclomethasone dipropionate MDI over 1mg daily in divided doses <strong>PLUS long-acting inhaled beta₂-agonist</strong> twice daily <strong>PLUS</strong> if needed leukotriene receptor antagonist (LAR) or modified release theophylline (MRT) or oral corticosteroids in the lowest dose possible, given as a single morning dose</td>
<td><strong>Short-acting bronchodilator:</strong> inhaled beta₂-agonist as needed for symptoms</td>
</tr>
<tr>
<td><strong>STEP 3</strong></td>
<td><strong>Moderate Persistent</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Inhaled corticosteroid</strong>, beclomethasone MDI 100-500 micrograms twice daily <strong>PLUS</strong> if needed long acting bronchodilator <strong>either long-acting inhaled beta₂-agonist</strong> or LAR or MRT (see Step 4) or high dose inhaled beclomethasone over 1mg daily in divided doses</td>
<td><strong>Short-acting bronchodilator:</strong> inhaled beta₂-agonist as needed for symptoms, not to exceed 3-4 times daily</td>
</tr>
<tr>
<td><strong>STEP 2</strong></td>
<td><strong>Mild Persistent</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Either inhaled corticosteroid</strong> beclomethasone 100-250 micrograms twice daily or sodium cromoglicate or modified-release theophylline or leukotriene receptor antagonist**</td>
<td><strong>Short-acting bronchodilator:</strong> inhaled beta₂-agonist as needed for symptoms, max 3-4 times daily</td>
</tr>
<tr>
<td><strong>STEP 1</strong></td>
<td><strong>Intermittent</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>None needed</strong></td>
<td><strong>Short-acting bronchodilator:</strong> inhaled beta₂-agonist as needed for symptoms (up to once daily) Intensity of treatment will depend on severity of attack.</td>
</tr>
<tr>
<td></td>
<td><strong>Consider inhaled beta₂-agonist or cromoglicate before exercise or exposure to allergen</strong></td>
<td></td>
</tr>
</tbody>
</table>

**STEP DOWN:** review treatment every 3-6 months. If control is sustained for at least 3 months, a gradual stepwise reduction in treatment may be possible.

**STEP UP:** if control is not achieved, consider step up. But first: review patient medication technique, compliance and environmental control.

[Mercy Ships note: Leukotriene receptor antagonist (LAR), aminophylline, modified release theophylline (MRT) and cromoglicate not available on our list].
3.01 ANTIASTHMATICS

3.01a BETA₂-AGONISTS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salbutamol Sulfate Inhaler 100micrograms/dose (Ventolin [Albuterol])</td>
<td>MSL IDA</td>
<td>Relief of acute bronchospasm, or prophylaxis of exercise-induced bronchospasm: by aerosol inhalation. Adult 100-200 micrograms (1-2 puffs), up to 3-4 times daily in chronic asthma (as adjunct in stepped treatment, refer to current asthma treatment guidelines); Child 100 micrograms (1 puff) increased to 200 micrograms (2 puffs), up to 4 times daily if needed.</td>
</tr>
<tr>
<td>Salbutamol Sulfate Respirator Solution 0.5% (5mg/ml), Nebules 1mg &amp; 2.5mg (Ventolin) [Albuterol]</td>
<td>IDA EML</td>
<td>By inhalation of nebulized solution. Adult &amp; Child &gt; 18 months, 2.5-5mg up to 4 times daily during acute severe asthma. Child &lt; 18 months clinical efficacy uncertain (transient hypoxaemia may occur – consider oxygen supplementation). Dilute 0.5% (5mg/ml) solution with 3ml of NS before administration.</td>
</tr>
</tbody>
</table>

COMMENT/CAUTIONS:
- If dosing is needed more than once daily in beta₂-agonists alone regimen, consider adjunct therapy. Refer above for WHO Model step treatment for chronic asthma and refer also to local and national guidelines.
- Inadequate response may be due to poor inhalation technique. See Appendix I for inhaler usage instructions and choice of inhaler devices for children.
- An aerochamber or spacer device may be useful. If multi-dose inhalers (MDIs) and spacers have been tried, dry powder devices such as turbuhalers or accuhalers may be considered for patients with coordination difficulties.
- Adverse effects (minimal with inhaled preparations): tachycardia, tremor, nervousness, hypokalaemia, muscle cramp, and impaired glucose tolerance. Monitor blood glucose if IV administration – ketoacidosis reported.
3.01b OTHER BRONCHODILATORS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ipratropium Bromide Inhaler 20micrograms/dose, 200 doses</td>
<td>EML</td>
<td>Chronic asthma or obstructive pulmonary disease: <em>by aerosol inhalation</em> Adult 20-40 micrograms (1-2 puffs) 3-4 times daily, max 80 micrograms (4 puffs) 4 times daily; Child &lt; 6 yo 20 micrograms (1 puff) 3 times daily; 6-12 yo 20-40 micrograms (1-2 puffs) 3 times daily.</td>
</tr>
<tr>
<td>(Atrovent Metered Aerosol)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **Ipratropium** is useful for bronchitis or emphysema, and in the elderly and in young children. It can provide short-term relief in chronic asthma but short-acting beta₂-agonists work more quickly.
- Inadequate response may be due to poor inhalation technique. See Appendix I for **inhaler usage instructions** and choice of **inhaler devices for children**.
- Refer above for WHO Model step treatment for chronic asthma and refer also to local and national guidelines.

3.02 CORTICOSTEROIDS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclomethasone Dipropionate Inhaler 50 micrograms/dose,</td>
<td>MSL</td>
<td>Chronic asthma: <em>by aerosol inhalation</em> Adult 200 micrograms (4 puffs) twice daily or 100 micrograms (2 puffs) 3-4 times daily, max 400 micrograms (8 puffs) twice daily in severe cases then reduce dose; Child 50-100 micrograms (1-2 puffs) 2-4 times daily or 100-200 micrograms (2-4 puffs) twice daily.</td>
</tr>
<tr>
<td>200 doses (Becotide 50)</td>
<td>IDA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
</tbody>
</table>

Cont. next page
### GENERIC (TRADE) NAME | CAT. | INDICATION/DOSE
--- | --- | ---
**Beclomethasone Dipropionate Inhaler 250micrograms/dose, 200 doses (Becloforte)** | D | Chronic asthma: *by aerosol inhalation* Adult 500 micrograms (2 puffs) twice daily or 250 micrograms (1 puff) 4 times daily, max 500 micrograms (2 puffs) 4 times daily.

**Hydrocortisone Inj 100mg/2ml or 100mg vial (as Sodium Succinate) (Solu-Cortef)** | MSL IDA | By IM, slow IV inj or IV infusion: Adult 100-500mg; Child < 1yo 25mg, 1-5 yo 50mg, 6-12 yo 100mg; given every 6-8 hours as needed.

For IM/IV inj reconstitute vial with 2ml of NS/WFI, inject slow IV over 3-5 minutes; for IV infusion further dilute 100mg with 100ml of D5/NS and infuse over 20-30 minutes.

**Prednisolone Tablet 5mg & 25mg** | MSL IDA | For acute severe asthma: *by mouth* Adult 30-60mg for 5 days; Child 1-2mg/kg daily (1-4 yo max 20mg, 5-15 yo max 40mg), for 3 days.

---

**COMMENT/CAUTIONS:**

- **REGULAR DOSING IS ESSENTIAL.** Consider aerochamber or spacer devices to minimise side effects and increase dosing efficiency. Administering bronchodilator before corticosteroid inhalation may enhance dosing.

- **Adverse effects:** hoarseness, candidiasis of mouth and throat (reduce by using spacer device, rinsing or wiping mouth with water after inhalation); glaucoma, paradoxical bronchospasm. Suppression of adrenal cortex may occur at beclomethasone doses of over 1500micrograms daily.

- Inadequate response may be due to poor inhalation technique. See Appendix I for inhaler usage instructions and choice of inhaler devices for children.

- Refer above for WHO Model step treatment for chronic asthma and refer also to local and national guidelines.
WHO MODEL FORMULARY 2008 NOTES:

Anaphylactic shock and conditions such as angioedema are medical emergencies that can result in cardiovascular collapse and/or death. They require prompt treatment of possible laryngeal oedema, bronchospasm or hypotension. Atopic individuals are particularly susceptible. Insect stings and certain foods including eggs, fish, cow's milk protein, peanuts and nuts are a risk for sensitized persons. Therapeutic substances particularly associated with anaphylaxis include blood products, vaccines, hyposensitizing (allergen) preparations, antibiotics (especially penicillins), iron injections, heparin, and neuromuscular blocking drugs. Acetylsalicylic acid and other nonsteroidal anti-inflammatory drugs (NSAIDs) may cause bronchoconstriction in leukotriene-sensitive patients. In the case of drug allergy, anaphylaxis is more likely to occur after parenteral administration. Resuscitation facilities should always be available when injecting a drug associated with a risk of anaphylactic reactions. Anaphylactic reactions may also be associated with additives and excipients in foods and medicines. Check full formula of preparations which may contain allergenic fats or oils.

STEPS IN THE MANAGEMENT OF ANAPHYLAXIS

<table>
<thead>
<tr>
<th>Sympathomimetic: Epinephrine (adrenaline) 1 in 1000 (1mg/ml) by IM inj Adult &amp; Adolescent 500 micrograms (0.5ml); Infant &lt; 6 months 50 micrograms (0.05ml); Child 6 months-6 yo 120 micrograms (0.12ml), 6-12 yo 250 micrograms (0.25ml). Repeat dose several times if necessary at 5-minute intervals, according to blood pressure, pulse and respiratory function. If circulation inadequate, epinephrine (adrenaline) 1 in 10000 (100 microgram/ml) by slow IV inj given at a rate of 1ml/minute; Adult 500 micrograms (5ml), Child 10 micrograms/kg (0.1ml/kg), given over several minutes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital functions: Maintain an open airway; give oxygen by mask, restore blood pressure (lay patient flat, raise feet).</td>
</tr>
<tr>
<td>Antihistamine: e.g. chlorphenamine by IV inj over 1 minute, Adult 10-20mg, repeated if required (max total dose 40mg in 24 hours), Child 1 month-1 yo 250 micrograms/kg (max 2.5mg), 1-5 yo 2.5-5mg, 6-12 yo 5-10mg repeated if needed up to 4 times daily</td>
</tr>
<tr>
<td>Corticosteroids: e.g. hydrocortisone by slow IV inj Adult 100-300mg; Child up to 1 yo 25mg; 1-5 yo 50mg; 6-12 yo 100mg.</td>
</tr>
<tr>
<td>Intravenous fluids: start sodium chloride infusion (500-1000ml during first hour).</td>
</tr>
<tr>
<td>If patient has asthma-like symptoms, give salbutamol 2.5-5mg by nebulization or aminophylline [not on Mercy Ships list] 5mg/kg by slow IV inj over 20 minutes.</td>
</tr>
</tbody>
</table>
3.03 ANTIHISTAMINES & ANTIALLERGICS

WHO MODEL FORMULARY 2008 NOTES:

The $H_1$-receptor antagonists are generally referred to as antihistamines. They inhibit the wheal, pruritus, sneezing and nasal secretion responses that characterize allergy. Antihistamines thus relieve the symptoms of allergic reactions, such as urticaria, allergic rhinitis, and allergic conjunctivitis; they also control pruritus in skin disorders, such as eczema. Antihistamines are used to treat drug allergies, food allergies, insect stings and some of the symptoms of anaphylaxis and angioedema. Drug treatment and other supportive care should not be delayed in critically ill patients (see notes above on anaphylaxis). Specific precipitants should be sought and if identified, further exposure avoided and desensitization considered.

In practice, all antihistamines are equally effective in relieving the symptoms of allergic reactions and differ mainly in the intensity of sedative and anticholinergic (more correctly antimuscarinic) effects. Selection of an antihistamine should thus be based on the intended therapeutic use, the likely adverse reactions, and the cost. Drowsiness and sedation are particular disadvantages of the older antihistamines such as chlorphenamine; patients should be warned against driving or operating machinery. Newer antihistamines do not cause significant sedation. Other central nervous depressants, including alcohol, barbiturates, hypnotics, opioid analgesics, anxiolytics and neuroleptics, may enhance the sedative effects of antihistamines. Since antihistamines interfere with skin tests for allergy, they should be stopped at least one week before such tests.

Corticosteroids, such as dexamethasone, hydrocortisone, or prednisolone, suppress or prevent almost all symptoms of inflammation associated with allergy. The route of administration depends on the particular type of allergic condition. For example, for a mild allergic skin reaction, the best therapy may be the use of a corticosteroid ointment or cream. If the skin reaction does not respond to topical corticosteroid therapy, it may be necessary to give a corticosteroid orally. Corticosteroids may be used topically to reduce inflammation in allergic rhinitis but should only be used systemically when symptoms are disabling.

Allergic reactions of limited duration and with mild symptoms, such as urticaria or allergic rhinitis, usually require no treatment. If on the other hand, symptoms become persistent, antihistamines constitute the mainstay of treatment. However, oral corticosteroids may be required for a few days in an acute attack of urticaria or for severe skin reactions. Oral corticosteroids are also used to relieve severe exacerbations in chronic urticaria, but long-term use should be avoided. For further information on corticosteroids, see section 7.01.
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorphenamine Maleate Tablet 4mg, Suspension 4mg/5ml, Injection 10mg/ml (Piriton) [Chlorpheniramine]</td>
<td>MSL IDA</td>
<td>Allergy: by mouth Adult 4mg every 4-6 hours (max 24mg daily); Child &lt; 1yo not recommended; 1-2 yo 1mg twice daily; 2-5 yo 1mg every 4-6 hours (max 6mg daily); 6-12 yo 2 mg every 4-6 hours (max 12mg daily). By SC or IM inj, Adult 10-20 mg, repeated if required (max 40 mg in 24 hours); by SC inj Child 87.5 micrograms/kg, repeated if necessary up to 4 times daily. Anaphylaxis (adjunct), by IV inj over 1 minute, Adult 10-20 mg; Child under 1yo 250 micrograms/kg, 1-5yo 2.5-5 mg, 6-12 yo 5-10mg. May cause drowsiness.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diphenhydramine Inj 50mg/ml (Benadryl)</td>
<td>EML</td>
<td>Antihistaminic: by IM or IV inj over 5 minutes, Adult 10-50mg every 2-3 hours, max 400mg/DAY; Child &gt;10kg, 5mg/kg/DAY divided in 4 doses, max 300mg/DAY.</td>
</tr>
<tr>
<td>Epinephrine Inj 1mg/ml [Adrenaline 1:1000]</td>
<td>MSL IDA</td>
<td>Anaphylaxis: by undiluted SC/IM inj, Adult 500 micrograms (0.5ml), 6-12 yo 250 micrograms (0.25ml), 6 mth-6 yo 120 micrograms (0.12ml), &lt; 6 mth 50 micrograms (0.05ml).</td>
</tr>
<tr>
<td>Hydroxyzine HCl Tab 25mg (Atarax)</td>
<td>EML</td>
<td>Pruritus: by mouth initially 25mg at night increased if necessary to 25mg 3-4 times daily; Child 6 mth-6 yo initially 5-15mg daily increased if necessary to 50mg daily in divided doses; &gt; 6 yo initially 15-25mg daily increased if necessary to 50-100mg/DAY given in divided doses. May cause drowsiness.</td>
</tr>
<tr>
<td>Loratadine Tab 10mg &amp; Syrup 5mg/5ml, 100ml (Clarityne)</td>
<td>MSL</td>
<td>Allergy: by mouth Adult &amp; Child &gt; 6 yo (or &gt; 30kg) 10mg daily; Child 2-5 yo (or &lt;30kg) 5mg daily.</td>
</tr>
</tbody>
</table>

Cont. next page
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promethazine HCl Tab 25mg &amp; Syrup 5mg/5ml (Phenergan) Antihistamine</td>
<td>IDA</td>
<td>Allergy: <em>by mouth</em> Adult 25-50mg daily in divided doses or single dose at night; &lt; 2 yo not recommended, 2-5 yo 5-15mg daily, 5-10 yo 10-25mg daily, in 1-2 divided doses. Premedication: <em>by mouth</em> Child &lt; 2 yo not recommended, 2-5 yo 15-20mg, 5-10 yo 20-25mg. Motion sickness: <em>by mouth</em> Adult 25mg half to one hour before travel/sail, repeated 8-12 hours after as needed, then 25mg twice daily on succeeding days of travel/sailing as needed; 5-10 yo half adult dose. <em>May cause drowsiness.</em></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td>Allergy/premedication: <em>by IM inj</em> Adult 25-50mg, max 100mg; Child 5-10 yo 6.25-12.5mg. <em>By slow IV inj</em> in emergencies Adult 25-50mg, max 100mg (max rate 25mg/minute). Inject IM undiluted deep into a large muscle mass over 1-2 minutes. Inject slow IV undiluted or dilute 25mg in 10ml WFI, over 1-2 minutes.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **Antihistamines** may cause drowsiness, advice patients not to drive or operate machinery if affected. They potentiate the effects of alcohol.
- **Caution:** Sedating antihistamines have significant antimuscarinic activity, use with care in prostatic hypertrophy, urinary retention, glaucoma and pyloroduodenal obstruction. Adjust dose in hepatic/renal impairment.
- **Adverse effects:** Drowsiness (less in newer antihistamines e.g. loratadine; rarely paradoxical stimulation with high doses or in children and elderly), hypotension, headache, palpitations, psychomotor impairment, urinary retention, dry mouth, blurred vision, gastrointestinal disturbances; liver dysfunction; blood disorders; hypersensitivity reactions, sweating and tremor.
- **Anaphylaxis:** refer above for WHO recommendations in treatment.
### 3.04 COUGH & COLD PREPARATIONS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough/Cold Preparations (various, not Benadryl)</td>
<td>D MSL</td>
<td>See individual product leaflets for detail. NOTE: some multi-ingredient preparations may contain paracetamol/acetaminophen (risk of overdose if taken concomitantly with other paracetamol preparations). See pharmacist/crew Dr if uncertain.</td>
</tr>
<tr>
<td>Diphenhydramine Expectorant Paediatric (Benadryl 1:2)</td>
<td>D</td>
<td><em>By mouth</em>, Child 2-6 yo 6.25mg every 4-6 hours, max 37.5mg/DAY; 6-12 yo 12.5mg every 4-6 hours, max 75mg/DAY.</td>
</tr>
<tr>
<td>Diphenhydramine Expectorant Adult (Benadryl)</td>
<td>D</td>
<td><em>By mouth</em>, Adult 5-10ml, Child 1-5 yo 2.5ml, 6-12 yo 5ml, usual 3-4 times daily for chesty cough.</td>
</tr>
<tr>
<td>Pholcodine Linctus 5mg/5ml (Pavachol-D)</td>
<td></td>
<td>Unproductive, persistent, dry &amp; painful cough: <em>By mouth</em>, Adult 5-10mg 3-4 times daily; Child 5-12 yo 2.5-5mg 3-4 times daily.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **Pholcodine** may cause constipation, monitor chronic use also for abuse.
- **DRUG-INDUCED DRY COUGHS:** All therapeutic aerosols may cause coughs by local irritant effect, ACE inhibitors can also produce the adverse effect of persistent dry cough. Other factors may include occupational or environmental exposure to irritant aerosolised chemicals or dust particles. Consider asthma, gastro-oesophageal reflux disease and ‘post-nasal drip’.
- **Common Cold:** Prevention of the spread of rhinovirus colds is most effective through **hand-washing** and not touching the nose or eyes. Sneeze or cough into a facial tissue and discard it immediately (rhinoviruses survive up to 3 hours outside the nasal passages on inanimate objects and skin). Symptomatic treatments include antihistamines for rhinitis, oral or topical decongestants for nasal congestion, analgesics for muscular aches and gargles and sprays for sore throats.

*NOTE.* For Systemic & Topical Nasal Decongestants, Throat and Mouth Preparations, see Chapter 10 Ear, Nose and Throat.
4 CENTRAL NERVOUS SYSTEM

4.01 HYPNOTICS & ANXIOLYTICS

WHO MODEL FORMULARY 2008 NOTES:

The most widely used anxiolytics and hypnotics are the benzodiazepines. Treatment of anxiety should be limited to the lowest effective dose for the shortest possible time. The cause of insomnia should be established and appropriate treatment for underlying factors instituted before hypnotics are considered. Hypnotics may be of value for a few days but rarely longer than a week.

Tolerance and dependence (both physical and psychological) and subsequent difficulty in withdrawing the drug may occur after regular use for more than a few weeks. Patients with chronic anxiety, alcohol or drug dependence or those with personality disorders are more likely to become dependent. Anxiolytics and hypnotics should be prescribed in carefully individualized dosage and use should be limited to control of acute conditions such as panic attacks and acute anxiety and severe, incapacitating insomnia. There is usually no justification for prolonging treatment with anxiolytics and hypnotics for more than one to two weeks.

If used for longer periods, withdrawal should be gradual by reduction of the dose over a period of weeks or months, as abrupt discontinuation may produce confusion, toxic psychosis, convulsions or a condition resembling delirium tremens. The benzodiazepine withdrawal syndrome may develop at any time up to 3 weeks after stopping a long-acting benzodiazepine but may occur within a few hours in the case of a short-acting one. The syndrome is characterized by insomnia, anxiety, loss of appetite and body-weight, tremor, perspiration, tinnitus and perceptual disturbances. These symptoms may be similar to the original complaint and encourage further prescribing. Some symptoms may continue for weeks or months after stopping benzodiazepines.

Patients should be warned that their ability to drive or operate machinery may be impaired and that the effects of alcohol may be enhanced.
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<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td><strong>Diazepam Tab 5mg (Valium)</strong></td>
<td>PS MSL IDA</td>
<td><strong>By mouth,</strong> Anxiety Adult 2mg 3 times daily max 30mg/DAY in divided doses; Elderly half adult dose. Insomnia (anxiety-linked) Adult 5-15mg at bedtime. Spastic conditions: Adult 2.5-15mg daily in divided doses, max 60mg/DAY; Child 2-40mg/DAY. Sedation/premedicaton see chapter 13 Anaesthetics section 13.06.</td>
</tr>
<tr>
<td><strong>Diazepam Inj 5mg/ml, 2ml (Valium)</strong></td>
<td>PS MSL IDA EML</td>
<td><strong>By slow IV inj</strong> undiluted over 2-4 minutes into a large vein. Severe acute anxiety (under close observation): Adult 10-20mg, repeat if needed after 4 hours. <strong>Avoid IM route - unreliable absorption.</strong></td>
</tr>
<tr>
<td><strong>Lorazepam Tab 1mg (Ativan/Temesta)</strong></td>
<td>PS EML</td>
<td><strong>By mouth,</strong> Anxiety: Adult 1-4mg daily in divided doses; Elderly half dose. Insomnia (anxiety-linked, short term use): Adult 1-2mg at night.</td>
</tr>
<tr>
<td><strong>Zolpidem Tab 10mg (Stilnox)</strong></td>
<td>PS D EML</td>
<td><strong>By mouth,</strong> Insomnia: Adult 10mg at bedtime; Elderly or debilitated 5mg.</td>
</tr>
</tbody>
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**COMMENT/CAUTIONS:**
- **PS Psychotropic Substances.** Recording required in pharmacy/ward/OR.
- It is recommended that benzodiazepines be used for short-term relief (around 2-4 weeks) of anxiety that is severe, disabling or subjecting the individual to unacceptable distress.
- All hypnotics/anxiolytics should be prescribed “as needed” as far as possible.
- Long acting benzodiazepines such as diazepam should not be used for insomnia especially in the elderly where they may give rise to memory and co-ordination problems.
  **Withdrawal:** To withdraw from chronic benzodiazepine therapy, transfer patient to an equivalent dose of diazepam if possible (e.g. diazepam 5mg = lorazepam 2.5mg = midazolam 7.5mg), then reduce in steps of one-eighth of the daily dose every 2 weeks.
- **Adverse effects:** drowsiness, light-headedness, confusion, ataxia, dependence, vertigo, GI disturbances, respiratory depression (NOTE for midazolam). Patients should be warned that their ability to drive or operate machinery may be impaired and that the effects of alcohol may be enhanced.
Treatment of psychotic disorders is both pharmacological and psychosocial. Individual and community programmes for relearning old skills and developing new ones and for learning to cope with the illness should be initiated. Classes of antipsychotic drugs include phenothiazines (e.g. chlorpromazine), butyrophenones (for example haloperidol), thioxanthenes (e.g. flupentixol) and newer ‘atypical’ neuroleptics including clozapine and risperidone. The various antipsychotic drugs do not, in general, differ in their antipsychotic activity, but differ in range and quality of adverse effects (see below).

ACUTE PHASE TREATMENT. The administration of chlorpromazine or haloperidol will relieve symptoms such as thought disorder, hallucinations and delusions and prevent relapse. They are usually less effective in apathetic, withdrawn patients, but they can sometimes have an activating influence. Patients with acute schizophrenia generally respond better than those with chronic symptoms. In the acute phase chlorpromazine may be administered by intramuscular injection in a dose of 25–50 mg which can be repeated every 6–8 hours while observing the patient for possible hypotension. In most cases, however, IM injection is not needed and patients can be treated with an oral dose. Haloperidol may be administered in the acute phase. [Note: Carbamazepine is available on Mercy Ships list for prophylactic use in bipolar disorder (manic-depressive disorder) in patients unresponsive to lithium.]

MAINTENANCE THERAPY. Long-term treatment for schizophrenia may be necessary after the first episode to prevent the illness from becoming chronic. The lowest possible dose of antipsychotic drug that will prevent major exacerbations of florid symptoms is used for long-term management. Too rapid a dose reduction should be avoided. Intramuscular depot preparations such as fluphenazine decanoate [not on Mercy Ships list] may be used as an alternative to oral maintenance therapy especially when compliance with oral treatment is unreliable. Exacerbations of illness in patients on maintenance drug therapy can be precipitated by stress. Withdrawal of maintenance drug treatment requires careful surveillance since it is not possible to predict the course of the disease and the patient may suffer a relapse if treatment is withdrawn inappropriately. Further, the need for continuation of treatment may not be evident on withdrawal of treatment because relapse may be delayed for several weeks.

ADVERSE EFFECTS. Very common with long-term administration of antipsychotic medicines. Treatment of all patients on antipsychotics must be carefully and regularly reviewed. Hypotension and interference with temperature regulation, neuroleptic malignant syndrome and bone-marrow depression are the most life-threatening. Hypotension and interference with temperature regulation
are dose-related. They can result in dangerous falls and hypothermia in the elderly and this must be considered before prescribing these drugs for > 70 yo.

Extrapyramidal symptoms are the most troublesome and are caused most frequently by the piperazine phenothiazines (e.g. fluphenazine), butyrophenones (e.g. haloperidol) and the depot preparations; the newer ‘atypical’ antipsychotics cause fewer extrapyramidal symptoms than other antipsychotics. Although easily recognized, they are not so easy to predict because they depend in part on the dose and patient susceptibility as well as the type of drug. Extrapyramidal symptoms consist of: Neuroleptic malignant syndrome (hypothermia, fluctuating levels of consciousness, muscular rigidity, and autonomic dysfunction with pallor, tachycardia, labile blood pressure, sweating and urinary incontinence) is a rare adverse effect of haloperidol and chlorpromazine. It is managed by discontinuing the antipsychotic, correcting fluid and electrolyte defects, and giving bromocriptine [not on Mercy Ships list] and sometimes dantrolene.

[ Mercy Ships note: Biperiden is available on the Mercy Ships list for drug-induced extrapyramidal symptoms (but not tardive dyskinesias).]

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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td>Biperiden HCl Tab 2mg</td>
<td>IDA</td>
<td>By mouth, Drug-induced extrapyramidal symptoms, parkinsonism: Adult initially 1mg twice daily, increased gradually to 2mg 3 times daily; usual maintenance dose 3-12mg/DAY in divided doses. May impair ability to drive or operate machinery (skilled tasks).</td>
</tr>
<tr>
<td>Carbamazepine Tab 200mg (Tegretol/Carbagen)</td>
<td>IDA</td>
<td>Prophylaxis of bipolar disorder unresponsive to lithium: By mouth Adult initially 400mg daily in divided doses increased until symptoms controlled; usual range 400-600mg daily; max 1.6g/DAY.</td>
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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td>Chlorpromazine Tab 25mg (Largactil/Thorazine)</td>
<td>MSL, IDA</td>
<td>Schizophrenia and other psychoses, mania, psychomotor agitation/violent behaviour, severe anxiety (adjunct): <em>By mouth</em>, Adult initially 25mg 3 times daily (or 75mg at night) adjusted according to response to usual maintenance dose 75-300mg daily (but up to 1g daily may be required in psychoses); Elderly (or debilitated) third to half adult dose; Child (childhood schizophrenia and autism) 1-5yo 500 micrograms/kg every 4-6 hours (max 40mg/DAY); 6-12yo third to half adult dose (max 75mg/DAY).</td>
</tr>
<tr>
<td>Chlorpromazine Inj 50mg/2ml (Largactil/Thorazine)</td>
<td>IDA</td>
<td>For relief of acute psychotic symptoms: <em>By deep IM inj undiluted</em> Adult 25-50mg every 6-8 hours; Child 500 micrograms/kg every 6-8 hours as needed (1-5 yo max 40mg/DAY, 6-12 yo max 75mg/DAY, in divided doses). Patient should remain supine and the blood pressure monitored for 30 minutes after IM injection.</td>
</tr>
<tr>
<td>Haloperidol Inj 5mg/ml (Serenace/Haldol)</td>
<td>IDA</td>
<td>Acute psychotic symptoms: <em>By deep IM inj undiluted</em> Adult 2-10mg subsequent doses every 4-8 hours according to response (up to every hour if necessary) to total maximum of 18mg; severely disturbed patients may require initial dose of up to 18mg; Elderly (or debilitated) half adult dose; Child not recommended.</td>
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### GENERIC (TRADE) NAME

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<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Haloperidol Tab 5mg (Serenace/Haldol)</td>
<td>IDA</td>
<td>Schizophrenia and other psychoses, mania, violent behaviour, short term adjunctive management of psycho-motor agitation and severe anxiety: <strong>By mouth</strong> Adult initially 1.5-3mg 2-3 times daily or 3-5mg 2-3 times daily in severely affected/resistant patient (up to 30mg daily in resistant schizophrenia); Elderly or debilitated initially half-adult dose; Child initially 25-50 micrograms/kg daily in 2 divided doses (max 10mg/DAY).</td>
</tr>
<tr>
<td>Risperidone Tab 2mg (Risperdal)</td>
<td>D</td>
<td>Psychoses: <strong>By mouth</strong> Adult 2mg in 1-2 divided doses on first day then 4mg in 1-2 divided doses on second day (slower titration if needed); usual dose range 4-6mg daily; doses above 10mg daily only if benefit considered to outweigh risk (max 16mg/DAY). Elderly initially 500 micrograms twice daily increased in steps of 500 micrograms twice daily to 1-2mg twice daily.</td>
</tr>
</tbody>
</table>

### COMMENT/CAUTIONS:
- **Cautious use in patients with cardiovascular/renal/hepatic disease, elderly.**
- **Adverse effects**: extra-pyramidal e.g. dystonia, akathisia, Parkinsonism & tardive dyskinesia, blood dyscrasias, cardiovascular effects e.g. hypotension, hyper/hypothermia, porphyria, urinary incontinence, hepato/photo/corneal toxicity, biliary cirrhosis, skin discoloration. IM inj may be painful. Note: Routine administration of anticholinergics are not justified as not all patients are affected and they may unmask or worsen tardive dyskinesia.
- **Antipsychotics** may potentiate the effects of alcohol, anxiolytics, hypotensive agents and anticholinergic drugs. They may antagonise the effects of anti-epileptic drugs.
4.03 ANTIDEPRESSANTS

WHO MODEL FORMULARY 2008 NOTES:

Tricyclic and related antidepressants and selective serotonin reuptake inhibitors (SSRIs) are the most widely used drugs in the treatment of depressive disorders. The response to antidepressant therapy is usually delayed with a lag-period of up to two weeks and at least six weeks before maximum improvement occurs. It is important to use doses that are sufficiently high for effective treatment, but not so high as to cause toxic effects. Low doses should be used for initial treatment in the elderly. The use of more than one antidepressant at a time is not recommended since this does not enhance effectiveness and may result in enhanced adverse effects/interactions.

Patients should be reviewed every 1-2 weeks at the start of treatment. Treatment should be continued for at least 4 weeks (6 weeks in the elderly) before considering whether to change to another antidepressant due to lack of efficacy. In the case of a partial response, treatment may be continued for a further 2 weeks (elderly patients may take longer to respond). Remission usually occurs after 3-12 months. Treatment at full therapeutic dose should be continued for at least 6 months, but preferably up to 12 months after resolution of symptoms (about 12 months in the elderly). Treatment should not be withdrawn prematurely otherwise symptoms are likely to recur. Patients with a history of recurrent depression should continue to receive maintenance treatment (for at least 5 years and possibly indefinitely). Lithium [not on Mercy Ships list] may be used as an alternative for maintenance treatment. Reduction in dose should be gradually carried out over a period of 4 weeks or longer if withdrawal symptoms emerge (6 months in patients who have been on long-term maintenance treatment).

Tricyclic and related antidepressants can be divided into those with more or less sedative effect. Those with sedative properties include amitriptyline and those with less sedative effects include imipramine [not on Mercy Ships list]. These drugs are most effective in the treatment of depression associated with psychomotor and physiological disturbances. Adverse effects include anticholinergic (more correctly antimuscarinic) symptoms of dry mouth, blurred vision, constipation and urinary retention. Arrhythmias and heart block can occur. Minimal quantities of tricyclic antidepressants should be prescribed at any one time (dangerous in overdose, high rate of fatality in the case of amitriptyline).

SSRIs (e.g. fluoxetine) characteristically cause gastrointestinal and sleep disturbances and hypersensitivity reactions including rash (may be a sign of an impending serious systemic reaction and discontinuation should be considered) but they are less sedating and have fewer anticholinergic (antimuscarinic) and cardiotoxic effects than tricyclic antidepressants. SSRIs are less toxic in overdose than the older tricyclic compounds, but there is some concern that SSRIs may increase suicidal ideation, especially in children and adolescents.
4.03a TRICYCLIC ANTIDEPRESSANTS [TCA]

[NOTE: Antidepressants may take at least TWO weeks to give effect, counsel patients accordingly to encourage compliance and avoid unreasonable expectations and disappointment.]

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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Amitriptyline Hydrochloride Tab 25mg</td>
<td>IDA</td>
<td>Depression: by mouth Adult initially 75mg daily in divided doses or as a single dose at bedtime increased gradually as needed to 150-200mg daily (Elderly/adolescents half dose); not recommended in under 16 yo.</td>
</tr>
<tr>
<td>Laroxyl</td>
<td>EML</td>
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</tr>
</tbody>
</table>

COMMENT/CAUTIONS:
- **Contraindications:** recent MI, arrhythmias (especially heart block); manic phase in bipolar disorders; severe liver disease; children; porphyria.
- **Adverse effects:** dry mouth, blurred vision, constipation, urinary retention. May cause drowsiness: caution patients to avoid driving/operate machinery.
- Do not use TCAs combined with MAOIs [Monoamine-oxidase inhibitor, none on the Mercy Ships list] unless under specialist supervision.

4.03b SELECTIVE SEROTONIN REUPTAKE INHIBITORS [SSRI]

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<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Fluoxetine Cap 20mg (Prozac) [SSRI]</td>
<td>IDA</td>
<td>Depression: by mouth Adult 20mg in the morning; child not recommended</td>
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<td></td>
<td>EML</td>
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COMMENT/CAUTIONS:
- A drug-free gap of ONE WEEK should be left after stopping SSRI (TWO WEEKS for paroxetine or sertraline, FIVE WEEKS for fluoxetine) before starting a MAOI [Monoamine-oxidase inhibitor, none on the Mercy Ships list]. A gap of TWO WEEKS is needed after stopping MAOI before starting another antidepressant.
- **Adverse effects:** diarrhoea, nausea/vomiting, headache, restlessness and anxiety. They tend to cause less sedation, cardiotoxicity and antimuscarinic effects. Caution use in epilepsy as it lowers the convulsion threshold.
- **Hyponatraemia** has been associated with all types of antidepressants (usually in the elderly). Consider in all patients who develop drowsiness, confusion or convulsions during treatment.
Treatment should always be started with a single drug, but the choice of an antiepileptic can only be made on an individual basis and will depend on the efficacy of the drug and the patient’s tolerance of treatment. If a drug fails to control the seizures after it has been used in full therapeutic dosage for an adequate period, or if it is not tolerated, it should be gradually substituted with another with the first drug being withdrawn only when the new regimen is mainly established. If monotherapy is ineffective, two drugs should be given in combination and several regimens may need to be tried before the most appropriate is found.

Initial dose of the drug of choice should be determined on the basis of the degree of urgency, the size and age of the patient. It should be increased gradually until an effective response is obtained. All antiepileptics commonly produce neurological adverse effects at too high a dose, and patients should be monitored closely for adverse effects to help in accurate dose titration. Except for phenytoin, it is rarely useful to measure plasma-drug concentrations as an aid to dose adjustment. Non-compliance because of inappropriate dosing and overdosing is a major impediment to effective antiepileptic treatment. Patients should ideally remain under supervision throughout treatment.

GENERALIZED TONIC-CLONIC, SIMPLE PARTIAL AND COMPLEX PARTIAL SEIZURES. Carbamazepine, phenobarbital, phenytoin, and valproate [not on Mercy Ships list] are widely used in the treatment of these conditions. However, each of these drugs is associated with dose-related and idiosyncratic adverse effects and monitoring of haematological and hepatic function is often advised, particularly for carbamazepine & valproate.

ABSENCE SEIZURES. Both ethosuximide and valproate [both not on Mercy Ships list] are widely used in the treatment of absence seizures (petit mal) and are usually well tolerated. However, ethosuximide can, rarely, cause lupus erythematosus and psychoses which call for immediate, but cautious, discontinuation. Absence seizures are commonly associated with tonic-clonic seizures and valproate is preferred since it is effective in both disorders.

TONIC, ATONIC AND ATYPICAL ABSENCE SEIZURES. Phenobarbital or phenytoin is widely used for tonic seizures, valproate [not on Mercy Ships list] for atonic and atypical absence seizures.

MYOCLONIC SEIZURES. Valproate [not on Mercy Ships list] is widely used and most effective for juvenile myoclonic seizures. However, both valproate and this type of seizure are associated with a high relapse rate and it is often necessary to continue therapy indefinitely. Other myoclonic seizures are often resistant to
treatment and some do not have an epileptic basis. Valproate can be of value here and other antiepileptic drugs may be useful in intractable cases.

INFANTILE SPASM (INFANTILE MYOCLONIC EPILEPSY). Infantile spasms, which are often associated with severe brain damage, can be resistant to antiepileptic drugs. Valproate [not on Mercy Ships list] is sometimes used.

FEBRILE CONVULSIONS. Brief febrile convulsions usually respond to sponging with tepid water and by giving an antipyretic such as paracetamol (section 5.01). Recurrent febrile convulsions or prolonged convulsions (those lasting 15 minutes or longer) are treated with diazepam, either rectally in solution or by intravenous injection, to prevent possible brain damage. Intermittent prophylaxis, with diazepam administered at the onset of fever, may prevent recurrence of febrile convulsions, but only in a small proportion of children and its routine use in this way is not recommended. Use of antiepileptics for continuous prophylaxis is controversial; it is probably indicated in only a small proportion of children including those whose first seizure occurred during the first 14 months of life, or who already have evident neurological abnormalities, or who have had previous prolonged or focal convulsions. Phenobarbital may be used for this purpose but careful clinical monitoring and dosage adjustment are necessary in order to minimize adverse effects risk. Valproate [not on Mercy Ships list] though effective is not recommended due to greater hepatotoxicity risk in young children.

STATUS EPILEPTICUS is a medical emergency which carries a high mortality rate. Initial management includes positioning the patient to avoid injury, supporting respiration including provision of oxygen, maintaining blood pressure, and the correction of any hypoglycaemia; maintenance of the airway and assisted ventilation are crucial even when the seizures are controlled, because the drugs used in its management may also depress respiration. The use of IV thiamine [not on WHO Model List] should be considered if alcohol abuse is suspected; pyridoxine should be administered if the status epilepticus is likely to be responsive to pyridoxine. IV diazepam is often effective in status epilepticus, acts rapidly and should be administered first, followed immediately by a loading dose of phenytoin which has a longer-acting effect. When cannulation is impossible, diazepam may be administered rectally as a solution (absorption from suppositories is too slow for treatment of status epilepticus). Intravenous phenobarbital is also effective but is more likely to cause respiratory depression; it is used in refractory cases but should be avoided in patients who have recently received oral phenobarbital. If seizures continue despite treatment, general anaesthesia may be required. The underlying cause must be identified and remedied in all cases.

[Mercy Ships note: Please refer to the WHO Formulary 2008 for the full notes including antiepileptics withdrawal and their use in pregnancy & breastfeeding.]
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<tr>
<td><strong>Diazepam Inj 10mg/2ml (Valium)</strong></td>
<td>PS MSL IDA EML</td>
<td>Status epilepticus, febrile convulsion: <em>By slow IV inj undiluted</em> (max rate 5mg/minute), Adult 10-20mg repeat if needed after 30-60 minutes (may be followed by <em>IV infusion</em> to max 3mg/kg over 24 hours); Child 200-300 micrograms/kg (or 1mg per year of age).</td>
</tr>
<tr>
<td><strong>Diazepam Rectal Tube 2mg/ml, 1.25 or 2.5ml tubes</strong></td>
<td>PS D</td>
<td>Status epilepticus, febrile convulsion: <em>By rectum</em> as rectal solution, Adult &amp; Child &gt; 10kg, 500 micrograms/kg, up to max 30mg (Elderly half dose), repeated after 12 hours if necessary.</td>
</tr>
<tr>
<td><strong>Phenobarbital Tab 30mg [Phenobarbitone] (Gardenal)</strong></td>
<td>PS IDA EML</td>
<td><em>By mouth</em> Adult 60-180mg at night; Child 5-8mg/kg daily.</td>
</tr>
<tr>
<td><strong>Phenobarbital Inj 100mg/ml, 2ml [Phenobarbitone] (Gardenal)</strong></td>
<td>PS IDA EML</td>
<td><em>By IV inj</em> diluted in 20ml WFI, Adult 10mg/kg at max rate 100mg/minute, max total dose 1g; Child 5-10mg/kg, at max rate 30mg/minute.</td>
</tr>
<tr>
<td><strong>Phenytoin Sodium Tab 100mg (Dilantin)</strong></td>
<td>IDA EML</td>
<td><em>By mouth</em>, daily as single dose at night or in 2-3 divided doses given after food, Adult 200-300mg, max 500mg/DAY; Child 5-8mg/kg daily in 2 divided doses, max 300mg/DAY.</td>
</tr>
<tr>
<td><strong>Phenytoin Sodium Inj 250mg/5ml (Dilantin Ready Mixed Inj)</strong></td>
<td>IDA EML</td>
<td>Status epilepticus: <em>By slow IV undiluted</em> Adult loading dose 13-15mg/kg at max rate 50mg/minute; maintenance 100mg every 6 hours. Child loading dose 15mg/kg at max rate 1mg/kg/minute.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **PS** Psychotropic Substances. Recording required in pharmacy/ward/OR.
- **Phenytoin**: Requires BP and ECG monitoring, max IV rate 50mg/minute to avoid cardiotoxicity and apnoea (fatalities reported when given IV too rapidly). Contraindicated in porphyria, sinus bradycardia, SA block, 2nd & 3rd degree AV block, and in patients with Stokes-Adams syndrome.
- **Phenytoin adverse effects**: sedation, mental depression, ataxia, nystagmus, allergic skin reactions, megaloblastic anaemia, osteomalacia.
4.05 ANTIMIGRAINE MEDICINES

WHO MODEL FORMULARY 2008 NOTES:

Chronic recurrent headache is associated with many disorders, both somatic and psychogenic. An accurate diagnosis must consequently be made before appropriate treatment can be initiated for migraine. Untreated, migraine attacks last for several hours and sometimes for as long as 3 days. Migraine headache is frequently accompanied by episodes of gastrointestinal disturbance including nausea and vomiting. The headache may be preceded or accompanied by aura (classical migraine) which is characterised by visual disturbances such as flickering lines and fragmented vision or sensory disturbances such as tingling or numbness; rarely, hemiparesis or impaired consciousness may occur. Migraine without aura (common migraine) is the more common form occurring in about 75% of patients who experience migraine.

Emotional or physical stress, lack of or excess sleep, missed meals, menstruation, alcohol and specific foods including cheese and chocolate are often identified as precipitating factors; oral contraceptives may increase the frequency of attacks. Avoidance of such precipitating factors can be of great benefit in preventing or reducing the frequency of attacks and should be addressed in detail. Women taking combined oral contraceptives who experience an onset or increase in frequency of headaches should be advised of other contraceptive measures.

The two principal strategies of migraine management are treatment of acute attacks and prophylactic treatment.

ACUTE MIGRAINE ATTACK. Treatment of acute attacks may be non-specific using simple analgesics; if nausea and vomiting are features of the attack, an antiemetic drug may be given. Treatment is generally by mouth; some drugs are available as suppositories which may be used if the oral route is not effective (poor oral bioavailability, or absorption from the gut impaired by vomiting), or not practicable (patient unable to take drugs orally). Excessive use of antimigraine medication (analgesics, 5HT1 agonists [not included on WHO Model List] and ergotamine [not included on WHO Model List]) is associated with medication overuse headache (analgesic-induced headache); therefore, increasing consumption of these medicines needs careful management. Simple analgesics including NSAIDs (nonsteroidal anti-inflammatory drugs) can be effective in mild to moderate forms of migraine if taken early in the attack; most migraine headaches respond to paracetamol (acetaminophen), acetylsalicylic acid (aspirin) or an NSAID such as ibuprofen (see section 5.01). Peristalsis is often reduced during migraine attacks and, if available, a dispersible or effervescent preparation of the drug is preferred because of enhanced absorption compared with a conventional tablet. The risk of Reye syndrome due to acetylsalicylic acid in children can be avoided by giving paracetamol instead.
An antiemetic such as metoclopramide, given as a single dose orally or by IM injection at the onset of a migraine attack, preferably 10-15 minutes before the analgesic, is useful not only in relieving nausea but also in restoring gastric motility, thus improving absorption of the analgesic.

Specific antimigraine drugs, such as the 5HT1 agonist sumitriptan [not included on the WHO Model List and not available on the Mercy Ships list], are used when analgesics are ineffective; they act on 5HT (serotonin) 1B/1D receptors and can be used during the established headache phase of an attack. Ergot alkaloids should no longer be used; they are associated with many side effects and must be avoided in cerebrovascular or cardiovascular disease. Products which contain barbiturates or codeine are undesirable since they may cause physical dependence and withdrawal headaches.

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<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amitriptyline Hydrochloride Tab 25mg</td>
<td>IDA</td>
<td>Migraine prophylaxis (unlicensed indication): by mouth Adult initially 10mg at bedtime increased gradually as needed to 50-75mg at bedtime.</td>
</tr>
<tr>
<td>(Laroxyl)</td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Propranolol Hydrochloride Tab 40mg</td>
<td>IDA</td>
<td>Migraine prophylaxis: by mouth Adult 40mg 2-3 times daily, maintenance 80-160mg daily in divided doses.</td>
</tr>
<tr>
<td>(Inderal/Avlocardyl)</td>
<td>EML</td>
<td></td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- Consider aspirin or paracetamol for acute attack pain relief.
- Consider metoclopramide for nausea & vomiting.

NOTE. For Antiemetics, see Chapter 01 Gastrointestinal System Section 1.02.

NOTE. For Antihistamines, see Chapter 03 Respiratory System Section 3.03 Antihistamines & Antiallergics.
5  MUSCULOSKELETAL SYSTEM

WHO MODEL FORMULARY 2008 NOTES:

Pain may be modified by psychological factors and attention to these is essential in pain management. Drug treatment aims to modify the peripheral and central mechanisms involved in the development of pain. Neuropathic pain may respond only partially to conventional analgesics; treatment can be difficult and includes the use of carbamazepine (100mg 1-2 times daily gradually increased to 200mg 3-4 times daily max 1.6g/DAY) for trigeminal neuralgia and amitriptyline (10-25mg at night increased if needed to 75mg daily) for diabetic neuropathy and postherpetic neuralgia.

Non-opioid analgesics (section 5.01) are particularly suitable for musculoskeletal pain whereas the opioid analgesics (section 5.02) are more suitable for moderate to severe visceral pain. Non-opioid analgesics which also have anti-inflammatory actions include salicylates and other nonsteroidal anti-inflammatory drugs (NSAIDs); they can reduce both pain and inflammation of chronic inflammatory disorders such as rheumatoid arthritis, but they do not alter or modify the disease process itself. For the management of rheumatoid arthritis disease-modifying antirheumatic drugs (DMARDs) [not on Mercy Ships list] may favourably influence the disease process. The pain and inflammation of an acute gout attack is treated with a NSAID (section 5.03) or colchicine [not included on WHO Model List]; allopurinol (section 5.03) is used for long-term control of gout.

5.01 NON-OPIOID ANALGESICS: NSAIDS & PARACETAMOL

WHO MODEL FORMULARY 2008 NOTES:

Non-opioid analgesics with anti-inflammatory activity include salicylates such as acetylsalicylic acid and other nonsteroidal anti-inflammatory drugs such as ibuprofen. Non-opioid analgesics with little or no anti-inflammatory activity include paracetamol (acetaminophen).

The principal effects of acetylsalicylic acid are anti-inflammatory, analgesic, antipyretic and antiplatelet. Oral doses are absorbed rapidly from the gastrointestinal tract; rectal absorption is less reliable but suppositories are useful in patients unable to take oral dosage forms. Acetylsalicylic acid is used for the management of mild to moderate pain such as headache, acute migraine attacks (section 4.05), transient musculoskeletal pain and dysmenorrhea, and for reducing fever. Although it may be used in higher doses in the management of pain and inflammation of rheumatoid arthritis, other NSAIDs are preferred because they are likely to be better tolerated. Acetylsalicylic acid is also used for
its antiplatelet properties (section 2.10). Adverse effects with analgesic doses are generally mild but include a high incidence of GI irritation with slight blood loss, bronchospasm and skin reactions in hypersensitive patients, and increased bleeding time. Anti-inflammatory doses are associated with a much higher incidence of adverse reactions, and they also cause mild chronic salicylism which is characterized by tinnitus and deafness. Acetylsalicylic acid should be avoided in children < 16 yo, unless specifically indicated (e.g. juvenile arthritis), due to an association with Reye syndrome (encephalopathy and liver damage); it should particularly be avoided during fever or viral infection in children and adolescents.

**Paracetamol** is similar in analgesic and antipyretic efficacy to acetylsalicylic acid. It is used for mild to moderate pain including headache and acute migraine attacks (section 4.05) and for reducing fever, including postimmunization pyrexia. Paracetamol is particularly useful in patients in whom salicylates or other NSAIDs are contraindicated, such as asthmatics and those with a history of peptic ulcer, or for children < 16 yo in whom salicylates should be avoided because of the risk of Reye syndrome. It is generally preferred to acetylsalicylic acid, particularly in the elderly, because it is less irritant to the stomach. Unlike acetylsalicylic acid and other NSAIDs, paracetamol has little anti-inflammatory activity which limits its usefulness for long-term treatment of pain associated with inflammation; however it is useful in the management of osteoarthritis, a condition with only a small inflammatory component. In normal doses adverse effects are rare, but overdosage with a single dose of 10–15 g is particularly dangerous because it may cause hepatocellular necrosis and, less frequently, renal tubular necrosis.

**NSAIDs (ibuprofen)** have analgesic, anti-inflammatory, antipyretic properties. In single doses NSAIDs have analgesic activity comparable to that of paracetamol. In regular full dosage, they have a lasting analgesic and anti-inflammatory effect, which makes them useful for continuous or regular pain due to inflammation. Differences in anti-inflammatory activity between different NSAIDs are small but there is considerable variation in individual patient response and in the incidence and type of adverse effects. Ibuprofen has fewer adverse effects than other NSAIDs but its anti-inflammatory properties are weaker. Ibuprofen is used in the treatment of mild to moderate pain and in the management of pain and inflammation in rheumatoid/juvenile arthritis. It may also be of value in the less well-defined conditions of back pain and soft-tissue disorders. Ibuprofen is also used to reduce pain in children. With all NSAIDs caution should be exercised in the treatment of the elderly, in allergic disorders, during pregnancy and breastfeeding. In patients with renal, cardiac or hepatic impairment, the dose should be kept as low as possible and renal function should be monitored. NSAIDs should not be given to patients with active peptic ulceration and should preferably not be used in those with a history of the disease. The commonest adverse effects are generally gastrointestinal including nausea, vomiting, diarrhoea, and dyspepsia; hypersensitivity reactions including anaphylaxis, bronchospasm, and rash have been reported, as has fluid retention.
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<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Acetylsalicylic Acid (Aspirin) Tab 100mg, 300mg, 500mg (various formulations)</td>
<td>IDA</td>
<td>By mouth Adult 300-900mg every 4-6 hours; max 4g/DAY in divided doses, after food (dissolve soluble tablets in a glass of water). [NOT for &lt; 16 yo, Reye's syndrome reported.]</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Diclofenac Sodium Tab 25mg &amp; 50mg, 100mg Suppository 25mg, 50mg &amp; 100mg (Voltaren)</td>
<td>MSL</td>
<td>Oral/rectal routes Adult 25-50mg up to 3 times daily; Child 6 mths - 18 yo 0.3-1mg/kg/DOSE 3 times daily; or 2-5 yo 25mg, 6-12 yo 50mg, given twice daily. Give oral dose after food. By deep IM inj (undiluted, into the gluteal muscle) Adult 75mg repeated if necessary after 4-6 hours for max 2 days, for acute/post-op pain; By IV infusion (in hospital setting) for prevention of post-op pain, initially after surgery Adult 25-50mg over 15-60 minutes or 75mg over 30-120 minutes, then by cont IV infusion 5mg/hour, for max 2 days. NOTE: Max total daily dose by any route 150-200mg. For IV infusion dilute 75mg with 100-500ml D5/NS.</td>
</tr>
<tr>
<td>Ibuprofen Tab 200mg &amp; 400mg, Suspension 100mg/5ml (Brufen)</td>
<td>MSL</td>
<td>By mouth Adult 200-400mg 4 times daily, preferably taken after food, max 2.4g/DAY; Child &gt;7kg, 20-30mg/kg/DAY in divided doses; or &lt;12kg (&lt;2yo) 5-7.5mg/kg/DOSE, &gt;12kg (2-12yo) 5-10mg/kg/DOSE; or 1-2 yo 50mg, 3-7 yo 100mg, 8-12 yo 200mg, taken 3-4 times daily.</td>
</tr>
<tr>
<td>Indometacin Tab 25mg [Indomethacin] (Indocid)</td>
<td>IDA</td>
<td>By mouth in divided doses with food. Dysmenorrhoea, up to 75mg/DAY; Rheumatic disease, 50-200mg/DAY; Acute gout, 150-200mg/DAY. May cause dizziness.</td>
</tr>
<tr>
<td>Ketorolac Tromethamine Inj 30mg/ml (Toradol)</td>
<td>MSL</td>
<td>Moderate post-op pain: by deep IM inj (undiluted over 15 seconds), Adult/Child &gt;16yo 10-30mg every 4-6 hours when needed for 2 days, max 90mg/DAY; Elderly/Adult &lt;50kg max 60mg/DAY.</td>
</tr>
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<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Paracetamol Chewable Tab 80mg or Suspension 160mg/5ml (Tylenol US brand) (Acetaminophen) [Do not exceed dose listed.]</td>
<td>D</td>
<td><em>By mouth</em> Child 1-5yo 80-160mg (1-2 chewable tablets or 2.5-5ml); 6-11yo, 160-320mg (2-4 chewable tablets or 5-10ml); dose may be repeated every 4-6 hours. Maximum 4 doses in 24 hours.</td>
</tr>
<tr>
<td>Paracetamol Suspension 120mg/5ml (generic/IDA) (Acetaminophen) [Do not exceed dose listed.]</td>
<td>IDA</td>
<td><em>By mouth</em> Infant &lt; 3 mth 5-10mg/kg (on doctor’s advice only); child 3mth-1 yo 60-120mg, 1-5 yo 120-250mg; 6-12yo 250-500mg; or &lt;12kg (&lt;2yo) 15mg/kg/DOSE, &gt;12kg (2-12yo) 15-20mg/kg/DOSE; all above doses may be repeated every 4-6 hours when needed. Maximum 4 doses in 24 hours.</td>
</tr>
<tr>
<td>Paracetamol Tab 500mg &amp; Effervescent Tab 500mg (Panadol/Tylenol) (Acetaminophen) [Do not exceed dose listed.]</td>
<td>MSL IDA</td>
<td><em>By mouth</em> Adult, 0.5-1g every 4-6 hours, max 4g daily; child 6-12 yo 250-500mg, given every 4-6 hours. Dissolve effervescent tablets in a glass of water. Maximum 4 doses in 24 hours.</td>
</tr>
<tr>
<td>Paracetamol Suppository 125mg, 250mg, 500mg &amp; 1g (Acetaminophen) [Do not exceed dose listed.]</td>
<td>IDA</td>
<td><em>Rectally</em>, child 1-5 yo 125-250mg, 6-12 yo 250-500mg, adult/child &gt;12yo 500-1000mg every 4-6 hours. Maximum 4 doses in 24 hours.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**

- **Adverse effects:** All NSAIDs can produce GI side effects. Antacids should not be added to NSAIDs since they will affect absorption and efficacy, and may also mask the symptoms of NSAID-induced ulceration. H2 antagonists, proton pump inhibitors and misoprostol should only be prescribed with NSAIDs for patients with peptic ulceration history if alternatives are not available (see BNF recommendations). May also cause worsening of asthma.
- **Drug interactions:** Commonly with antihypertensives (antagonism of hypotension, increased risk of renal failure with ACE inhibitors), diuretics (increased risk of nephrotoxicity, NSAIDs antagonise diuretic effect of loop diuretics) and warfarin (increased risk of bleeding).
- **Aspirin:** Due to association with Reye’s syndrome, aspirin should not be prescribed for under 16 yo unless specifically indicated e.g. juvenile arthritis.
- **Ketorolac Inj:** Pain relief may not occur for up to 30 minute after injection.
WHO MODEL FORMULARY 2008 NOTES:

Morphine is effective in relieving moderate to severe pain, particularly of visceral origin; there is a large variation in patient response. Weaker opioids such as codeine are suitable for mild to moderate pain. **Codeine** is an opioid analgesic much less potent than morphine and much less liable, in normal doses, to produce adverse effects including dependency. It is effective for mild to moderate pain but is too constipating for long-term use. **Morphine** remains the most valuable analgesic for severe pain. In addition to pain relief it confers a state of euphoria and mental detachment; repeated administration may cause dependence and tolerance, but this should not be a deterrent in the control of pain in terminal illness. Regular use may also be appropriate for certain cases of non-malignant pain, but specialist supervision is required. In normal doses common adverse effects include nausea, vomiting, constipation and drowsiness; larger doses produce respiratory depression and hypotension.

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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</thead>
<tbody>
<tr>
<td>Codeine Tab 30mg</td>
<td>N/CD</td>
<td>By mouth Adult 30-60mg every 4 hour when needed max 240mg/DAY</td>
</tr>
<tr>
<td>Codeine Syrup 25mg/5ml</td>
<td>N/CD</td>
<td>By mouth Child 1-12 yo 3mg/kg/DAY given in divided doses.</td>
</tr>
<tr>
<td>Codeine 30mg + Paracetamol 500mg Combination Tablet (Co-Codamol 30/500) [Paracetamol=Acetaminophen]</td>
<td>N/CD</td>
<td>By mouth Adult 1-2 tablets every 4-6 hours, maximum 8 tablets daily.</td>
</tr>
<tr>
<td>Fentanyl Inj 100microgram/2ml (as citrate) [Opioids]</td>
<td>N/CD</td>
<td>Premed: <em>By IM inj</em> 50-100 microgram 30-60 minute pre-surgery, or <em>by IV inj or infusion</em> 20-100 microgram/kg, max 150 microgram/kg total dose. Analgesic: <em>IM inj</em> 50-100 microgram. See manufacturer’s leaflet for detail. <em>May cause respiratory depression.</em> Inject IM undiluted into a large muscle mass, or IV undiluted over 2-3 minute. For IV infusion, further dilute with D5/NS.</td>
</tr>
</tbody>
</table>

N/CD – Drugs subject to international control under the Single Convention on Narcotic Drugs (1961).
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine Sustained Release Tab 30mg (SRM-Rhotard) [Opiates]</td>
<td>N/CD IDA</td>
<td>By mouth 30-60mg twice daily for patients stabilised on morphine, dose titrate according to pain control, see Chart below for conversion from morphine oral solution dose.</td>
</tr>
<tr>
<td>Morphine Hydrochloride Oral Solution 10mg/5ml [Opiates]</td>
<td>N/CD EML</td>
<td>By mouth 5-20mg every 4 hours, titrate according to pain control. Half dose can be given for breakthrough pain before the next 4 hourly dose. Oral dose is 2-3 times of parenteral dose, convert to sustained release tablet preparation when stabilised.</td>
</tr>
<tr>
<td>Morphine Sulphate Inj 10mg/ml [Opiates]</td>
<td>N/CD MSL IDA</td>
<td>Acute pain: by SC/IM inj undiluted; Adult 10mg every 4 hours when needed or slow IV in small boluses of 2-10mg over 4-5 minutes, titrate to pain control. Infant &lt;1 month, 25-50 microgram/kg with monitoring; 1-12 months 200 microgram/kg/DOSE; 1-5 yo: 2.5-5mg; 6-12 yo 5-10mg; given every 4 hours when needed. (convert to oral doses when tolerated, see chart below). Premed 1 hour before surgery: Adult by SC/IM inj 150-200microgram/kg; Child by IM inj 50-100microgram/kg. Inject IM/SC undiluted; slow IV 10mg dilute in 5-10ml WFI over 5 minutes, IV infusion dilute in 50-100ml of D5/NS infuse at 2mg/minute.</td>
</tr>
<tr>
<td>Pholcodine Linctus 5mg/5ml (Pavachol-D)</td>
<td>N/CD EML</td>
<td>For unproductive persistent cough: By mouth adult 5-15mg up to 4 times daily; child 6-12 yo 5mg up to 4 times daily; 3-5 yo 5mg up to 3 times daily; 1-2 yo 2.5mg up to 4 times daily.</td>
</tr>
</tbody>
</table>

N/CD – Drugs subject to international control under the Single Convention on Narcotic Drugs (1961).

Cont. next page
### Tramadol Hydrochloride

**Cat.** IDA  
**Indication/Dose:** Adult/Child > 14 yo *oral/SC/IM/IV* (IM/IV given over 2-3 minutes), 50-100mg every 6 hours; max 400mg in 24 hours. *Monitor for respiratory depression.*

**Cat.** D  
**Indication/Dose:** Adult/Child > 12 yo: *By mouth* 100-200mg given 1-2 times daily, max 400mg in 24 hours; or (according to the product leaflet) >1yo 1mg/kg/DOSAGE every 6 hours, 2-12yo 2mg/kg/DOSAGE every 4-6 hours, max 8mg/kg/DAY. Swallow whole, do not chew.

N/CD – Drugs subject to international control under the Single Convention on Narcotic Drugs (1961).

**Comment/CAUTIONS:**

- **N/CD Narcotic/Controlled Drugs.** Recording required in pharmacy/ward/OR.  
  **Morphine for pain relief:** The appropriate dose is that which relieves pain but does not give toxic side effects. Morphine is well absorbed by mouth producing peak blood levels in 1.5-2 hours. It should be given at 4 hourly intervals regularly unless sustained release preparations are used which can be given 12 hourly. To initiate: administer 5-10mg morphine oral solution 4 hourly when needed, increasing dose by 50% until pain is controlled. Convert to sustain release (SR) morphine using the chart below. Treat breakthrough pain with morphine oral solution on a ‘when needed’ basis with 1/6th of the 24-hour total dose requirement, increasing the morphine SR tablet dose if needed.

- **Morphine - Adverse effects:** 20% sedation, 30% nausea/vomiting (usually temporary), 95% constipation.

- **Morphine Conversion Chart:**
  
<table>
<thead>
<tr>
<th>Morphine Injection</th>
<th>Morphine Oral Solution</th>
<th>Morphine SR Tab</th>
</tr>
</thead>
<tbody>
<tr>
<td>(every 4 hours)</td>
<td>(every 4 hours)</td>
<td>(every 12 hours)</td>
</tr>
<tr>
<td>Dose / 2</td>
<td>Dose</td>
<td>Dose x 3</td>
</tr>
<tr>
<td>5mg</td>
<td>10mg</td>
<td>30mg</td>
</tr>
<tr>
<td>10mg</td>
<td>20mg</td>
<td>60mg</td>
</tr>
</tbody>
</table>

  (...and so forth according to patient tolerance to side effects and pain relief).
5.03 MEDICINES USED IN GOUT

WHO MODEL FORMULARY 2008 NOTES:

ACUTE GOUT. Acute attacks of gout are usually treated with high doses of a NSAID such as indometacin (150–200 mg daily in divided doses); ibuprofen has weaker anti-inflammatory properties than other NSAIDs and is therefore less suitable for treatment of gout. Salicylates, including acetylsalicylic acid are also not suitable because they may increase plasma-urate concentrations. Colchicine [not on WHO Model List] is an alternative for those patients in whom NSAIDs are contraindicated. Its use is limited by toxicity with high doses. It does not induce fluid retention and can therefore be given to patients with heart failure; it can also be given to patients receiving anticoagulants.

CHRONIC GOUT. For long-term control of gout in patients who have frequent attacks, the presence of tophi, or acute gouty arthritis, the xanthine oxidase inhibitor allopurinol may be used to reduce production of uric acid. It should not be used to treat an acute attack since it may prolong it indefinitely. Treatment for chronic gout should not be started until after an acute attack has completely subsided, usually 2–3 weeks. The initiation of allopurinol treatment may precipitate an acute attack therefore colchicine [not on WHO Model List] or a suitable NSAID should be used as a prophylactic and continued for at least one month after the hyperuricaemia has been corrected. If an acute attack develops during treatment for chronic gout, then allopurinol should continue at the same dosage and the acute attack should be treated in its own right. Treatment for chronic gout must be continued indefinitely to prevent further attacks of gout.

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Allopurinol Tab 100mg</td>
<td>IDA</td>
<td>Gout prophylaxis: By mouth Adult initially 100mg after food with plenty of water; maintenance 100-200mg daily in mild conditions, up to max 900mg/DAY given in divided doses; Child 10-20mg/kg/DAY in divided doses, taken after food with water.</td>
</tr>
</tbody>
</table>

[NOTE: DO NOT START TREATMENT DURING AN ACUTE GOUT ATTACK.]
**Colchicine Tab 500microgram**

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<tr>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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</thead>
<tbody>
<tr>
<td>D</td>
<td>Acute gout attack: <em>By mouth</em> Adult initially 0.5-1mg after food, then 0.5mg (500 micrograms) every 2-3 hours until pain relief or until vomiting or diarrhoea occurs, max total dose 6mg. Do not repeat course within 3 days. Short-term prophylaxis: 0.5mg 2-3 times daily continuing for at least 1 month after hyperuricaemia has been corrected.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**

- Consider long-term gout prophylaxis only for: 1) persistent hyperuricaemia, 2) > 3 gout attacks/year + hyperuricaemia, 3) gout + hyperuricaemia + renal impairment, 4) chronic tophaceous gout.
- During acute gout attack, an NSAID may relieve inflammation & pain (see Notes above). Use colchicine where NSAIDs are contraindicated.
- Do NOT give allopurinol within TWO WEEKS of an acute attack (may precipitate further attacks, see Notes above).
- **Drug Interactions:** Thiazide diuretics may increase risk of allopurinol toxicity.
- DRUG-INDUCED Hyperuricaemia: Salicylates, diuretics, pyrazinamide, nicotinic acid and cytotoxic drugs may precipitate gout attacks.

**NOTE:** For Non-depolarising/Depolarising Neuromuscular Blocking Agents e.g. atracurium, see Chapter 13 Anaesthetics Section 13.04 Muscle Relaxants Used in Surgery.

**NOTE:** For Antimuscarinics e.g. atropine, glycopyrrolate and neostigmine, see Chapter 13 Anaesthetics Section 13.05 Antimuscarinics/Anticholinesterases.

**NOTE:** For Antimigraine Drugs see Chapter 4 Central Nervous System Section 4.05 Antimigraine Drugs.
6 ANTI-INFECTIVES

WHO MODEL FORMULARY 2008 NOTES:

The following should be considered before starting antimicrobial therapy:

1. **Viral infections** should not be treated with antibacterials. But antibacterials are occasionally helpful in controlling secondary bacterial infection (e.g. acute necrotising ulcerative gingivitis secondary to herpes simplex infection);

2. Where possible samples should be taken for culture and sensitivity testing; ‘blind’ antibacterial prescribing for unexplained pyrexia usually leads to further difficulty in establishing the diagnosis;

3. Knowledge of **prevalent organisms** and their current sensitivity is of great help in choosing an antibacterial before bacteriological confirmation is available;

4. The **dose** of an antibacterial varies according to a number of factors including age, weight, hepatic/renal function, severity of infection. The prescribing of the so-called ‘standard’ dose in serious infections may result in failure of treatment; therefore it is important to prescribe a dose appropriate to the condition. An inadequate dose may also increase the likelihood of antibacterial resistance. On the other hand, for an antibacterial with a narrow margin between the toxic and therapeutic dose (e.g. aminoglycoside) it is also important to avoid an excessive dose and the concentration of the drug in the plasma may need to be monitored;

5. The **route** of administration of an antibacterial often depends on the severity of the infection. Life-threatening infections require IV therapy. Antibacterials that are well absorbed can be given by mouth even for some serious infections. Whenever possible painful intramuscular injections should be avoided in children;

6. **Duration** of therapy depends on the nature of the infection and the response to treatment. Courses should not be unduly prolonged because they encourage resistance, they may lead to side-effects and they are costly. However, in certain infections such as tuberculosis or chronic osteomyelitis it is necessary to treat for prolonged periods. Conversely a single dose of an antibacterial may cure uncomplicated urinary-tract infections.

**SUPERINFECTION.** In general, broad-spectrum antibacterial drugs such as the cephalosporins are more likely to be associated with adverse reactions related to the selection of resistant organisms for example fungal infections or antibiotic associated colitis (pseudomembranous colitis); other problems associated with superinfection include vaginitis and pruritus ani.
6.01 ANTIBACTERIALS

WHO MODEL FORMULARY 2008 NOTES:

Beta-lactam antibiotics including penicillins, cefalosporins and carbapenems share a common structure; they are bactericidal, their mechanism of action resulting from inhibition of peptidoglycan, a mucopeptide in bacterial cell walls. Benzylpenicillin and phenoxyethylpenicillin are active against susceptible strains of Gram-positive bacteria and Gram-negative bacteria, spirochaetes, and actinomycetes, but are inactivated by penicillinase and other beta-lactamases. Benzathine benzylpenicillin and procaine benzylpenicillin are long-acting preparations which slowly release benzylpenicillin on injection. A range of penicillins with improved stability to gastric acid and penicillinases have been produced by substitution of the 6-amino position of 6-aminopenicillanic acid. Cloxacillin is an isoxazoyl penicillin which is resistant to staphylococcal penicillinase. Broad-spectrum penicillins such as ampicillin are acid-stable and active against Gram-positive and Gram-negative bacteria, but are inactivated by penicillinase. Beta-lactamase inhibitors such as clavulanic acid are often necessary to provide activity against beta-lactamases produced by a wide range of both Gram-negative and Gram-positive bacteria.

Cefalosporins are classified by generation, with the first generation agents having Gram-positive and some Gram-negative activity; the second generation drugs have improved Gram-negative activity and the third generation cefalosporins have a wider spectrum of activity, although may be less active against Gram-positive bacteria than first generation drugs, but they are active against Gram-negative Enterobacteriaceae and Pseudomonas aeruginosa.

Carbapenems are semisynthetic derivatives of Streptomyces cattleya. They have a broad spectrum of activity and are stable to most penicillinases. They should be reserved for severe infections resistant to other antibiotics.

Penicillins may cause encephalopathy due to cerebral irritation. This rare, but serious adverse effect may result from very high doses or in severe renal failure. Penicillins should not be given by intrathecal injection because they can cause encephalopathy which may be fatal.

HYPERSENSITIVITY. The most important adverse effect of penicillins is hypersensitivity which causes rashes and, occasionally anaphylaxis, which can be fatal. A careful history should be taken with regard to previous allergic reactions. If rash develops, another antimicrobial should be substituted. Allergic reactions to penicillins occur in 1-10% of exposed individuals, while anaphylactic reactions occur in fewer than 0.05% of treated patients. Individuals with a history of anaphylaxis, urticaria, or rash immediately after penicillin administration are at risk of immediate hypersensitivity to a penicillin. These individuals should not
receive a penicillin, a cefalosporin or another beta-lactam antibiotic. Patients who are allergic to one penicillin will be allergic to them all because the hypersensitivity is related to the basic penicillin structure and about 10% of penicillin-sensitive patients will be allergic to cefalosporins and other beta-lactams. Individuals with a history of a minor rash (a non-confluent rash restricted to a small area of the body) or a rash occurring more than 72 hours after penicillin administration are possibly not allergic to penicillin and in these individuals a penicillin should not be withheld unnecessarily for a serious infection; however, the possibility of an allergic reaction should be borne in mind and facilities should be available for treating anaphylaxis.

6.01a Penicillins

Benzylpenicillin [Penicillin G] remains an important and useful antibiotic but it is inactivated by bacterial beta-lactamases. It is effective for many streptococcal (including pneumococcal), gonococcal and meningococcal infections and also for anthrax, diphtheria, gas gangrene, leptospirosis, tetanus and treatment of Lyme disease in children. Pneumococci, meningococci and gonococci often have decreased sensitivity to penicillin and benzylpenicillin is no longer the first choice for pneumococcal meningitis. Benzylpenicillin is given by injection as it is inactivated by gastric acid and absorption from the intestinal tract is low. Phenoxybenzylpenicillin [Penicillin V] is suitable for oral administration; it has a similar spectrum of activity but is less effective than benzylpenicillin. Do not use for serious infection as absorption and plasma concentration are variable.

Ampicillin is active against certain Gram-positive and Gram-negative organisms. It is used to treat a wide range of infections including otitis media, respiratory-tract and urinary-tract infections, and gonorrhoea due to susceptible bacteria. However, ampicillin is inactivated by penicillinases including those produced by Staphylococcus aureus and by common Gram-negative bacilli such as Escherichia coli; many strains of Haemophilus influenzae, Moraxella catarrhalis, Neisseria gonorrhoeae, and Salmonella and Shigella spp. are resistant. There are geographical variations in the incidence of resistance, an awareness of local patterns is important. In some areas, oral use should be restricted to treatment of Shigella infections; it is given in an oral dose of 1 g every 6 hours for 7–10 days.

Amoxicillin has a similar spectrum of activity to ampicillin, but is also inactivated by penicillinases. However, it is better absorbed after oral administration than ampicillin and higher plasma and tissue levels are achieved. Amoxicillin is preferred to ampicillin for the treatment of some infections including otitis media and respiratory-tract and urinary-tract infections.
**Clavulanic acid** is a beta-lactamase inhibitor. It has no significant antibacterial activity but in combination with **amoxicillin** widens amoxicillin’s spectrum of activity and allows its use against amoxicillin-resistant strains of bacteria. It is used in respiratory-tract, genito-urinary and abdominal infections, cellulitis, animal bites, and dental infections. **Cloxacillin** is used to treat infections due to penicillinase-producing staphylococci which are resistant to benzylpenicillin. It is acid-stable and may therefore be given by mouth as well as by injection.

These antibiotics may also be administered with an aminoglycoside to increase their spectrums of activity. The penicillin and aminoglycoside should not be mixed before or during administration, because loss of aminoglycoside activity can occur on mixing.

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<tr>
<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Amoxicillin Cap 250mg, 500mg, Suspension 250mg/5ml (Amoxyl)</td>
<td>IDA</td>
<td>By mouth, Adult/Child &gt; 10 yo 250mg every 8 hours doubled in severe infections; Child up to 10 yo 125mg every 8 hours doubled in severe infections. Severe/recurrent purulent respiratory infections: Adult 3g every 12 hours. Pneumonia: Adult 0.5-1g 8 hourly. Dental abscess (short course): Adult 3g repeated once after 8 hours. Urinary-tract infections (short course): Adult 3g repeated once after 10-12 hours. Chlamydia: Adult 500mg every 8 hours for 7 days. Otitis media (short course): Child 3-10 yo 750mg twice daily for 2 days. Surgical prophylaxis: Adult 3g; child &lt; 5 yo 750mg; &lt; 10 yo 1.5g, given 1 hour pre-procedure, repeated 6 hours later if needed.</td>
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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Amoxicillin 1g with Clavulanate 200mg Inj [Co-Amoxiclav] (Augmentin Inj 1.2g)</td>
<td>IDA</td>
<td>NOTE. ALL DOSES EXPRESSED AS AMOXICILLIN. Infections due to susceptible beta-lactamase producing organisms: <em>By mouth</em>, Adult and Child &gt;12 yo, 250 mg every 8 hours, doubled in severe infections; Child under 1 yo, 20 mg/kg/DAY in 3 divided doses; 1-6 yo, 125 mg every 8 hours; 6-12 yo, 250 mg every 8 hours. Severe dental infections: <em>By mouth</em>, Adult 250mg every 8 hours for 5 days.</td>
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<tr>
<td>Amoxicillin 500mg with Clavulanate 125mg Tab [Co-Amoxiclav] (Augmentin Tab 625mg)</td>
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<tr>
<td>Amoxicillin 250mg with Clavulanate 125mg Tab [Co-Amoxiclav] (Augmentin Tab 375mg)</td>
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</tr>
<tr>
<td>Amoxicillin 250mg with Clavulanate 62mg Suspension [Co-Amoxiclav] (Augmentin 250/62mg/5ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amoxicillin 125mg with Clavulanate 31.25mg Suspension [Co-Amoxiclav] (Augmentin 125/31.25mg/5ml)</td>
<td>EML</td>
<td>Infections due to susceptible beta-lactamase producing organisms: <em>By slow intravenous injection</em> over 3-4 minutes or IV infusion (diluted in 100ml NS/WFI over 30-40 minutes), Adult/Child &gt;12 yo 1g every 8 hours increased to 1g every 6 hours in severe infections; Neonate 25 mg/kg every 12 hours; Infant up to 3 months, 25 mg/kg every 8 hours; Child 3 months to12 yo 25 mg/kg every 8 hours increased to 25 mg/kg every 6 hours in severe infections. Surgical prophylaxis: <em>By slow IV inj</em>, Adult 1g at induction, with up to 2-3 further doses of 1g every 8 hours if increased risk of infection.</td>
</tr>
<tr>
<td>Ampicillin Sodium Inj 500mg [Sodium content: 2.8mmol/g = 2.8mEq/g]</td>
<td>IDA</td>
<td>Infection due to sensitive organisms: <em>By IM inj, slow IV inj or infusion</em>, Adult 500mg every 4-6 hours; Child &lt; 10 half adult dose. Meningitis: <em>By slow IV injection</em>, Adult 1-2g every 3-6 hours (max 14g/DAY); Child 150-200mg/kg daily in divided doses.</td>
</tr>
<tr>
<td>GENERIC (TRADE) NAME</td>
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<tr>
<td>Cloxacillin Sodium Inj 500mg [Sodium content: 2mmol/g = 2mEq/g]</td>
<td>IDA</td>
<td>By IM inj, Adult 250mg every 4-6 hours (doubled in severe infections); by slow IV inj, Adult 1-2g every 6 hours; Child &lt; 2 yo quarter adult dose; 2-10 yo half adult dose. Reconstitute IM inj in 1.7ml WFI, for IV inj dilute 500mg in 4.8ml WFI and inject slowly over 2-4 minutes (max concentration 50mg/ml).</td>
</tr>
<tr>
<td>Cloxacillin Sodium Cap 250mg &amp; 500mg, Suspension 125mg/5ml</td>
<td>IDA</td>
<td>By mouth, Adult 500mg 4 times daily (doubled in severe infections); Child 2-10 yo 250mg, &lt; 2 yo 125mg, given 4 times daily. Administer oral dose 30 minutes before food.</td>
</tr>
<tr>
<td>Penicillin G/ Benzylpenicillin Inj 600mg [=1 mega unit MU] (Crystapen)</td>
<td>MSL IDA</td>
<td>IM, slow IV or IV infusion, Adult 0.3g (0.5 MU) every 6 hours, doubled in severe infections; Neonate 50mg/kg/DAY in 2 divided doses; Infant 1-4 weeks 75mg/kg/DAY in 3 divided doses; Child 1 month-12 yo 100mg/kg/DAY in 4 divided doses. Bacterial endocarditis: IV route only, Adult max 7.2g (12 MU) daily in 6 divided doses. Meningococcal disease: by slow IV inj or IV infusion, Adult 2.4g (4 MU) every 4-6 hours; Neonate 100mg/kg/DAY in 2 divided doses; Infant 150mg/kg/DAY in 3 divided doses; Child 1 month-12 yo 180-300mg (0.25-0.5 MU)/kg/DAY in 4-6 divide doses. IV infusion dilute in NS, give over 15-60 minutes, at conc 100000-500000 units/ml (60-300mg/ml) for Adults, or for Infants 50000 units/ml (30mg/ml).</td>
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### GENERIC (TRADE) NAME

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<tbody>
<tr>
<td>Penicillin V/Phenoxymethylpenicillin Tab 250mg Suspension 125mg/5ml</td>
<td>IDA</td>
<td>By mouth, Adult 500mg every 6 hours (doubled in severe infections); Child &lt; 1 yo 62.5mg, 1-5 yo 125mg, 6-12 yo 250mg, given every 6 hours. Rheumatic fever secondary prophylaxis: by mouth Adult 500mg twice daily; Child 1-5 yo 125mg, 6-12 yo 250mg, given twice daily. Administer dose at least 30 minutes before or 2 hours after food.</td>
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**COMMENT/CAUTIONS:**
- Phenoxymethylpenicillin is poorly absorbed orally; take on an empty stomach. Large doses (especially benzylpenicillin) may cause electrolyte disturbances due to excess sodium.

### 6.01b CEFALOSPORINS AND IMIPENEM WITH CILASTATIN

**WHO MODEL FORMULARY 2008 NOTES:**

Cefalosporins are classified by generation, with the first generation agents having Gram-positive and some Gram-negative activity; the second generation drugs have improved Gram-negative activity and the third generation cefalosporins have a wider spectrum of activity, although may be less active against Gram-positive bacteria than first generation drugs, but they are active against Gram-negative Enterobacteriaceae and Pseudomonas aeruginosa.

**Cefazolin** is a first generation cephalosporin. Cefazolin is active against Gram-positive bacteria such as *Staphylococcus aureus* and *Streptococcus* spp., and Gram-negative bacteria including *Escherichia coli* and *Klebsiella* spp. Cefazolin is used for surgical prophylaxis of infection in clean surgery where there is no inflammation present, and where the respiratory, alimentary, or genitourinary tract are not entered. These include herniorrhaphy, cardiac, vascular, neurological, orthopaedic, and breast surgery. Cefazolin is also used for prophylaxis in surgery where contamination can be controlled such as caesarian section and abdominal hysterectomy.

**Cefixime, ceftazidime** and **ceftriaxone** are third generation cefalosporins. Cefixime is orally active and is used for the treatment of uncomplicated gonorrhoea. Ceftriaxone is used for serious infections such as septicaemia, pneumonia and meningitis; it is used as a reserve antimicrobial to treat meningitis due to *Streptococcus pneumoniae* in some areas where penicillin
resistance is found. Ceftazidime is active against Pseudomonas aeruginosa and other Gram-negative bacteria; it is used in the treatment of pseudomonas infections and in some areas is restricted to use only where gentamicin resistance is high.

**Imipenem** is a broad-spectrum antibiotic. As it is partially inactivated by enzymatic activity in the kidney, it is administered with cilastatin which inhibits the renal metabolism of imipenem. It is active against many aerobic and anaerobic Gram-positive and Gram-negative bacteria; in some areas it is kept in reserve for the treatment of infections due to *Acinetobacter* spp. and *Ps aeruginosa*, which are resistant to other more usual treatments.

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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td><strong>Cefaclor Tab 250mg &amp; 500mg (Distaclor)</strong></td>
<td>D</td>
<td><em>By mouth</em>, Adult 250-500mg every 8 hours, max 4g/DAY. Child 1-5yo 125mg, &gt; 5yo 250mg, every 8 hours; or 20mg/kg/DAY given in divided doses 8 hourly, max 1g/DAY.</td>
</tr>
<tr>
<td><strong>Cefalexin Cap 250mg &amp; 500mg, Suspension 250mg/5ml (Ceporex) [Cephalexin]</strong></td>
<td>IDA</td>
<td><em>By mouth</em>, Adult 250mg every 6 hours, doubled in severe infections; Child 25-50mg/kg/DAY every 6-12 hours, max 1g/DOSE, 4-6g/DAY.</td>
</tr>
</tbody>
</table>
| **Cefazolin Inj 1g (Ancef/Kefzol)**                       | EML  | *By IV/IM inj*, Adult usual doses, 500mg-1g every 6-12 hours, max 4g/DAY; Child usual doses *(IV only)* 25-50mg/kg/DAY given every 6-8 hours, max 100mg/kg/DAY.  
Reconstitute IM 1g with 2.5ml WFI and inject into a large muscle mass. For IV injection further dilute 1g with 10ml WFI and inject slowly over 3-5 minutes, for IV infusion further dilute 1g with 50-100ml D5/NS/RL and infuse over 20-60 minutes. |

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<tbody>
<tr>
<td>Ceftazidime Inj 1g (Fortum)</td>
<td>EML</td>
<td>Deep IM, slow IV inj or infusion (IV route only in children or if single dose &gt; 1g), Adult 1g every 8 hours or 2g every 12 hours; severe up to 3g every 12 hours (elderly max 3g/DAY, IM dose &gt; 1g divide between 2-4 sites). Child &gt; 2 months 30-100mg/kg/DAY given 8 hourly. Neonate, severe infection 25-60mg/kg/DAY given 12 hourly. Meningitis: by IV inj or infusion, Child &gt; 2 months up to 150mg/kg/DAY in 3 divided doses (max 6g/DAY). Reconstitute IM 1g with 3ml WFI or 2-3ml 1% lidocaine and inject into a large muscle mass. Slow IV further dilute 1g with 10ml WFI, inject over 3-5 minutes; IV infusion further dilute 1g with 50-100ml of D5/NS, infuse over 15-30 minutes.</td>
</tr>
<tr>
<td>Ceftriaxone Inj 1g (Rocephin)</td>
<td>IDA</td>
<td>Deep IM, slow IV or IV infusion, Adult/child &gt; 12yo 1-2g once daily, max 4g/DAY (IM dose &gt; 1g divide between 2-4 sites). Infant/child &lt; 50kg 20-50mg/kg once daily; severe infection IV infusion over 10-30 minutes 50-80mg/kg once daily. Neonates IV infusion over 60 minutes, 20-50mg/kg once daily. Reconstitute IM 1g in 3.6ml WFI or 2-3ml 1% lidocaine and inject into a large muscle mass. For IV inj, dilute 1g with 10ml WFI and inject slowly over 2-4 minutes. For IV infusion further dilute 1g in 50-100ml of D5/NS, infuse over 10-30 minutes (over 60 minutes in neonates).</td>
</tr>
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<td>GENERIC (TRADE) NAME</td>
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<tr>
<td><strong>Cefuroxime Inj 750mg</strong> <em>(Zinacef)</em></td>
<td>MSL</td>
<td><strong>By IM, slow IV or IV infusion,</strong> Adult 750mg every 6-8 hours, doubled in severe infections; IV only for single doses &gt; 750mg. Surgical prophylaxis: <em>by IV inj</em> Adult 1.5g then 750mg every 8 hours for 24-48 hours. Child 10-30mg/kg every 8 hours. Reconstitute IM/slow IV 750mg with 3ml WFI (<em>or IM in 2ml 1% lidocaine</em>), inject into a large muscle mass. *or slow IV over 3-5 minutes, IV infusion further dilute 750mg with 50-100ml of D5/NS/RL and infuse over 15-30 minutes (max conc 30mg/ml).</td>
</tr>
<tr>
<td><strong>Imipenem 500mg with Cilastatin 500mg Inj</strong> <em>(Primaxin)</em></td>
<td>EML</td>
<td><strong>NOTE. ALL DOSES ARE IN TERMS OF IMIPENEM.</strong> Infections due to susceptible organisms: <em>By IV infusion,</em> Adult 1-2g daily (in 3-4 divided doses); Less susceptible organisms: Adult up to 50mg/kg daily (max 4g/DAY) in 3-4 divided doses; Child over 3 months, 60mg/kg daily (max 2g/DAY) in 4 divided doses; Child over 40kg, adult dose. Reconstitute IV 500mg vial in 10ml D5/NS then further dilute with at least 90ml D5/NS and infuse over 20-30 minutes (max conc 5mg/ml).</td>
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**COMMENT/CAUTIONS:**
- **Adverse effects:** 10% of patients with hypersensitivity to penicillin will also be allergic to cefalosporins.
6.01c QUINOLONES

WHO MODEL FORMULARY 2008 NOTES:

Ciprofloxacin is active against both Gram-positive and Gram-negative bacteria. It is particularly active against salmonella, shigella, campylobacter, neisseria, Bacillus anthracis and pseudomonas. It is also active against chlamydia and some mycobacteria. Most anaerobic organisms are not susceptible. Ciprofloxacin is used with doxycycline and metronidazole to treat pelvic inflammatory disease.

USE IN CHILDREN: Ciprofloxacin causes arthropathy in the weight-bearing joints of immature animals and is therefore generally not recommended in children and growing adolescents. However, the significance of this effect in humans is uncertain and in some specific circumstances short-term use of ciprofloxacin in children may be justified. Ciprofloxacin is used for pseudomonal infections in cystic fibrosis (for children over 5 years), and for treatment and prophylaxis of inhalational anthrax.

TENDON DAMAGE: Tendon damage (including rupture) has been reported rarely in patients receiving quinolones. Tendon rupture may occur within 48 hours of starting treatment. Healthcare workers should be aware that:

1. Quinolones are contra-indicated in patients with a history of tendon disorders related to quinolone use;
2. elderly patients are more prone to tendonitis;
3. the risk of tendon rupture is increased by the concomitant use of corticosteroids;
4. if tendonitis is suspected, the quinolone should be discontinued immediately.

SKILLED TASKS: Ciprofloxacin may impair ability to perform skilled tasks, for example operating machinery, driving.
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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Ciprofloxacin (as HCl) Tab 250mg &amp; 500mg (Ciprobay)</td>
<td>MSL IDA</td>
<td>By mouth, Infections due to susceptible organisms: Adult 250-750mg twice daily. Shigellosis, chancroid: Adult 500mg twice daily for 3 days. Cholera: Adult 1g as a single dose. Gonorrhoea and gonococcal conjunctivitis: Adult 500mg as a single dose. Pelvic inflammatory disease: Adult 500mg twice daily. Surgical prophylaxis: Adult 750mg 60-90 minutes before procedure. Prophylaxis of meningococcal meningitis: Adult 500mg single dose.</td>
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**COMMENT/CAUTIONS:**
- Equivalent plasma concentrations when given orally or IV.
- Cautious use in pregnancy, children and epilepsy.
- Adverse effects: may cause tendon damage, at the first sign of unexplained pain or inflammation, discontinue treatment and rest the affected limb until tendon symptoms have resolved.

---

**6.01d MACROLIDES**

**WHO MODEL FORMULARY 2008 NOTES:**

Erythromycin is a macrolide; it has an antibacterial spectrum that is similar but not identical to penicillin and is used as an alternative in penicillin-allergic patients. It is effective in respiratory infections, whooping cough, legionnaires’ disease and campylobacter enteritis. Azithromycin is more active than erythromycin against some Gram-negative organisms such as *Chlamydia trachomatis*. The concentration and persistence of azithromycin is much higher in the tissue than in plasma; a single dose of azithromycin is used in the treatment of uncomplicated genital chlamydia and trachoma. Azithromycin is not recommended if there is a possibility of gonorrhoea because macrolide resistance emerges rapidly when it is used in this setting.

[NOTE: Mercy Ships stock clarithromycin in place of azithromycin. Their ranges are comparable but please refer to respective drug monographs for details.]
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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td>Clarithromycin Tab 250mg (Klacid)</td>
<td>IDA</td>
<td>By mouth, Adult 250mg twice daily; doubled in severe infections, treat for 5-7 days.</td>
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<tr>
<td>Erythromycin Stearate Tab 250mg &amp; 500mg</td>
<td>MSL</td>
<td>By mouth, Adult/Child &gt; 8 yo, 250-500mg every 6 hours; max 4g/DAY in divided doses for severe infection.</td>
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<tr>
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<td>IDA</td>
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<tr>
<td>Erythromycin Stearate Suspension 125mg/5ml</td>
<td>IDA</td>
<td>By mouth, Child up to 2 yo 125mg, 2-8 yo 250mg, given every 6 hours, doubled in severe infections.</td>
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**COMMENT/CAUTIONS:**

- **Clarithromycin Indications:** Please use for the treatment of complicated infections especially respiratory tract infection, unresponsive to standard macrolides or in patients intolerant or allergic to standard macrolides.
- **Macrolides Adverse effects:** nausea/vomiting, diarrhoea, and arrhythmias, avoid concomitant use with astemizole, terfenadine, cisapride, disopyramide, amiodarone & other arrhythmogenic drugs.
- **Macrolides Drug interactions:** As P450 enzyme inhibitors they may increase levels of anticoagulants, antiepileptics, antipsychotics, anxiolytics, hypnotics, ciclosporin, theophylline.

**6.01e Tetracyclines**

**WHO MODEL FORMULARY 2004 NOTES:**

Doxycycline is a tetracycline and is a broad-spectrum antibiotic effective for conditions caused by chlamydia, rickettsia, brucella and the spirochaete, *Borrelia burgdorferi* (Lyme disease). It is the preferred tetracycline since it has a more favourable pharmacokinetic profile than tetracycline. It is deposited in growing bone and teeth causing staining and occasionally dental hypoplasia. It should not be given to children under 8 years or pregnant women; in some countries, use in children under 12 years is contraindicated.
**Comments/CAUTIONS:**

- **Drug Interaction:** Antacids and iron and zinc salts may reduce absorption.
- **Adverse effects:** see notes above. May cause photosensitivity - avoid skin exposure to direct sunlight or sun lamps.

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**6.01f AminoGlycosides**

**WHO Model Formulary 2008 Notes:**

Aminoglycosides including **gentamicin** are bactericidal and active against some Gram-positive and many Gram-negative organisms including *Pseudomonas aeruginosa*. Aminoglycosides are not absorbed from the gut and must therefore be given by injection for systemic infections. Excretion is mainly by the kidney and accumulation occurs in renal impairment. Restrict gentamicin use to trained health personnel, ensure correct dosage and do not exceed duration of treatment as most adverse effects are dose related. The most important adverse effects are ototoxicity and nephrotoxicity and they are most common in the elderly and in patients with renal impairment. These groups and, if possible, all patients should be monitored for ototoxicity by audiometry. If there is impairment of renal function the dose interval must be increased; in severe renal impairment, the dose should also be reduced. Serum concentration monitoring avoids both excessive and subtherapeutic concentrations and can prevent toxicity and ensure efficacy. If possible serum concentrations should be monitored in all patients, but **must** be measured in infants, the elderly, in obesity, in cystic fibrosis, in high-dosage regimens, in renal impairment, or if treatment lasts for longer than 7 days. Loading and maintenance doses are based on the patient’s weight and renal function (e.g. using a nomogram) with adjustments based on plasma gentamicin concentration. High doses are used occasionally for serious infections.
**GENERIC (TRADE) NAME** | **CAT.** | **INDICATION/DOSE**
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Gentamicin Inj 80mg/2ml (as sulphate) | IDA | *By IM, slow IV Inj (over at least 3 minutes) or IV infusion (max conc 10mg/ml), Adult 3-5mg/kg/DAY in divided doses given every 8 hours or 4-7mg/kg/DAY given every 24 hours; Child up to 2 weeks, 3mg/kg/DOSE every 12 hours; 2 weeks - 12 yo 2mg/kg/DOSE given every 8 hours. Streptococcal/Enterococcal Endocarditis (as part of combination therapy, see current guidelines): by slow IV inj (over at least 3 minutes), Adult 80mg twice daily or 1mg/kg/DOSE every 8 hours. For IV infusion, reconstitute every 80mg in 100ml of D5/NS to infuse over 30-60 minutes.*

Gentamicin Sulphate Impregnated Collagen Fleece, containing 467mg collagen, 58mg gentamicin sulphate & 175mg gentamicin crobafate 5 x 8 cm (Septocoll) | EML | *To fill affected cavity as needed, for use in surgery in wound infection treatment or prophylaxis.*

**COMMENT/CAUTIONS:**
- **Adverse effects**: Dose-related, ototoxicity & nephrotoxicity; avoid concurrent use with ototoxic diuretics e.g. frusemide, cephalosporins, amphotericin.
- If plasma level monitoring is available: first assay 24 hours after starting, twice weekly, peak levels taken 1 hour after dosing (range 5-10mg/L), trough levels taken just before the next dose (range < 2mg/L or 2 micrograms/ml).
WHO MODEL FORMULARY 2008 NOTES:

**Clindamycin** is a bacteriostatic antibacterial with activity against Gram-positive aerobes and a wide range of anaerobes. However, its use is limited because of adverse effects. Antibiotic-associated colitis can occur with a wide range of antibacterials, but occurs most frequently with clindamycin. It may be fatal and is most common in women and the elderly; it can develop during or after treatment with clindamycin. Patients should discontinue treatment immediately if diarrhoea develops. Clindamycin is recommended for the treatment of staphylococcal bone and joint infections and for intra-abdominal sepsis. It is also used for endocarditis prophylaxis when a penicillin is not appropriate.

Chemoprophylaxis with **isoniazid** can prevent the development of clinically apparent tuberculosis in persons in close contact with infectious patients, and also prevent the reactivation of previously dormant disease in other persons at high risk particularly those who are immunodeficient. [Mercy Ships note: Isoniazid is in the formulary STRICTLY for this indication.]

**Metronidazole** has high activity against anaerobic bacteria and protozoa (section 6.04).

**Nitrofurantoin** is bactericidal *in vitro* to most Gram-positive and Gram-negative urinary-tract pathogens and it is used to treat acute and recurrent urinary-tract infections. It is also used prophylactically in chronic urinary-tract infections.

The usefulness of sulfonamides is limited by an increasing incidence of bacterial resistance. For many indications they have been replaced by antibiotics that are more active and safer. **Sulfamethoxazole** is used in combination with **trimethoprim** because of their synergistic activity. In some countries, indications for the use of this combination (summarized as **co-trimoxazole**) have been restricted. The treatment of *Pneumocystis carinii* infections must only be undertaken with specialist supervision where there are appropriate monitoring facilities. **Trimethoprim** is also used alone for respiratory-tract infections and, in particular, for urinary-tract infections. [Mercy Ships note: see current guidelines for treatment of respiratory-tract infections.]

**Vancomycin** is not significantly absorbed from the gastrointestinal tract and must be given intravenously for systemic infections which cannot be treated with other effective, less toxic antimicrobials. It is used to treat serious infections due to Gram-positive cocci including methicillin-resistant staphylococcal infections, brain abscess, staphylococcal meningitis and septicaemia.
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<tr>
<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Clindamycin Cap 150mg (Dalacin C)</td>
<td>IDA</td>
<td>EML</td>
</tr>
<tr>
<td>Co-trimoxazole Tab 960mg (Sulfamethoxazole 800mg with Trimethoprim 160mg) (Bactrim/Septin 960mg)</td>
<td>IDA</td>
<td>EML</td>
</tr>
<tr>
<td>Co-trimoxazole Suspension 240mg/5ml (Sulfamethoxazole 200mg with Trimethoprim 40mg/5ml) (Bactrim 240mg/5ml) Co-trimoxazole Tab 480mg (Sulfamethoxazole 400mg with Trimethoprim 80mg) (Bactrim/Septin 480mg)</td>
<td>IDA</td>
<td>EML</td>
</tr>
<tr>
<td>Isoniazid Tab 300mg</td>
<td>IDA</td>
<td>EML</td>
</tr>
<tr>
<td>GENERIC (TRADE) NAME</td>
<td>CAT.</td>
<td>INDICATION/DOSE</td>
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</tr>
<tr>
<td>Metronidazole Tab 200mg, Suspension 125mg/5ml (Flagyl)</td>
<td>MSL IDA</td>
<td>By mouth, Anaerobic infections: Adult 800mg initially then 400-500mg every 8 hours; Child 7.5mg/kg/DOSE every 8 hours; usually treated for 7 days. Bacterial vaginosis: Adult 2g single dose or 400mg twice daily for 7 days. Leg ulcers and pressure sores: Adult 400mg every 8 hours for 7 days. Acute ulcerative gingivitis: Adult 200-250mg every 8 hours for 3 days; Child 1-3 yo 50mg every 8 hours, 3-7 yo 100mg every 12 hours, 7-10 yo 100mg every 8 hours, for 3 days. Antibiotic-associated colitis: Adult 800mg initially then 400mg 3 times daily for 10 days. Tablets should be swallowed whole with water, during or after a meal; Suspension should be taken one hour before a meal.</td>
</tr>
<tr>
<td>Metronidazole Inj 500mg/100ml (Flagyl)</td>
<td>MSL IDA</td>
<td>Treatment: IV infusion only, (in NS over 20-60 minutes of 5-8mg/ml), Adult 500mg every 8 hours. Child loading dose 15mg/kg, maintenance 7.5mg/kg/DOSE (max 600mg), Neonate given every 12 hours, Child &gt; 4 weeks given every 8 hours. Surgical prophylaxis: IV infusion, Adult 500mg at induction, up to 3 further doses of 500mg may be given every 8 hours for high-risk procedures; Child 7.5mg/kg/DOSE.</td>
</tr>
<tr>
<td>GENERIC (TRADE) NAME</td>
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</tr>
<tr>
<td>Nitrofurantoin Tab 100mg (Furadantin)</td>
<td>MSL IDA</td>
<td>By mouth, Acute uncomplicated urinary tract infections (UTI): Adult 100 mg every 12 hours or 50 mg every 6 hours with food for 7 days; Child &gt; 3 months, 3 mg/kg/DAY in 4 divided doses. Severe recurrent UTI: Adult 100 mg every 6 hours with food for 7 days (reduce dose to 200mg/DAY in divided doses if severe nausea). Prophylaxis of UTI (see Caution notes): Adult 50-100 mg at night; Child &gt; 3 months 1 mg/kg at night.</td>
</tr>
<tr>
<td>Trimethoprim Tab 100mg</td>
<td>EML</td>
<td>By mouth, Acute infections: Adult 200 mg every 12 hours; Child 6 weeks–5 months, 25 mg twice daily; 6 months–5 yo, 50 mg twice daily; 6–12 yo, 100 mg twice daily. Chronic infections and prophylaxis: Adult 100 mg at night; Child 1–2 mg/kg/DOSE at night. Urinary-tract infection treatment: Adult 200-300mg 1-2 times daily for 3-7 days or 1200mg single dose; prophylaxis 100-300mg at night.</td>
</tr>
<tr>
<td>Vancomycin Inj 1g</td>
<td>EML</td>
<td>By intravenous infusion, Serious staphylococcal infections: Adult 500mg every 6 hours or 1g every 12 hours; Elderly (&gt; 65 yo), 500mg every 12 hours or 1g once daily; Neonate up to 1 week, initially 15 mg/kg then 10 mg/kg every 12 hours Infant 1-4 weeks, 15 mg/kg initially, then 10 mg/kg every 8 hours; Child &gt; 1 month, 10 mg/kg/DOSE every 6 hours. Reconstitute 1g with 10ml WFI, further dilute with 100-200ml D5/NS to give conc 5-10mg/ml, infuse 500mg over 60 minutes or 1g over 100 minutes, max rate 10mg/minute.</td>
</tr>
</tbody>
</table>
COMMENT/CAUTIONS:

- **Isoniazid**: Counsel patients or their carers to recognize signs of liver disorder.
- **Metronidazole Adverse effects**: avoid alcohol, may cause a disulfiram-like reaction (flushing, palpitations etc). Also unpleasant taste, furred tongue, dizziness/headache, dark urine, leucopenia rarely peripheral neuropathy.
- **Nitrofurantoin**: Monitor lung and liver function if on long-term therapy (discontinue if lung function deteriorates). May cause false positive urinary glucose (if testing for reducing substances), may colour urine yellow or brown.
- **Trimethoprim** – Avoid in the first trimester of pregnancy.
- **Vancomycin indications**: 1) Confirmed MRSA infection; 2) MRSA prophylaxis in ICU; 3) septicaemia in IV drug users; 4) bone infections (haematogenous, prosthetic joint); 5) gastroenteritis with *Clostridium difficile* toxin & positive antibiotic associated colitis. **Vancomycin** is not absorbed orally, use oral route only for treating pseudomembranous colitis.
- **Vancomycin Adverse effects**: Monitor renal & auditory function in patients prescribed concurrent drugs that are neurotoxic and/or nephrotoxic e.g. aminoglycosides, amphotericin B and frusemid.
- **Vancomycin Injection**: Avoid rapid IV infusions, may lead to anaphylactoid reactions. If plasma level monitoring is available: target peak level (1 hour after end of infusion) 29-45mg/L, trough level (just before next dose) 5-10mg/L or 5-10 micrograms/ml.

6.02 ANTIFUNGALS

**WHO MODEL FORMULARY 2008 NOTES:**

Fungal infections can be superficial (affect only the skin, hair, nails or mucous membranes) or systemic (affect the body as a whole). Systemic fungal infections are sometimes caused by inhalation, ingestion or inoculation of primary pathogens, and sometimes by opportunistic invasion of commensals in patients with lowered host resistance. They are increasing in prevalence not only because of the pandemic of HIV infection, but also because of the rise in illicit IV drug use, and greater use of broad spectrum antibiotics and invasive medical procedures. In immunodeficient patients systemic fungal infections are often disseminated.

**Amphotericin B** is a lipophilic polyene antibiotic; it is fungistatic against a broad spectrum of pathogenic fungi, including *Candida* spp., *Aspergillus* spp., *Cryptococcus neoformans*, *Histoplasma capsulatum*, *Blastomyces dermatitidis*, *Coccidioides immitis*, *Paracoccidioides brasiliensis*, *Mucor*, *Absidia* and *Phicopes* spp.; it is active against algal *Prototheca* spp. and against the *Leishmania protozoa*. It is used for the empirical treatment of serious fungal infections and is used in conjunction with fluocytosine to treat cryptococcal meningitis and systemic candidosis. Amphotericin B has to be administered parenterally as there is little or no absorption from the gastrointestinal tract; it can be nephrotoxic. Duration of
therapy depends on initial severity of the infection and patient’s clinical response. In some infections several months of continuous treatment may be needed.

Clotrimazole is an imidazole antifungal which is effective in short courses for vaginal candidosis treatment (insertion of pessaries/vaginal tablets or cream high into the vagina including during menstruation). Recurrent infection may be treated with a single dose clotrimazole 500-mg pessary every week for 6 months. Fluconazole, an orally active synthetic imidazole derivative, possesses fungistatic activity against dermatophytes, yeasts and other pathogenic fungi. It is widely used in the treatment of serious GI and systemic mycoses as well as in the management of superficial infections. Griseofulvin is a fungistatic antibiotic derived from Penicillium griseofulvum with selective activity against the dermatophytes causing ringworm, Microsporum canis, Trichophyton rubrum and T. verrucosum. It has no activity against pityriasis versicolor or candida infections. Griseofulvin is deposited selectively in keratin precursor cells of skin, hair and nails where it disrupts the mitotic apparatus of fungal cells thus preventing fungal invasion of newly-formed cells. It is unsuitable for prophylactic use. Close attention should be given to hygiene and to possible reservoirs of reinfection in clothing, footwear and bedding. Nystatin, a polyene antifungal antibiotic derived from Streptomyces noursei, is effective against infections caused by a wide range of yeasts and yeast-like fungi. It is poorly absorbed from the GI tract and it is not absorbed from skin or mucous membranes when applied topically. It is used for the treatment of candidosis.

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<tr>
<td>Amphotericin B (as sodium deoxycholate complex) Inj 50mg (Fungizone)</td>
<td>IDA</td>
<td>Systemic fungal infections, by IV infusion, Adult &amp; Child initial test dose of 1 mg over 20-30 minutes, then 250 micrograms/kg daily, gradually increased up to 1 mg/kg daily or in severe infection, up to 1.5 mg/kg given daily or on alternate days. Prolonged treatment usually necessary; if interrupted for longer than 7 days, recommence at 250 micrograms/kg daily and increase gradually as above. See Caution notes below for admin/test dosing.</td>
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<td>°Fridge Item</td>
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<tbody>
<tr>
<td>Clotrimazole Vaginal Tab 500mg &amp; Cream 1%, 20g (Canesten)</td>
<td>MSL</td>
<td>Vulvovaginal candidiasis: <em>Insert a single dose vaginal tab</em> 500mg at night <em>and/or apply cream</em> to affected area 2-3 times daily for 7 days.</td>
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<tr>
<td></td>
<td>IDA</td>
<td>EML</td>
</tr>
<tr>
<td>Fluconazole Tab 50mg &amp; 150mg (Diflucan)</td>
<td>IDA</td>
<td><em>By mouth,</em> Systemic mycoses: Adult 200 mg daily for at least 6 months; Child over 2 yo 3–6 mg/kg daily for at least 6 months. Systemic candidosis (in patients unable to tolerate amphotericin B), Adult 400 mg as initial dose, then 200 mg daily for at least 4 weeks; Child 6-12 mg/kg daily (Neonates up to 2 weeks old give dose every 72 hours, 2-4 wks old every 48 hours) Oesophageal and oropharyngeal candidosis: Adult 200 mg initial dose, then 100 mg daily until symptoms resolved; up to 400 mg daily in very resistant infections; Child 3-6 mg/kg on the first day, then 3 mg/kg daily (Neonates up to 2 weeks old give dose every 72 hours, 2-4 wks old every 48 hours) Vaginal candidosis, <em>by mouth,</em> Adult 150 mg as a single dose.</td>
</tr>
<tr>
<td>Griseofulvin Tab 500mg (Grivin)</td>
<td>IDA</td>
<td>Superficial fungal infections, <em>by mouth,</em> Adult 500mg daily in 1-2 divided doses; Child 10 mg/kg/DAY in 1-2 divided doses. Duration of treatment depends on the infection and thickness of keratin at site of infection; at least 4 weeks for skin and hair, at least 6 weeks for scalp ringworm and in severe infection, up to 3 months; 6 months for fingernails and 12 months or more for toenails Administer dose with or after food.</td>
</tr>
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**GENERIC (TRADE) NAME** | **CAT.** | **INDICATION/DOSE**
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Itraconazole Cap 100mg (Sporanox) | IDA | Pityriasis versicolor: *By mouth*, Adult 200mg daily for 7 days; Tinea corporis/cruris 100mg daily for 15 days; Vulvovaginal candidiasis: 200mg twice daily for 1 day.

Ketoconazole Tab 200mg (Nizoral) | IDA | *By mouth*, Systemic fungal infection: Adult 200mg daily with food for 14 days. Child 3mg/kg/DAY.

Nystatin Suspension 100 000 units/ml (Mycostatin) | IDA | *By mouth*, Oral candidosis: Adult & Child > 1 month, 100 000 units after food 4 times daily; Intestinal/oesophageal candidosis: Adult 500 000 units 4 times daily; Child > 1 month 100 000 units 4 times daily; continue for 48 hours after clinical cure. Place dose in mouth after food.

|  |  |  |
|  |  |  |

**COMMENT/CAUTIONS:**

- **Amphotericin B** lipid complex (Abelcet), liposomal (Ambisone) and colloidal (Amphotec/Amphocil) formulations have different drug profiles compared to conventional Amphotericin B (Fungizone). Consult individual product information for dosing details.
- **Amphotericin B** is toxic when given parenterally. Reconstitute each 50mg vial with 10ml WFI to produce a 5mg/ml solution, then dilute further in 490ml of D5 to a 100 micrograms/ml (1mg/10ml) solution (pH of glucose must not be below 4.2); give initial test dose of 1mg in 10ml over 20-30 minutes, observe patient, if no adverse reaction after 30 minutes infuse dose as required over 2-4 hours, protect from light, incompatible with saline solutions.
- **Amphotericin B adverse effects:** fever, chills, hypotension, nausea, nephrotoxicity and thrombophlebitis. Monitor for hypokalaemia and weekly blood counts are advisable. Systemic corticosteroids may be needed. Avoid giving other nephrotoxic drugs concomitantly.
- **DRUG-INDUCED CANDIDOSIS:** oral thrush and other stomatitis are sometimes induced by broad-spectrum antibiotics and cytotoxics (withdraw if possible) or inhaled corticosteroids (reduce by using spacer device, or rinsing/wiping mouth with water after inhalation).
- **Ketoconazole** is associated with liver damage and fatal hepatotoxicity respectively, monitor liver function during treatment (also for fluconazole and itraconazole), discontinue if signs or symptoms of hepatic disease occur.
6.03 ANTIMALARIALS

WHO MODEL FORMULARY 2008 NOTES:

[This section is an adaptation of the WHO recommendations for Mercy Ships according to antimalarials available on the Mercy Ships formulary:]

Malaria, which is transmitted by anopheline mosquitoes, is caused by four species of plasmodial parasites. *Plasmodium vivax* is extensively distributed. *P. falciparum* is also widespread, and causes the most severe infections which are responsible for nearly all malaria-related deaths. *P. ovale* is mainly confined to Africa and is less prevalent, while *P. malariae*, which causes the least severe but most persistent infections, also occurs widely. Certain tissue forms of *P. vivax* and *P. ovale* which persist in the liver for many months and even years are responsible for the relapses. Such latent forms are not generated by *P. falciparum* or *P. malariae*. Recrudescence of these infections results from persistent blood forms in inadequately treated or untreated patients.

TREATMENT OF MALARIA

Blood schizontocides, which suppress malaria by destroying the asexual blood forms of the parasites, are the mainstay of the treatment of acute malaria and some are used for prophylaxis. They include the 4-aminoquinolines (*amodiaquine* and *chloroquine*), the related arylaminoalcohols (*mefloquine* and *quinine*), and *artemisinin* and its derivatives (*artemether* and *artesunate*). Blood schizontocides are not active against intrahepatic forms and therefore they do not eliminate infections by *P. vivax* and *P. ovale*. Combinations of some antimetabolites act synergistically, e.g. a combination of *pyrimethamine* with *sulfadoxine* is an effective blood schizontocide; on their own these substances are of little value because they act slowly. Some antibiotics (e.g. *doxycycline*) are blood schizontocides; the tetracyclines are used primarily as adjuncts to quinine where multiple-drug-resistant *P. falciparum* is prevalent.

TREATMENT OF UNCOMPLICATED FALCIPARUM MALARIA.

Consider *artemether with lumefantrine*. Treatment failure *more than 14 days* after initial treatment can be retreated with the same drug. If treatment failure occurs *within 14 days* of initial treatment, consider *quinine* (10mg/kg three times a day) *plus either doxycycline or clindamycin or tetracycline* for 7 days each.

For crew returning to non-endemic countries, consider one of the following (if malaria chemoprophylaxis was taken, use a different drug for treatment):

- *artemether with lumefantrine* (see below for dose);
- *quinine* (10mg/kg every 8 hours) *plus either doxycycline* (3.5mg/kg once daily) *or clindamycin* (10mg/kg twice daily), for 7 days each;
• atovaquone with proguanil (15mg/6mg/kg; usual adult dose 4 tablets once a day for 3 days).
• In the first trimester of pregnancy, quinine + clindamycin for 7 days is the treatment of choice; this combination can be used throughout pregnancy. If clindamycin is not available, give quinine as a monotherapy. In the second and third trimesters give artemether with lumefantrine for 7 days.
• Breastfeeding women should receive standard antimalarial treatment (including artemether with lumefantrine) except tetracyclines and dapsone.

TREATMENT OF SEVERE FALCIPARUM MALARIA.

Parenteral artemether or quinine is required. Parenteral antimalarials are also used to initiate treatment in patients unable to take oral treatment. The risk of death in severe malaria is greatest in the first 24 hours; give the first dose of parenteral treatment before further referral to a health facility. Combination antimalarial treatment should start as soon as patients are able to take oral medication.

Patients with HIV infection who develop malaria should receive standard antimalarial treatment regimens, but avoid sulfadoxine with pyrimethamine if they are receiving sulfamethoxazole with trimethoprim for prophylaxis against opportunistic infections (increased risk of adverse reactions to sulfonamides).

TREATMENT OF BENIGN MALARIAS.

Chloroquine is the drug of choice for \textit{P. vivax} infection; primaquine is added for a radical cure (to destroy parasites in the liver and thus prevent relapses). Alternatives in chloroquine resistant areas include an artemisinin derivative or mefloquine, in all cases followed by primaquine for radical cure. Treat severe/complicated vivax malaria as for severe falciparum malaria (see above). Treat \textit{P. ovale} or \textit{P. malariae} malaria with chloroquine. For radical cure of \textit{P. ovale}, primaquine is added as for vivax malaria, see above. In pregnant patients with \textit{P. vivax} or \textit{P. ovale} infection, radical cure with primaquine should be postponed until after delivery; chloroquine at a dose of 600 mg (as the base) each week can be given until then.

Chloroquine, a rapidly acting schizontocide, is well tolerated, safe and inexpensive. It can be used to treat malaria wherever the parasites remain susceptible. However, widespread resistance has limited its value in the treatment of falciparum malaria. Chloroquine-resistant strains of \textit{P. vivax} have been reported in parts of Oceania, Indonesia, East Timor, and Peru. \textit{P. malariae} and \textit{P. ovale} remain fully sensitive to chloroquine.
The combination of **sulfadoxine with pyrimethamine** is also used in combination with other antimalarials for the treatment of uncomplicated *P. falciparum* infection (see above). Resistance to sulfadoxine with pyrimethamine is now widespread, particularly in south-east Asia and South America and it occurs at low prevalence in east and central Africa. Because sulfonamides are associated with haemolysis and methaemoglobinaemia in the newborn, quinine is preferred for chloroquine-resistant malaria during pregnancy (see below).

**Mefloquine** resistance is common in Thailand, Myanmar and Cambodia, and has occurred in the Amazon region of South America and occasionally in Africa. A parenteral preparation is not available and it is thus suitable only for patients who can take drugs by mouth. It is generally well tolerated but some adverse effects have been reported (see below).

**Quinine**, given orally, is used in combination with clindamycin or doxycycline to treat relapses of *P. falciparum* infections which occur within 14 days of treatment and are likely to be unresponsive to other drugs. Resistance to quinine was, until recently, rare, but the prevalence of resistant strains is now increasing in parts of south-east Asia and South America. Doxycycline is given with quinine except in pregnant women and children under 8 years.

Preparations of **artemisinin** or its derivatives (**artemether** or **artesunate**) are used in combination with other antimalarial drugs for the treatment of falciparum malaria. When given alone or in combination with other rapidly eliminated antimalarials a 7-day course is required, but when given in combination with slowly eliminated antimalarials, a 3-day course is effective. They should not be used in the first trimester of pregnancy except where no other effective antimalarial medicine is available. Parenteral artemether or artesunate are effective alternatives to quinine for the treatment of severe falciparum malaria and are preferred in areas with decreased efficacy of quinine. A fixed-dose oral formulation of **artemether with lumefantrine** is available for the treatment of uncomplicated falciparum malaria; the combination is not for use in this first trimester of pregnancy.

[Mercy Ships note: please refer to the current Mercy Ships’ protocol on malaria treatment and prophylaxis.]

**PROPHYLAXIS AGAINST MALARIA**

No drug regimen gives assured protection to everybody, and indiscriminate use of antimalarials can increase the risk of inducing resistance. Avoidance of mosquito bites using insect repellents, mosquito nets (preferably impregnated with an insecticide), and door and window screens is important. When possible pregnant women should avoid travel to malarious areas; when travel is unavoidable effective prophylaxis is essential.
Chloroquine, which is usually well-tolerated at the required dosage, is preferred where *P. falciparum* remains fully sensitive. The combination of proguanil with chloroquine may overcome mild chloroquine resistance. Chloroquine is best started 1 week before exposure, and continued for at least 4 weeks after the last exposure in non-immune individuals. This is sufficient to ensure elimination of *P. falciparum* and *P. malariae*, but not of *P. vivax* and *P. ovale*, whose residual hepatic forms survive. Chloroquine can be used during pregnancy.

Mefloquine may be used for prophylaxis in areas of high risk or where multiple-drug resistance has been reported. Where possible prophylaxis should be started 2-3 weeks before travel to enable any adverse reactions to be identified before exposure (over three-quarters of adverse reactions occur by the third dose) and should be continued for 4 weeks after last exposure. Mefloquine may be used for prophylaxis during the second and third trimesters. It should be used in early pregnancy only if alternative drugs are either not available or unlikely to be effective and when it is impracticable for the woman to leave the endemic area.

[Doxycycline is an alternative to mefloquine in areas of high risk or multiple-drug resistance; it should not be given during pregnancy.

Proguanil, a predominantly tissue schizontocide with little blood schizontocidal activity, is active against pre-erythrocytic intrahepatic forms, particularly of *P. falciparum*. The latent persistent liver forms of *P. ovale* and *P. vivax* are unresponsive. However, there is evidence that it may be effective against *P. vivax* only immediately after the initial infection. *P. falciparum* resistance to proguanil or related compounds can occur in malaria endemic areas and particularly where it has been used for mass prophylaxis. Proguanil is used for prophylaxis with chloroquine in areas where there is resistance to chloroquine but a low risk of infection because it may give some protection against *P. falciparum* and may attenuate symptoms if an attack occurs. Proguanil and chloroquine can also be used prophylactically in areas of high risk or multi-drug resistance as a third choice where mefloquine or doxycycline are not appropriate. There is no evidence that proguanil is harmful in prophylactic doses during pregnancy. Because of the vulnerability of pregnant women to falciparum malaria, it should be used at full prophylactic dosage wherever the disease is prevalent and likely to be responsive to proguanil, if chloroquine is not available. Proguanil can be given with chloroquine if chloroquine alone is unlikely to be effective. Folic acid 5 mg daily should be given with proguanil during pregnancy.]
[NOTE: Please refer to current local & national guidelines and the Mercy Ships’ protocol for malaria prophylaxis and treatment. Warn crew about importance of avoiding mosquito bites, taking prophylaxis regularly, and immediate visit to the doctor if ill within 1 year and especially within 3 months of return].

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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Artemether Injection 80mg/ml</td>
<td>IDA</td>
<td>Treatment of severe <em>P. falciparum</em> malaria (if quinine resistance): <em>by IM inj</em>, Adult/Child &gt; 6 months, loading dose 3.2 mg/kg, then 1.6 mg/kg daily until patient switch to oral dose or to max 7 days; followed by mefloquine single dose 15 mg/kg (<em>or</em> if needed 25 mg/kg) to effect a radical cure. Since small volumes are required for children, a 1-ml syringe should be used to ensure correct dosage. <em>May cause dizziness.</em></td>
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<tr>
<td>Artemether 20mg with Lumefantrine 120mg Tab [Co-Artemether] (Riamet)</td>
<td>IDA</td>
<td>Treatment of uncomplicated falciparum malaria: <em>by mouth</em>, Adult &amp; Child &gt; 12 yo and &gt; 35 kg, initially 4 tablets followed by 5 further doses of 4 tablets each at 8, 24, 36, 48 and 60 hours (total 24 tablets over 60 hours); Child 10-14 kg, 6 timed doses of 1 tablet, 15-24 kg, 6 timed doses of 2 tablets, 25-34 kg, 6 timed doses of 3 tablets; time scale as above for adult dosing. Repeat dose if vomiting occurs within 1 hour of administration.</td>
</tr>
<tr>
<td>Artemether 15mg with Lumefantrine 90mg in 5ml Suspension [Co-Artemether]</td>
<td>IDA</td>
<td>Treatment of uncomplicated falciparum malaria: <em>by mouth</em>, Adult &amp; Child, 4mg Artemether/kg body weight once daily for three days, round to the nearest ml, <em>or</em> body weight 5 to 7.4kg 7ml per dose, 7.5-9.9kg 10ml, 10-12.4kg 14ml, 12.5-14.9kg 17ml, 15-17.4kg 20ml, 17.5-19.9kg 24 ml, dose given once daily for three days; confirm dose with manufacturer’s product leaflet.</td>
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### GENERIC (TRADE) NAME

**Atovaquone 250mg with Proguanil 100mg Tab (Malarone)**

**INDICATION/DOSE**

**Cat.**

**By mouth**, Treatment: Adult & child > 40 kg, 4 tablets daily, Child 11-20kg 1 tab daily, 21-30kg 2 tabs daily, 31-40kg 3 tabs daily; for 3 days. Prophylaxis: Adult or > 40kg, 1 tablet daily, start 1 week before travelling to malaria region and continue 1 week after leaving malaria region [1-2 days Before – 1 week After].

**NOTE:** Limited stock on board, please use for treatment only, and when co-artemether is ineffective or inappropriate.

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**Chloroquine Tab 150mg (base), Suspension 10mg/ml (base)**

**Indication/DOSE**

**Cat.**

[Dose expressed as base.]

**By mouth,** Benign malaria treatment (*P. vivax*, *ovale* & *malariae*): Adult initially 600mg (4 tablets) then 300mg (2 tabs) after 6-8 hours, then 300mg (2 tabs) daily for 2 days. Child initial dose of 10mg/kg followed by 5mg/kg after 6-8 hours, then 5mg/kg on next 2 days (or 10 mg/kg for 2 days, followed by 5 mg/kg daily on day 3); total dose, 25 mg/kg over 3 days. Prophylaxis: Adult 300mg (2 tabs) once a WEEK, Child 5mg/kg once a WEEK, with proguanil.

[1 week Before – 4 weeks After]. Give dose after meals to minimize nausea/vomiting; if vomiting occurs readminister same dose immediately.

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**Doxycycline Cap 100mg (Vibramycin)**

**INDICATION/DOSE**

**Cat.**

**By mouth**, supplement to malaria treatment (see notes above): Adult & Child > 8 yo, 100mg twice daily for 7-10 days. Malaria prophylaxis: Adult 100mg daily; Child > 8 yo 1.5 mg/kg daily.

[1 day Before – 4 weeks After]. Swallow capsules whole with plenty of fluid while sitting or standing to prevent oesophageal irritation. May be given with milk or food. See Section 6.01e Tetracyclines for more notes on Doxycycline.

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[NOTE: Please refer to current local & national guidelines and the Mercy Ships’ protocol for malaria prophylaxis and treatment. Warn crew about importance of avoiding mosquito bites, taking prophylaxis regularly, and immediate visit to the doctor if ill within 1 year and especially within 3 months of return].

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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td>Mefloquine Tab 250mg (Lariam)</td>
<td>IDA</td>
<td>[Dose expressed as base]. By mouth, Treatment of malaria (see notes above): Adult &amp; Child 25mg/kg/DOSE given over 2-3 days. Prophylaxis: once a WEEK dosing, Adult 250mg, Child over 5kg, 5mg/kg [1-3 weeks Before – 4 weeks After].</td>
</tr>
<tr>
<td>Primaquine Tab 15mg (base)</td>
<td>IDA</td>
<td>[Dose expressed as base]. By mouth, Radical treatment of <em>P. vivax</em> or <em>P. ovale</em> malaria (after standard chloroquine therapy): Adult 250 micrograms/kg (<em>or</em> 15mg) daily, Child 250 micrograms/kg daily, for 14 days; in G6PD deficiency, Adult/Child 500-750 micrograms/kg once a week for 8 weeks. Gametocytocidal treatment of <em>P. falciparum</em> (after routine blood schizontocide therapy): Adult/Child 500-750 micrograms/kg single dose.</td>
</tr>
<tr>
<td>Proguanil Tab 100mg</td>
<td>IDA</td>
<td>By mouth, Prophylaxis of malaria, with chloroquine: Adult (or &gt; 45 kg), 200mg daily after food, Child &lt; 1 yo (<em>or</em> &lt;6kg) 25mg, 1-4 yo (6-10kg) 50mg, (10-16kg) 75mg, 5-8 yo (16-25kg) 100mg, 9-14 yo (25-45kg) 150mg, dose given daily. [1 week Before – 4 weeks After].</td>
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| **Quinine Sulphate Tab 300mg**  
[300mg salt = 250mg base] | IDA | [Dose expressed as salt]. Treatment of multiple-drug resistant *P. falciparum* malaria: *By mouth*, Adult 600mg (2 tablets), Child 10mg/kg, give every 8 hours for 3, 7 or 10 days (duration depending on local susceptibility and whether other antimalarials are used, see notes.) Give dose after meals to minimize nausea and vomiting; if part or all of dose is vomited, readminister the dose immediately. |
| **NOTE:** may cause severe thrombocytopenia, and use with caution in cardiac disease. | EML |
| **Quinine DiHCl Inj 600mg/2ml** | IDA | [Dose expressed as salt]. Treatment of multiple-drug resistant *P. falciparum* malaria (in patients unable to take quinine by mouth), *by slow IV infusion only* (over 4 hours), Adult loading dose 20 mg/kg (*or max* 1.4g), then after 8-12 hours maintenance dose 10 mg/kg (*or max* 600mg) every 8 hours; Child loading dose 20 mg/kg then 10 mg/kg every 12 hours; until patient can swallow tablets to complete 7 day course (see WHO notes above). Half loading dose if during previous 12-24 hours patients have received quinine, quinidine or mefloquine. For IV infusion dilute 600mg with 50-100ml D5/NS, infuse over 4 hours. |
| **NOTE:** may cause severe thrombocytopenia, and use with caution in cardiac disease. | EML |
| **Sulfadoxine 500mg + Pyrimethamine 25mg Tab (Fansidar)** | IDA | *By mouth*, Treatment as single dose with chloroquine for benign malaria (*P. vivax, ovale & malariae*) or with quinine for susceptible *P. falciparum* malaria (see WHO notes above): Adult 3 tablets as a single dose; Child 5-10kg half tablet; 11-20kg 1 tab; 21-30kg 1.5 tab; 31-45kg, 2 tabs, as a single dose with last chloroquine/quarine dose. |
| | EML |
COMMENT/CAUTIONS:

- Please refer to current local & national guidelines and the Mercy Ships’ protocol for malaria prophylaxis and treatment. Warn crew about importance of avoiding mosquito bites, taking prophylaxis regularly, and immediate visit to the doctor if ill within 1 year and especially within 3 months of return.

- **Chloroquine adverse effects:** hepatic/renal impairment, avoid concurrent therapy with hepatotoxic drugs. May cause reversible retinal damage (ophthalmic examinations in long term treatment), avoid in history of epilepsy.

- **Mefloquine adverse effects:** Due to the special risk to self and others in a ship situation if psychiatric adverse effects occur, mefloquine should only be prescribed as malaria prophylaxis if there are no alternatives. Advise crew to seek immediate medical attention at first signs of such adverse effects.

- **Quinine:** Quinine (anhydrous base) 100 mg = quinine bisulfate 169 mg = quinine dihydrochloride 122 mg = quinine sulfate 121 mg. Quinine bisulfate 300 mg tablets provide less quinine than 300 mg of sulphate or diHCl. **Cautious use** in cardiac disease, may cause severe thrombocytopenia.

- **Proguanil:** If used in pregnancy for prophylaxis, give 5mg folic acid oral supplement daily.

### 6.04 OTHER ANTIPROTOZOALS

**WHO MODEL FORMULARY 2008 NOTES:**

**AMOEBIASIS.** Amoebic dysentery is caused by *Entamoeba histolytica*. It is transmitted by the faeco-oral route and infection is usually caused by ingestion of cysts from contaminated food and drink. Asymptomatic carriers are common in endemic areas. In non-endemic areas, symptomless carriers should be treated with a luminal amoebicide which will reduce the risk of transmission and protect the patient from invasive amoebiasis. Diloxanide furante is most widely used, but other compounds, including clefamide, etofamide, and teclozan [all not available on Mercy Ships list], are also effective. Treatment with diloxanide furante is regarded as successful if stools are free of *E. histolytica* for one month. Several specimens should be examined in evaluating response to treatment.

Symptomatic (invasive) amoebiasis may be classified as intestinal or extra-intestinal. Intestinal amoebiasis is either amoebic dysentery or non-dysenteric amoebic colitis. Extra-intestinal amoebiasis most commonly involves the liver, but may involve the skin, genito-urinary tract, lung and brain. Invasive amoebiasis is more likely in malnutrition, immunosuppression and pregnancy. Amoebic dysentery may take a fulminating course in late pregnancy and the puerperium; treatment with metronidazole may be life saving. In less severe infection, metronidazole should, if possible, be avoided in the first trimester. All patients with invasive amoebiasis require treatment with a systemically active compound such as metronidazole, followed by a luminal amoebicide in order to eliminate...
any surviving organisms in the colon. Combined preparations are useful. In severe cases of amoebic dysentery, **tetracycline** given in combination with a systemic amoebicide lessens the risk of superinfection, intestinal perforation and peritonitis. Hepatic abscesses should be lanced by needle aspiration.

**GIARDIASIS.** Giardiasis is caused by *Giardia intestinalis* and is acquired by oral ingestion of *Giardia* cysts. Giardiasis can be treated with a single dose **tinidazole** or with **metronidazole**; both are highly effective and should be offered when practicable to all infected patients. Treat family and institutional contacts as well. Larger epidemics are difficult to eradicate due to high proportion of symptomless carriers and excreted cysts survive for long periods outside the human host.

**TRICHOMONIASIS.** Trichomoniasis is an infection of the genito-urinary tract caused by *Trichomonas vaginalis* and transmission is usually sexual. In women it causes vaginitis although some are asymptomatic. It is usually asymptomatic in men but may cause urethritis. Patients and their sexual partners should be treated with **metronidazole** or other nitroimidazole.

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<tr>
<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Metronidazole Tab 200mg, Suspension 125mg/5ml, Inj 500mg/100ml (Flagyl)</td>
<td>MSL IDA</td>
<td>By mouth, Invasive amoebiasis: Adult/Child 30 mg/kg/DAY in 3 divided doses or Adult 400-800mg every 8 hours for 8-10 days. Or Child 1-3 yo 600mg/DAY, 3-7 yo 800mg/DAY, 7-10 yo 1.2g/DAY; in 3-4 divided doses for 8-10 days. Or by IV infusion, Adult/Child 30mg/kg/DAY in 3 divided doses (until oral route ok to finish course); consider course of luminal amoebicide (see WHO notes above). Giardiasis: By mouth, Adult 2g once daily for 3 days; Child 15mg/kg/DAY in 3 divided doses for 5-10 days. Urogenital trichomoniasis: By mouth, Adult 2g as a single dose or 400-500mg twice daily for 7 days (treat sexual partners concomitantly).</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **Metronidazole Adverse effects:** avoid alcohol, may cause a disulfiram-like reaction (flushing, palpitations etc). Also unpleasant taste, furred tongue, dizziness/headache, dark urine, leucopenia rarely peripheral neuropathy.
6.05 ANTHelmintics

WHO MODEL FORMULARY 2008 NOTES [Edited]:

INTESTINAL ANTHelmintics

CESTODE INFECTIONS (tapeworms) include intestinal taeniasis and cysticercosis, hymenolepiasis (dwarf tapeworm), diphyllobothriasis and echinococcosis (hydatid disease). Cysticercosis is a systemic infection caused by the larval form (cysticercus) of *Taenia solium*. Neurocysticercosis occurs when the infection involves the brain. In man, echinococcosis is due to the larval stage of *Echinococcus granulosus* or *E. multilocularis*. The larvae (oncospheres) develop by expansion (cystic echinococcosis) or tumour-like infiltration (alveolar echinococcosis), respectively, in the liver, lungs, or other organs. In animal studies, *albendazole* and *mebendazole* have been found to be teratogenic. They are contraindicated for treatment of cestode infections in pregnancy; pregnancy should be excluded before treatment with albendazole (non-hormonal contraception during and for 1 month after treatment). For single-dose or short-term use in pregnancy, see below under ‘Hookworm Infections’.

In TAENIASIS, *praziquantel* is well tolerated and extensively absorbed and kills adult intestinal taenia worms in a single dose. Praziquantel also kills *T. solium* cysticerci when taken for 14 days in high doses and it can therefore be used to treat neurocysticercosis. However, because dying and disintegrating cysts may induce localized cerebral oedema, treatment with praziquantel must always be undertaken in a hospital setting. In addition, a corticosteroid is usually given to reduce the inflammatory response. *Albendazole* also kills neurocysticerci when given daily for one month; a corticosteroid or an antihistamine is also given to reduce any inflammatory reaction. Surgery may be preferred for treating neurocysticercosis in some cases. The longer-established *niclosamide* [not on Mercy Ships list] acts only against the adult intestinal worms. Cestode infections, due to *T. solium*, during pregnancy should always be treated immediately (with praziquantel or niclosamide but not albendazole) because of risk of cysticercosis.

NEMATODE INFECTIONS

ASCARIASIS is an infection, usually of the small intestine, caused by *Ascaris lumbricoides* (ROUNDWORM). Single doses of *levamisole* or *pyrantel* [both not on Mercy Ships list] are effective; *albendazole* or *mebendazole* are also effective. ENTEROBIASIS is an infection of the large intestine caused by *Enterobius vermicularis* (PINWORM, THREADWORM). All household members should be treated concurrently with a single dose of *mebendazole*, albendazole or pyrantel [not on Mercy Ships list]. Since reinfection readily occurs, at least one further dose should be given 2-4 weeks later.
HOOKWORM INFECTIONS are caused by *Ancylostoma duodenale* (ancylostomiasis) and *Necator americanus* (necatoriasis); they are a major cause of iron-deficiency anaemia in the tropics and sub-tropics. Ideally all cases of hookworm infection should be treated. However, when this is impracticable, priority should be given to women in second- and third-trimester of pregnancy, children and debilitated patients. In hookworm, broad-spectrum anthelmintics are preferred wherever other nematode infections are endemic. Both mebendazole and albendazole are effective. In animal studies, albendazole and mebendazole have been found to be teratogenic. There is some evidence to suggest that the use of mebendazole in pregnancy is not associated with an increased incidence of adverse effects on the fetus. However, neither mebendazole nor albendazole should be used during the first trimester of pregnancy to treat nematode infections. Both drugs are contraindicated for the treatment of cestode infections in pregnancy (see above). Patients with iron-deficiency anaemia caused by hookworm infection require supplementary iron salts (e.g. ferrous sulfate 200 mg daily for adults) for at least 3 months after the haemoglobin concentration of 12 g/100 ml is obtained.

STRONGYLOIDIASIS is an infection of the small intestine caused by *Strongyloides stercoralis*. All infected patients should be treated. Ivermectin [not on Mercy Ships list] in a single dose of 200 micrograms/kg or 200 micrograms/kg/day on two consecutive days is the treatment of choice for chronic strongyloidiasis but it may not be available in all countries. Albendazole 400 mg once or twice daily for 3 days is well tolerated by both adults and children over 2 years old and it may eradicate up to 80% of infections. Mebendazole has also been used but, to be effective, it must be administered for longer periods as it has a limited effect on larvae and hence the prevention of autoinfection.

TRICHURIASIS is an infection of the large intestine caused by *Trichuris trichiura* (WHIPWORM). Chemotherapy is required whenever symptoms develop or when faecal samples are found to be heavily contaminated (up to 10 000 eggs per gram). A single dose of albendazole (400 mg) or mebendazole (500 mg) can be effective in mild to moderate infections; heavier infections require a 3-day course.

DRACUNCULIASIS (DRACONTIASIS, GUINEA-WORM infection) is caused by infection with *Dracunculus medinensis*, acquired through drinking water containing larvae that develop in small freshwater crustaceans. Metronidazole (section 6.04) (25 mg/kg daily for 10 days, daily max 750 mg for children) provides rapid symptomatic relief, and weakens the anchorage of worms in subcutaneous tissues, they can then be removed by traction. However, since it has no effect on the larvae of pre-emergent worms, it does not immediately prevent transmission.
VISCERAL LARVA MIGRANS (TOXOCARIASIS) is caused by infection with the larval forms of *Toxocara canis* and less commonly, *T. cati* (which infect dogs and cats). Treatment should be reserved for symptomatic infections. A 3-week oral course of **diethylcarbamazine** kills the larvae and arrests the disease, but established lesions are irreversible. To reduce the intensity of allergic reactions induced by dying larvae, dosage is commonly commenced at 1 mg/kg twice daily and raised progressively to 3 mg/kg twice daily (adults and children). Ocular larva migrans occurs when larvae invade the eye, causing a granuloma which may result in blindness. In order to suppress allergic inflammatory responses in patients with ophthalmic lesions, prednisolone should be administered concurrently, either topically or systemically.

**TREMATODE INFECTIONS**

SCHISTOSOMIASIS, a waterborne parasitic infection is caused by several species of trematode worms (blood flukes). Its socioeconomic impact as a parasitic disease is outstripped only by that of malaria. Intestinal schistosomiasis is caused principally by *Schistosoma mansoni* as well as *S. japonicum*, *S. mekongi*, and *S. intercalatum*. Urinary schistosomiasis is caused by *S. haematobium*. The latter is an important predisposing cause of squamous cell cancer of the bladder. **Praziquantel** has transformed the treatment of schistosomiasis and is often effective in a single dose, against all species of the parasite. It can be of particular value in patients with mixed infections and those who do not respond adequately to other drugs. It is also extremely well tolerated and well suited for mass treatment control programmes. Extensive use over years has provided no evidence of serious adverse effects or long-term toxicity, nor has mutagenic or carcinogenic activity been shown in experimental animals.

[Mersey Ships note: Please refer to the WHO Formulary 2008 for the full notes on anthelmintics treatments including angiostrongyliasis, anisakiasis, capillariasis, cutaneous larva migrans, filariasis, hymenolepiasis, loiasis, onchocerciasis, trichinellosis, trichostrongyliasis and other fluke infections.]
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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td><strong>Albendazole Tab Chewable</strong></td>
<td>IDA</td>
<td>By mouth, Neurocysticercosis: Adult &gt; 60kg, 800mg daily in 2 divided doses for 8-30 days; Adult &lt; 60kg, 15 mg/kg daily in two divided doses (max 800mg/DAY) for 8-30 days. Ascariasis, hookworm infections, enterobiasis: Adult/Child &gt; 2 yo, 400mg as a single dose; 12 months-2 yo, 200mg as a single dose. Trichuriasis (whipworm): Adult &amp; Child &gt; 2 yo, 400mg single dose (moderate infections) or 400mg daily for 3 days (severe infections); Child 12 months-2 yo, 200mg single dose (moderate infections) or 200mg initially then 100mg twice daily for 3 days (severe infections). Strongyloidiasis: Adult &amp; Child &gt; 2yo, 400mg 1-2 times daily for 3 days.</td>
</tr>
<tr>
<td><strong>Diethylcarbamazine Tab 50mg (Hetrazan)</strong></td>
<td>IDA</td>
<td>By mouth, Treatment of microfilariae and adults of <em>Loa loa, Wuchereria bancrofti</em> and <em>Brugia malayi</em>: Adult initially 1mg/kg/DAY on day 1, doubled dose on day 2 and 3, then adjusted to 2-3mg/kg 3 times daily for a further 18 days. Always consult local/country treatment regimens before treatment, caution in heavy infection (meningoencephalitis risk).</td>
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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Mebendazole Tab Chewable 100mg (Vermox)</td>
<td>MSL IDA</td>
<td>By mouth, Ascariasis: Adult &amp; Child &gt; 1yo, 500mg as a single dose or 100mg twice daily for 3 days. Hookworm infections, trichuriasis: Adult &amp; Child &gt; 1yo, 100mg twice daily for 3 days; may be repeated after 3-4 weeks; alternatively (for mass treatment control programs), 500mg as a single dose. Enterobiasis: Adult &amp; Child &gt; 2yo, 100mg single dose, may be repeated after 2-3 weeks; treat all household &gt; 2yo at the same time. Take doses between meals.</td>
</tr>
<tr>
<td>Praziquantel Tab 600mg (Cysticide)</td>
<td>IDA EML</td>
<td>By mouth, Adult &amp; Child &gt; 4yo, <em>Taenia saginata/solium</em> infections (tapeworm): 5-10 mg/kg single dose. Cysticercosis: 50 mg/kg daily in 3 divided doses for 14 days with prednisolone given 2-3 days before and throughout treatment period. Dermal cysticercosis: 60 mg/kg daily in 3 divided doses for 6 days. Schistosomiasis: 40-60 mg/kg single dose; or 3 doses of 20 mg/kg on one day at intervals of 4-6 hours.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- Anthelmintics should be combined with hygienic measures to break the autoinfection cycle – advise patients to wash hands and scrub fingernails before meals and after visits to the toilet and to bath/shower daily. If patient has normal bowel movements a purgative is not needed. All members of the household require treatment.
6.06 ANTIVIRALS

WHO MODEL FORMULARY 2008 NOTES [Edited]:

HERPES SIMPLEX VIRUS (HSV) INFECTION. Aciclovir is active against herpes viruses but does not eradicate them. It is only effective if started at onset of infection; it is also used for prevention of recurrence in the immunocompromised. Genital lesions, oesophagitis and proctitis may be treated with oral aciclovir. HSV encephalitis or pneumonitis should be treated with intravenous aciclovir. Valaciclovir [not included on WHO Model List or Mercy Ships list], a prodrug of aciclovir, can be given by mouth as an alternative treatment for herpes simplex infections of the skin and mucous membranes (including initial and recurrent genital herpes).

VARICELLA–ZOSTER INFECTIONS. Chickenpox in neonates should be treated with parenteral aciclovir to reduce the risk of severe disease. Otherwise, antiviral treatment is generally not required except for immunocompromised patients and those at special risk (for example because of severe cardiovascular or respiratory disease or chronic skin disorder); aciclovir should be given for 10 days with at least 7 days of parenteral treatment. Specialist advice should be sought for the treatment of chickenpox during pregnancy.

While most HIV positive patients with ZOSTER experience only one self-limiting course, some will experience repeated episodes. Treatment should be reserved for debilitating disease and when there is high risk of serious complications, e.g. advanced HIV disease. Aciclovir is the treatment of choice and it can be administered in high oral dose or in lack of response to oral therapy or CNS involvement, it should be given intravenously. Parenteral antiviral ganciclovir [not on Mercy Ships list] arrests retinochoroiditis and enteritis caused by CMV in HIV infected patients. Maintenance therapy with oral ganciclovir should be given to prevent relapse of retinitis. Alternative therapy with IV foscarnet [not on Mercy Ships list] can be used if needed.

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<tbody>
<tr>
<td>Aciclovir Cream 5% (Zovirax)</td>
<td>IDA</td>
<td>Herpes simplex infections: begin treatment as early as possible (intact blisters); apply to lesions 4 hourly (5 times daily) for 5 days.</td>
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### GENERIC (TRADE) NAME

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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Aciclovir Tab 200mg (Zovirax)</td>
<td>IDA</td>
<td>By mouth, Herpes simplex infection, Adult/Child &gt; 2 yo 200mg (400mg in immunocompromised) 5 times daily; Child &lt; 2 yo half adult dose; treat for 5 days (or longer if new lesions appear during treatment or if healing incomplete.) Varicella/herpes zoster: Adult 800mg 5 times a day for 5-10 days; Child 20mg/kg max 800mg 4 times daily for 5 days or child &lt; 2 yo 200mg 4 times daily, 2-5 yo 400mg 4 times daily, &gt; 6 yo 800mg 4 times daily.</td>
</tr>
<tr>
<td>Indinavir Cap 400mg (Crixivan)</td>
<td>EML</td>
<td>ONLY for post-exposure prophylaxis among health workers in high risk HIV occupational exposure: by mouth, Adult 800mg every 8 hours, before food with plenty of water (~1.5 litre every day), for 4 weeks.</td>
</tr>
<tr>
<td>Lamivudine 150mg with Zidovudine 300mg Cap (Combivir) [Zidovudine=AZT or Azidothymidine]</td>
<td>EML</td>
<td>ONLY for post-exposure prophylaxis among health workers in high risk HIV occupational exposure: By mouth, Adult one capsule every 12 hours, for 4 weeks.</td>
</tr>
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</table>

**COMMENT/CAUTIONS:**

- **Aciclovir:** higher doses may be required in immunocompromised patients. To reduce risk of nephrotoxicity with IV route it is essential to give infusion over 60 minutes, maintaining adequate hydration and avoiding concurrent administration of other nephrotoxic drugs.

- **Post-Exposure Prophylaxis (PEP)** – to start preferably within first 6 hours of exposure with monitoring, please refer to current PEP guidelines.
Corticosteroids include hormones secreted by the adrenal cortex and synthetic analogues of these hormones. The adrenal cortex normally secretes hydrocortisone which has glucocorticoid activity and weak mineralocorticoid activity. It also secretes the mineralocorticoid aldosterone. Synthetic glucocorticoids include betamethasone, dexamethasone and prednisolone. Fludrocortisone [not included on WHO Model List] has glucocorticoid properties but it is used for its potent mineralocorticoid effects. In physiological (low) doses, corticosteroids replace deficient endogenous hormones. In pharmacological (high) doses, glucocorticoids decrease inflammation and suppress the immune response. In therapeutic doses glucocorticoids suppress release of corticotrophin (adrenocorticotropic hormone, ACTH) from the pituitary thus the adrenal cortex ceases secretion of endogenous corticosteroids. If suppressive doses are given for prolonged periods, the adrenal cortex may atrophy; this leads to a deficiency on sudden withdrawal or dosage reduction of the corticosteroid in or situations such as stress or trauma when corticosteroid requirements are increased. After high dosage or prolonged therapy, withdrawal of the corticosteroid should be gradual, see Withdrawal of Systemic Corticosteroids. The suppressive effect of a corticosteroid on cortisol secretion is least when it is given as a single dose in the morning. Because the therapeutic effects of corticosteroids are of longer duration than the metabolic effects, intermittent therapy may allow the therapeutic effects to be maintained while reducing metabolic effects. Alternate-day dosing is, however, suitable only in certain disease states and for corticosteroids with small mineralocorticoid effects and a relatively short duration of action.

Hydrocortisone is used in adrenal replacement therapy and on a short-term basis by intravenous injection for the emergency management of some conditions. Its mineralocorticoid activity is too high for it to be used on a long-term basis for disease suppression. The high mineralocorticoid activity of fludrocortisone is used together with glucocorticoids in adrenal insufficiency. Prednisolone has predominantly glucocorticoid activity and is the corticosteroid used for long-term disease control. Dexamethasone has very high glucocorticoid activity and insignificant mineralocorticoid activity, making it particularly suitable for conditions where water retention would be a disadvantage. It also has a long duration of action and this, together with its lack of mineralocorticoid activity makes it particularly suitable for conditions requiring suppression of corticotrophin secretion such as congenital adrenal hyperplasia.
DISADVANTAGES. Overdosage or prolonged use may exaggerate some of the normal physiological actions of corticosteroids leading to mineralocorticoid and glucocorticoid adverse effects.

Mineralocorticoid adverse effects include hypertension, sodium and water retention and potassium loss. These effects are most marked with fludrocortisone but are significant with hydrocortisone, occur slightly with prednisolone and are negligible with dexamethasone.

Glucocorticoid adverse effects include diabetes mellitus and osteoporosis which is of particular importance in the elderly since it may result in osteoporotic fractures of the hip or vertebrae. High doses may also be associated with avascular necrosis of the femoral neck. Muscle wasting may also occur and there is a weak link with peptic ulceration. Mental disturbances can occur, including serious paranoid state or depression with risk of suicide, particularly in patients with a history of mental disorders; euphoria is also common. High doses may cause Cushing syndrome with moon face, striae and acne; it is usually reversible on withdrawal of treatment, but this should always be tapered gradually to avoid symptoms of acute adrenal insufficiency (see also Withdrawal if Systemic Corticosteroids). Corticosteroids may result in suppression of growth in children. Corticosteroids administered during pregnancy can affect adrenal development in the fetus. Any adrenal suppression in the neonate following prenatal exposure usually resolves spontaneously after birth and is rarely clinically important. Healing of wounds may be impaired and infections and thinning of the skin may occur; spread of infections may result from modification of tissue reactions.

Adrenal suppression occurs during prolonged therapy with corticosteroids, with development of adrenal atrophy which may persist for years after stopping. Abrupt withdrawal after a prolonged period may lead to acute adrenal insufficiency, hypotension or death (see Withdrawal of Systemic Corticosteroids, below). Withdrawal may also be associated with fever, myalgia, arthralgia, rhinitis, conjunctivitis, painful itchy skin nodules and weight loss.

CORTICOSTEROID COVER DURING STRESS

To compensate for a diminished adrenocortical response caused by prolonged corticosteroid treatment, any significant intercurrent illness, trauma, or surgery requires a temporary increase in corticosteroid dose, or if already stopped, a temporary re-introduction of corticosteroid treatment. Anaesthetists must therefore know whether a patient is taking or has been taking a corticosteroid, to avoid a precipitous fall in blood pressure during anaesthesia or in the immediate postoperative period. A suitable regimen for corticosteroid replacement, in patients who have taken more than 10 mg prednisolone daily (or equivalent) within 3 months of surgery, is:
Minor surgery under general anaesthesia: usual oral corticosteroid dose on the morning of surgery or hydrocortisone 25-50 mg intravenously at induction; the usual oral corticosteroid dose is recommenced after surgery.

Moderate or major surgery: usual oral corticosteroid dose on the morning of surgery and hydrocortisone 25-50 mg intravenously at induction, followed by hydrocortisone 25-50 mg 3 times a day by intravenous injection for 24 hours after moderate surgery or for 48-72 hours after major surgery; the usual preoperative oral corticosteroid dose is recommenced on stopping hydrocortisone injections.

INFECTIONS. Prolonged courses of corticosteroids increase susceptibility to infections and increase their severity; clinical presentation of infections may also be atypical. Serious infections, for example septicaemia and tuberculosis, may reach an advanced stage before being recognised, and amoebiasis or strongyloidiasis may be activated or exacerbated (exclude before initiating a corticosteroid in those at risk or with suggestive symptoms). Fungal or viral ocular infections may also be exacerbated.

[Mercy Ships notes: See WHO Model Formulary 2008 for further notes on chickenpox and measles infection risk management.]

WITHDRAWAL OF SYSTEMIC CORTICOSTEROIDS. The rate of withdrawal of systemic glucocorticoids is dependent upon several factors including size of dose, duration of treatment, individual response and the likelihood of relapse of the underlying disease. If there is uncertainty about suppression of the HPA axis, withdrawal should be gradual to enable the adrenal gland to recover. Patients should be advised not to stop taking glucocorticoids abruptly unless permitted by their doctor.

Gradual withdrawal should be considered in those whose disease is unlikely to relapse and who have:
- recently received repeated courses (particularly if taken for > 3 weeks)
- taken a short course within 1 year of stopping long-term therapy
- other possible causes of adrenal suppression
- received more than 40 mg daily prednisolone (or equivalent)
- been given repeat doses in the evening
- received more than 3 weeks’ treatment

Abrupt withdrawal may be considered in those whose disease is unlikely to relapse and who have received treatment for 3 weeks or less and who are not included in the patient groups described above.

During corticosteroid withdrawal the dose may be reduced rapidly down to the physiological dosage (equivalent to 7.5 mg prednisolone daily) and then reduced more slowly. Assessment of the disease may be needed during withdrawal to ensure that relapse does not occur.
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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td><strong>Dexamethasone Inj 5mg/ml (as sodium phosphate)</strong></td>
<td>IDA</td>
<td>[Dose expressed as sodium phosphate.] <em>By IM, slow IV, or IV infusion</em>, Adult range 0.5-20mg/DAY, Child 200-500 micrograms/kg/DAY. Cerebral oedema: Adult <em>By slow IV inj</em> 10mg, then <em>by IM inj</em> 4mg every 6 hours as needed for 2-10 days. Give IM/slow IV undiluted. For IV infusion dilute 8mg in 50ml D5/NS and infuse over 15-30 minutes.</td>
</tr>
<tr>
<td><strong>Dexamethasone Tab 500 microgram &amp; 4mg</strong></td>
<td>EML</td>
<td>Suppression of inflammatory/allergic disorders: <em>by mouth</em>, Adult usual range 0.5-10 mg daily.</td>
</tr>
<tr>
<td><strong>Hydrocortisone Inj 100mg/2ml or 100mg vial (as sodium succinate) (Solu-Cortef)</strong></td>
<td>MSL IDA</td>
<td><em>By slow IV inj or IV infusion</em>: Adult 100-500mg, 3-4 times in 24 hours or as required; Child <em>by slow IV inj</em>, &lt; 1 yo 25mg, 1-5 yo 50mg, 6-12 yo 100mg. Angioedema or anaphylaxis: <em>by slow IV</em> Adult 100-300mg. For IV injection reconstitute vial with 2 ml of NS/WFI, give slow IV over 3-5 minutes; for IV infusion further dilute 100mg in 100ml D5/NS and infuse over 20-30 minutes.</td>
</tr>
<tr>
<td><strong>Prednisolone Tab 5mg &amp; 25mg</strong></td>
<td>MSL IDA</td>
<td>Suppression of inflammatory and allergic disorders: <em>by mouth</em>, Adult initially up to 10-20 mg daily (max 60mg daily), given in the morning after breakfast; may reduce dose within a few days, but may need to continue for several weeks/months. Child may use fractions of adult dose (e.g. at 1yo 25% of adult dose, at 7yo 50%, at 12yo 75%) but clinical factors must be given due weight. See chapter 03 for its use in asthma.</td>
</tr>
</tbody>
</table>
**Triamcinolone Acetonide Inj**  
10mg/ml, 2ml  
(Adcortyl, Kenalog-10)  
[Not for IM use]

**Intra-articular inj,** Adult 2.5-15mg  
(depending on joint size & severity).  
**Intradermal inj,** Adult 2-3mg  
(depending on lesion size) max  
30mg (not > 5mg at any one site).  
See product leaflet for detail.

**COMMENT/CAUTIONS:**

- **Equivalent anti-inflammatory corticosteroid doses**  
  [NOTE. This table takes no account of mineralocorticoid effects nor does it  
  take account of variations in duration of action]:

  - **Prednisolone 5mg**
    -  ≡ Betamethasone 750 micrograms  ≡ Cortisone 25 mg
    -  ≡ Dexamethasone 750 micrograms  ≡ Hydrocortisone 20 mg
    -  ≡ Methylprednisolone 4 mg  ≡ Triamcinolone 4 mg

- **Patient counselling:** Advise patients on prolonged courses of systemic  
  corticosteroids to consult their doctor promptly if they come into close contact  
  with anyone who has chickenpox or shingles, or if they become ill.

- **Dexamethasone**  1 mg = dexamethasone phosphate 1.2 mg =  
  dexamethasone sodium phosphate 1.3 mg.

### 7.02  THYROID & ANTITHYROID MEDICINES

**WHO MODEL FORMULARY 2008 NOTES:**

THYROID AGENTS are natural or synthetic agents containing levothyroxine  
(thyroxine) or liothyronine (tri-iodothyronine). The principal effect is to increase  
the metabolic rate. They also exert a cardiostimulatory effect which may be the  
result of a direct action on the heart. Thyroid hormones are used in  
hypothyroidism (myxoedema) and also in diffuse non-toxic goitre, Hashimoto  
thyroiditis (lymphadenoid goitre) and thyroid carcinoma. Neonatal hypothyroidism  
requires prompt treatment for normal development. Levothyroxine sodium  
(thyroxine sodium) is the treatment of choice for maintenance therapy. It is  
almost completely absorbed from the gastrointestinal tract but the full effects are  
not seen for up to 1 to 3 weeks after beginning therapy; there is a slow response  
to dose change and effects may persist for several weeks after withdrawal.  
Dosage of levothyroxine in infants and children for congenital hypothyroidism and  
juvenile myxoedema should be titrated according to clinical response, growth  
assessment and measurement of plasma thyroxine and thyroid-stimulating  
hormone.
ANTITHYROID DRUGS such as propylthiouracil and carbimazole are used in the management of thyrotoxicosis. They are also used to prepare the patient for thyroidectomy. They are usually well-tolerated, with mild leukopenia or rashes developing in a few percent of cases, usually during the first 6-8 weeks of therapy. During this time the blood count should be checked every 2 weeks or if a sore throat or other signs of infection develop. The drugs are generally given in a high dose in the first instance until the patient becomes euthyroid, the dose may then be gradually reduced to a maintenance dose which is continued for 12-18 months, followed by monitoring to identify relapse. There is a lag time of some 2 weeks between the achievement of biochemical euthyroidism and clinical euthyroidism. Beta-blockers (usually propranolol) may be used as a short-term adjunct to antithyroid drugs to control symptoms but their use in heart failure associated with thyrotoxicosis is controversial.

Treatment can be given, if necessary, in pregnancy but antithyroid drugs cross the placenta and in high doses may cause fetal goitre and hypothyroidism. The lowest dose that will control the hyperthyroid state should be used (requirements in Graves disease tend to fall during pregnancy). Propylthiouracil appears in breast milk but does not preclude breastfeeding as long as neonatal development is closely monitored and the lowest effective dose is used.

If surgery (partial thyroidectomy) is contemplated, it may be necessary to give iodine for 10 to 14 days in addition to antithyroid drugs to assist control and reduce vascularity of the thyroid. Iodine should not be used for long-term treatment since its antithyroid action tends to diminish. In patients in whom drug therapy fails to achieve long-term remissions definitive treatment with surgery or (increasingly) radioactive iodine is preferable.

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<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Carbimazole Tab 5mg (Neomercazole)</td>
<td>IDA</td>
<td>By mouth, Adult initially 15-40mg daily in 2-3 divided doses; maintenance 5-15mg daily; Child initially 250 micrograms/kg/DOS given 3 times daily adjusted according to response.</td>
</tr>
<tr>
<td>Propylthiouracil Tab 50mg</td>
<td>D</td>
<td>Hyperthyroidism: by mouth, Adult 300-600 mg daily in divided doses or once daily, until patient becomes euthyroid; then reduce dose gradually, usual maintenance dose 50-150 mg daily.</td>
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<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Levothyroxine Sodium Tab 100 microgram [Thyroxine, levo]</td>
<td>IDA</td>
<td>Hypothyroidism, <em>by mouth</em>, Adult initially 50-100 micrograms daily (&gt; 50 yo half adult dose) before breakfast, increased by 25-50 micrograms every 3-4 weeks until normal metabolism maintained (usual maintenance dose 100-200 micrograms daily); where there is cardiac disease, initially 25 micrograms daily or 50 micrograms on alternate days, adjusted in steps of 25 micrograms every 4 weeks. Congenital hypothyroidism and juvenile myxoedema (see notes above): <em>By mouth</em>, Neonate up to 1 month, initially 5-10 micrograms/kg daily, Child &gt; 1 month, initially 5 micrograms/kg daily, adjusted in steps of 25 micrograms every 2-4 weeks, until mild toxic symptoms appear, then reduce dose slightly.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **Carbimazole & Propylthiouracil:** Warn patient to tell doctor immediately if sore throat, mouth ulcers, bruising, fever, malaise or non-specific illness develops whilst on treatment. This may indicate the rare but serious side effect of agranulocytosis. Rashes are also common but can be controlled with antihistamines without discontinuing therapy.
- **Thyroxine:** Caution in patients with cardiovascular disorder or adrenal insufficiency. Adverse effects include arrhythmia, anginal pain, tachycardia, cramps in skeletal muscles, headache, restlessness, excitability, flushing, sweating, diarrhoea, excessive weight loss.
Diabetes mellitus is characterized by hyperglycaemia and disturbances of carbohydrate, fat and protein metabolism. There are 2 principal types of diabetes. Type 1 diabetes or insulin-dependent diabetes mellitus is due to a deficiency of insulin caused by autoimmune destruction of pancreatic beta cells. Patients require administration of insulin. Type 2 diabetes or non-insulin dependent diabetes mellitus is due to reduced secretion of insulin or to peripheral resistance to the action of insulin. Patients may be controlled by diet alone, but often require administration of oral antidiabetic drugs or insulin. The energy and carbohydrate intake must be adequate but obesity should be avoided. In type 2 diabetes, obesity is one of the factors associated with insulin resistance. Diets high in complex carbohydrate and fibre and low in fat are beneficial. Emphasis should be placed on exercise and increased activity. The aim of treatment is to achieve the best possible control of blood-glucose concentration and prevent or minimize complications including microvascular complications (retinopathy, albuminuria, neuropathy). Diabetes mellitus is a strong risk factor for cardiovascular disease; other risk factors such as smoking, hypertension, obesity and hyperlipidaemia should also be addressed.

INSULIN. Appropriate insulin regimens should be worked out for each patient. Insulin requirements may be affected by variations in lifestyle (diet and exercise)—drugs such as corticosteroids, infections, stress, accidental or surgical trauma, puberty and pregnancy (second and third trimesters) may increase insulin requirements; renal or hepatic impairment and some endocrine disorders (for example Addison disease, hypopituitarism) or coeliac disease may reduce requirements. In pregnancy insulin requirements should be monitored frequently.

Insulin must be given by injection because it is inactivated by gastrointestinal enzymes. Generally, insulin is given by subcutaneous injection into the upper arms, thighs, buttocks, or abdomen. There may be increased absorption from a limb site, if the limb is used in strenuous exercise following the injection. It is essential to use only syringes calibrated for the particular concentration of insulin administered. Insulin preparations can be classified according to duration of action after subcutaneous injection as follows:
- those of short duration which have a relatively rapid onset of action, for example soluble or neutral insulin;
- those with an intermediate action, for example isophane insulin;
- those with a relatively slow onset and long duration of action, for example protamine zinc insulin.
Soluble insulin, when injected subcutaneously, has a rapid onset of action (after 30-60 minutes), a peak action between 2 and 4 hours, and a duration of action up to 8 hours. Soluble insulin by the IV route is reserved for urgent treatment and fine control in serious illness and perioperatively. When injected intravenously, soluble insulin has a very short half-life of only about 5 minutes and its effects disappear within 30 minutes. When injected subcutaneously, intermediate-acting insulins have an onset of action of approximately 1-2 hours, a maximal effect at 4-12 hours and a duration of action of 16-24 hours. They can be given twice daily together with short-acting insulin or once daily, particularly in elderly patients. Most can be mixed with soluble insulin in the syringe, essentially retaining properties of each component. Long-acting insulins have an onset of action approximately 4 hours after subcutaneous injection; peak activity is between 10 and 20 hours, and duration of action up to 36 hours. Mixed insulin zinc suspension can be classified as either intermediate or long-acting.

The duration of action of different insulin preparations varies considerably from one patient to another and this needs to be assessed for every individual. The type of insulin used and its dose and frequency of administration depend on the needs of each patient. For patients with acute onset diabetes mellitus, treatment should be started with soluble insulin given 3 times daily with medium-acting insulin at bedtime. For those less seriously ill, treatment is usually started with a mixture of pre-mixed short- and medium-acting insulins (for example 30% soluble insulin with 70% isophane insulin) given twice daily. The proportions of soluble insulin can be increased in patients with excessive post-prandial hyperglycaemia.

Regimens should be developed by each country.

MONITORING. If possible patients should monitor their own blood-glucose concentration using blood glucose strips. Since blood-glucose concentration varies throughout the day, patients should aim to maintain blood-glucose concentration between 4-9 mmol/litre (72-180 mg/dl) for most of the time (4-7mmol/litre before meals and less than 9 mmol/litre after meals) while accepting that on occasions it will be higher; strenuous efforts should be made to prevent blood-glucose concentrations falling below 4 mmol/litre (72 mg/dl) because of the risk of hypoglycaemia. Patients should be advised to look for troughs and peaks of blood glucose and to adjust their insulin dosage only once or twice a week. Insulin doses are determined on an individual basis, by gradually increasing the dose to optimise blood-glucose concentration while avoiding hypoglycaemia. In the absence of blood-glucose monitoring strips, urine-glucose monitoring strips can be used (method of personal choice for many patients with Type 2 diabetes mellitus). It is less reliable than blood glucose but is easier and costs much less. All patients should monitor either blood- or urine-glucose concentration daily.
HYPOGLYCAEMIA is a potential complication in all patients treated with insulin or less frequently with sulfonylureas. The consequences of hypoglycaemia include confusion, seizures, coma and cerebral infarction. Initial treatment of hypoglycaemia involves glucose 10–20 g given by mouth either in liquid form or as granulated sugar (2 teaspoons) or sugar lumps (3 lumps). If necessary this may be repeated in 10–15 minutes. Alternatively, 25 ml of glucose intravenous infusion 50% (section 8.03) may be given, but this higher concentration is more irritant and viscous, which makes administration difficult. Glucose intravenous infusion 10% may also be used but a larger volume is needed. Close monitoring is necessary in the case of an overdose with a long acting insulin because further administration may be required. Patients whose hypoglycaemia is caused by a sulphonylurea should be transferred to hospital because the hypoglycaemic effects of these drugs may persist for many hours.

DIABETIC KETOACIDOSIS is a potentially lethal condition caused by an absolute or relative lack of insulin; it commonly occurs when adjustments to insulin dosage fail to compensate for increases in insulin requirements, for example during severe infection or major intercurrent illness. Diabetes ketoacidosis occurs mostly in patients with Type 1 diabetes mellitus. It also occurs in Type 2 diabetics who have a temporary need for insulin. Diabetic ketoacidosis is characterized by hyperglycaemia, hyperketonaemia and acidaemia with dehydration and electrolyte disturbances. It is essential that soluble insulin (and intravenous fluids) is readily available for its treatment.

INFECTIONS are more likely to develop in patients with poorly controlled diabetes mellitus. These should be treated promptly and effectively to avoid diabetic ketoacidosis.

SURGERY. Particular attention should be paid to insulin requirements when a patient with diabetes undergoes surgery that is likely to need IV infusion of insulin for longer than 12 hours. Soluble insulin should be given in IV infusion of glucose and potassium chloride (provided the patient is not hyperkalaemic), and adjusted to provide a blood-glucose concentration 7-12 mmol/litre (126-216 mg/dl). The duration of action of IV insulin is only a few minutes therefore the infusion must not be stopped unless the patient becomes frankly hypoglycaemic. For non-insulin dependent diabetics, insulin treatment is almost always required during surgery (oral hypoglycaemic drugs having been omitted). [Mercy Ships note: please continue oral hypoglycaemic drugs during surgery unless directed otherwise.]
**GENERIC (TRADE) NAME** | **CAT.** | **INDICATION/DOSE**
---|---|---
Insulin, Soluble 100 units/ml (Neutral insulin, R) (e.g. Actrapid HM, check current brand in stock) | EML | SC, IM, IV or IV infusion, Diabetes mellitus, Adult & Child dose according to individual requirements. See WHO notes above. 

Note: Only short-acting insulin can be given IV. Insulins are ° Fridge Items unless currently in use.

**COMMENT/CAUTIONS:**
- **Acute illness:** Insulin requirement may vary - consider transfer to soluble insulin by SC route every 6 hours; never reduce or stop insulin in patients with vomiting as extra insulin may be needed.
- **Beta-blockers** especially non-selective ones may mask the onset of hypoglycaemic symptoms.
- **Administration:** when mixing insulins draw up the shorter-acting one first and administer directly after mixing. Patients should only be transferred from one brand of insulin to another under medical supervision and in most instances they can be initiated at the same dose and schedule.
- **Diabetic ketoacidosis:** Give soluble insulin by IV infusion, well-diluted to 1unit/ml in NS at a rate of 6 units/hour (Adult) or 0.1unit/kg/hour (Child). When plasma glucose level is acceptable reduce rate to 3units/hour (Adult) or 0.02unit/kg/hour (Child), until SC insulin regime is restarted.

## 7.04 ORAL HYPOGLYCAEMIC AGENTS

**WHO MODEL FORMULARY 2008 NOTES:**

Oral antidiabetic (hypoglycaemic) drugs are used for non-insulin-dependent diabetes mellitus in patients who do not respond to dietary adjustment and an increase in physical exercise. They are used to supplement the effect of diet and exercise. There are various types of oral antidiabetic agents. The most commonly used are the **sulfonylureas** and the **biguanide** metformin.

Sulfonylureas act mainly by augmenting insulin secretion and are therefore only effective if there is some residual pancreatic beta-cell activity. They may occasionally lead to hypoglycaemia 4 hours or more after food. This usually indicates excessive dose and it occurs more frequently in the elderly and with long-acting sulfonylureas e.g. **glibenclamide**. Disadvantage: may encourage weight gain. They should not be used during breastfeeding and caution is required in the elderly and those with renal or hepatic insufficiency because of the risk of hypoglycaemia. Insulin therapy is generally required during intercurrent illness such as myocardial infarction, coma, infection, and trauma, during surgery and also during pregnancy.
Metformin exerts its effect by decreasing gluconeogenesis and by increasing peripheral utilization of glucose. Metformin can only act in the presence of endogenous insulin therefore is effective only in diabetics with some residual functioning pancreatic islet cells. It is used as a first-line treatment in overweight non-insulin-dependent diabetic patients and in others when strict dieting and sulfonylureas have failed to control the disease. Gastrointestinal adverse effects are common on initial treatment and may persist, particularly when very high doses (such as 3 g daily) are given. In order to reduce gastrointestinal effects, initiate with a low dose which may be gradually increased. Metformin may provoke lactic acidosis which is most likely to occur in patients with renal impairment; it should not be used in patients with even mild renal impairment. One major advantage of metformin is that it does not usually cause hypoglycaemia. It may be used together with insulin (but weight gain and hypoglycaemia can be problems) or sulfonylureas (but possibility of increased adverse effects with such combinations). During medical and surgical emergencies insulin treatment is almost always required; insulin should be substituted for metformin before elective surgery and in pregnancy.

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<tbody>
<tr>
<td>Glibenclamide (Glyburide) Tab 5mg (Daonil) [Sulphonylurea]</td>
<td>IDA</td>
<td>By mouth, Adult initially 5 mg once daily with breakfast (Elderly 2.5 mg, but avoid—see WHO notes above), adjusted according to response (maximum 15 mg daily).</td>
</tr>
<tr>
<td>Metformin Tab 500mg (Glucophage) [Biguanide]</td>
<td>IDA</td>
<td>By mouth, Adult initially 500 mg with breakfast for at least 1 week then 500 mg with breakfast and evening meal for at least 1 week, then 500 mg with breakfast, lunch and evening meal or 850 mg every 12 hours with or after food (max 2g/DAY in divided doses).</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**

- **Metformin**: Contraindicated in renal impairment and hepatic disease (see WHO notes above). Adverse effects include GI disturbances, lactic acidosis (increase risk with alcohol). Monitor vitamin B\textsubscript{12} levels yearly.
- **DRUG-INDUCED HYPOGLYCAEMIA**: hypoglycaemia may be potentiated by anticoagulants, chloramphenicol, fluconazole, NSAIDs, and fibrates. Conversely, the hypoglycaemic effects of antidiabetics may be reduced by oral contraceptives, corticosteroids, diuretics.
7.05 SEX HORMONES & RELATED MEDICINES

WHO MODEL FORMULARY 2008 NOTES:

[Mercy Ships note: See WHO Model Formulary 2008 for full HRT & COC notes.]

ESTROGENS are necessary for the development of female secondary sexual characteristics; they also stimulate myometrial hypertrophy with endometrial hyperplasia. They affect bone by increasing calcium deposition. They are secreted at varying rates during the menstrual cycle throughout the period of activity of the ovaries. During pregnancy, the placenta becomes the main source of estrogens. Ovarian secretion declines at the menopause. Estrogen therapy is given cyclically or continuously principally for contraception and for the alleviation of menopausal symptoms. If long-term therapy is required for menopausal hormone therapy a progestogen should be added to prevent cystic hyperplasia of the endometrium (or of endometrial foci in women who have had a hysterectomy) and possible transformation to cancer.

PROGESTOGENS. **Progesterone** is a hormone secreted by the corpus luteum whose actions include induction of secretory changes in the endometrium, relaxation of uterine smooth muscle and production of changes in the vaginal epithelium. Progesterone is relatively inactive following oral administration and produces local reactions at site of injection. This has led to the development of synthetic progestogens including levonorgestrel, norethisterone and medroxyprogesterone [not on Mercy Ships list]. Where endometriosis requires drug treatment, it may respond to synthetic progestogens on a continuous basis. A progestrogen may also be used for the treatment of severe dysmenorrhoea but where contraception is also required the best choice is a combined oral contraceptive. In postmenopausal women receiving long-term estrogen therapy for hormone replacement, a progestogen needs to be added for women with an intact uterus to prevent hyperplasia of the endometrium. Progestogens have been used for the treatment of menorrhagia, but they are not as effective as tranexamic acid [not included on WHO Model List]; mefenamic acid [not included on WHO Model List or Mercy Ships list] is particularly useful when dysmenorrhoea is also a problem.

COMBINED ORAL CONTRACEPTIVES (COC). Estrogen plus progestogen combinations are the most widely used hormonal contraceptives. They produce a contraceptive effect mainly by suppressing the hypothalamic-pituitary system resulting in prevention of ovulation; in addition, changes in the endometrium make it un receptive to implantation.

COC & SURGERY. Estrogen-containing oral contraceptives should preferably be discontinued (and adequate alternative contraceptive arrangements made) 4 weeks before major elective surgery and all surgery to the legs or surgery which involves prolonged immobilization of a lower limb. They should normally be
restarted at the first menses occurring at least 2 weeks after full mobilization. When discontinuation is not possible thromboprophylaxis (with heparin and graduated compression hosiery) is advised.

COCs should be STOPPED IMMEDIATELY if any of the following symptoms occur and resumed only after consultation with a health care provider:

- Sudden severe chest pain (even if not radiating to left arm);
- Sudden breathlessness (or cough with blood-stained sputum);
- Severe pain in calf of one leg;
- Severe stomach pain;
- Serious neurological effects including unusual, severe, prolonged headache especially if first time or getting progressively worse or sudden partial or complete loss of vision or sudden disturbance of hearing or other perceptual disorders or dysphagia or bad fainting attack or collapse or first unexplained epileptic seizure or weakness, motor disturbances, very marked numbness suddenly affecting one side or one part of body;
- Hepatitis, jaundice, liver enlargement;
- Blood pressure above systolic 160 mmHg and diastolic 100 mmHg;
- Detection of 2 or more risk factors for venous thromboembolism or arterial disease, see notes above [Mercy Ships note: refer to WHO formulary.]

PROGESTOGEN-ONLY CONTRACEPTIVES or preparations (POP), such as oral levonorgestrel may offer a suitable alternative when estrogens are contraindicated but the oral POPs do not prevent ovulation in all cycles and have a higher failure rate than combined estrogen-containing preparations. POPs carry less risk of thromboembolic and cardiovascular disease than COCs and are preferable for women at increased risk of such complications, for example smokers over 35 years. They can be used as an alternative to estrogen-containing combined preparations prior to major surgery. Oral POPs may be started 3 weeks after birth; breastfeeding women should preferably start at least 6 weeks after birth. Menstrual irregularities (oligomenorrhoea, menorrhagia, amenorrhoea) are common.

Levonorgestrel is used for emergency contraception. [see below for dose]. Adverse effects include nausea, vomiting, headache, dizziness, breast discomfort, and menstrual irregularities. If vomiting occurs within 2–3 hours of taking the tablets, replacement tablets can be given with an antiemetic. Advise patient that her next period may be early or late; that she needs to use a barrier contraceptive method until her next period, and she should seek prompt medical attention if lower abdominal pain occurs, or if subsequent menstrual bleed is abnormally light, heavy, brief or absent. There is no evidence of harmful effects to the fetus if pregnancy should occur.
### GENERIC (TRADE) NAME | CAT. | INDICATION/DOSE
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Ergometrine Inj 0.5mg/ml [Ergonovine] ° Fridge Item | MSL | Uterine bleeding: By IM inj 0.2 mg every 2 to 4 hours; for diagnostic use in angina pectoris, the usual dose is 0.05 to 0.2 mg intravenously.

Estrogen, Conjugated Tab 0.625mg (Premarin) [HRT] | IDA | Menopausal/post-menopausal symptoms: by mouth 0.625mg daily, usually on a cyclical basis and in conjunction with an added progesterone for part of the cycle.

Ethinylestradiol 30microgram/Levonorgestrel 150microgram Tab (e.g. Microgynon 30) [COC] | IDA | By mouth one tablet (‘pill’) daily taken same time each day for 21 days; subsequent courses repeated after 7-day pill-free interval (during which withdrawal bleeding occurs). Initiate first course on day 1 after the beginning of the menstrual period.

Levonorgestrel Tab 750 micrograms, 2 tablet pack | IDA | Emergency contraception: by mouth, Adult (female) 1.5 mg as a single dose (taken within 120 hours/5 days of unprotected intercourse); or 750 micrograms (taken within 72 hours) followed by a second dose 750 micrograms 12 hours later.

Norethisterone Tab 5mg [HRT] | IDA | By mouth, Endometriosis: Adult 10mg daily starting on day 5 of cycle (increased if spotting occurs to 20-25mg daily, reduced once bleeding has stopped). Menorrhagia: Adult 5mg 3 times daily for 10 days to stop bleeding; to prevent bleeding 5mg twice daily from day 19 to 26 of cycle Dysmenorrhea: 5mg 2-3 times daily from day 5 to 24 for 3 to 4 cycles. HRT: 5mg daily from day 15 to 26 of each 28-day estrogen HRT cycle.

Oxytocin Inj 10 units/ml ° Fridge Item | MSL | Induction & augmentation of labour: IV infusion of 5-10 units in 1000 ml D5/NS/RL solution at a rate of 0.5-5ml/minute titrate to response. Postpartum haemorrhage: IM or IV infusion 5-10 units as above titrate to response (of 10-40 units/ml solution)
COMMENT/CAUTIONS:

- **Ergometrine/Ergonovine:** Contraindicated for labour induction in threatened spontaneous abortion and in hypersensitive patients, not recommended prior to delivery of the placenta. Caution should be exercised in patients with heart, hepatic, or renal dysfunction, hypertension, vascular disease, or sepsis.

- **COC Initiation:** Use another form of contraceptive for day 1-7 of first cycle. Each tablet (‘pill’) should be taken at approximately the same time each day.

- **COC Missed tablets:** Take the missed tablet as soon as possible and take the next tablet at the usual time, but use an additional method of contraception for 7 days—if the 7 days extend beyond the end of the packet/cycle, a new packet/cycle is started without leaving a gap between packets. If delayed by longer than 24 hours contraceptive protection may be lost. Critical time for loss of protection is when a pill is omitted at beginning or end of a cycle (which lengthens the pill-free interval). Emergency contraception is recommended if either 2 or more pills are missed from the first 7 pills in a packet or 4 or more consecutive pills are missed mid-packet.

- **Vomiting up to 3 hours after taking an oral contraceptive or very severe diarrhoea** can interfere with the absorption of the pill. Additional precautions should be used during and for 7 days after recovery. If vomiting and diarrhoea occur during the last 7 pills, the next pill-free period should be omitted.

- **COC Breastfeeding:** Start 12 weeks after delivery to not affect breastfeeding.

- **COC Contraindications:** Thromboembolism or phlebitis (present/history), pregnancy, cerebral vascular or coronary artery disease, estrogen-dependent cancer, unexplained vaginal bleeding or amenorrhoea, diabetes with vascular disease, hypertension, liver/heart/renal/adrenal disease, heavy smoker > 35 yo, headaches with focal neurological symptoms (patient should report any increase in headache frequency or onset of focal symptoms).

- **COC Precautions:** Weight change, lipid/liver/GI/emotional disorders, undiagnosed bleeding irregularities, fluid retention, contact lenses; recommend annual med history/exam.

- **COC Drug Interactions:** reduced contraceptive effect by rifampicin and broad-spectrum antibiotics, griseofulvin and antiepileptics; antagonise anticoagulant effects, may increase side effects of tricyclic antidepressants.

- **HRT Drug Interactions:** Unlikely due to the low dose of oestrogen in HRT.

- **HRT Contraindications:** Estrogen dependent cancer, active thrombo-phlebitis or thromboembolic disorders, liver disease, unexplained vaginal bleeding, pregnancy or breast-feeding.
### 7.06 DRUGS FOR URINARY INCONTINENCE

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<tr>
<td>Oxybutynin HCl Tab 5mg (Cystrin/Ditropan)</td>
<td></td>
<td>VVF patients: Adult and Child &gt; 12yo. <em>By mouth</em> initially 5mg 2-3 times daily; increased if needed to max 5mg 4 times daily; Elderly initially 2.5-3mg twice daily; increased to 5mg twice daily according to response and tolerance.</td>
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**COMMENT/CAUTIONS:**
- **Oxybutynin**: Please check current VVF standing orders and guidelines. Not to be confused with hyoscine n-butylibromide (*butylscopolamine* or *Buscopan*), see Section 1.04 Antispasmodics.
8 VITAMINS, MINERALS & PARENTERAL SOLUTIONS

8.01 VITAMINS

WHO MODEL FORMULARY 2008 NOTES:

Vitamins are used for the prevention and treatment of specific deficiency states or when the diet is known to be inadequate. It has often been suggested but never convincingly proved, that subclinical vitamin deficiencies cause much chronic ill-health and liability to infections. This has led to enormous consumption of vitamin preparations, which have no more than placebo value. Most vitamins are comparatively non-toxic but prolonged administration of high doses of retinol (vitamin A), ergocalciferol (vitamin D\textsubscript{2}) and pyridoxine (vitamin B\textsubscript{6}) may have severe adverse effects.

Retinol (vitamin A) is a fat-soluble substance stored in body organs, principally the liver. Periodic high-dose supplementation is intended to protect against vitamin A deficiency which is associated with ocular defects particularly xerophthalmia (including night blindness which may progress to severe eye lesions and blindness), and an increased susceptibility to infections, particularly measles and diarrhoea. Universal vitamin A distribution involves the periodic administration of supplemental doses to all preschool-age children with priority given to age groups, 6 months to 3 years, or regions at greatest risk. All mothers in high-risk regions should also receive a high dose of vitamin A within 8 weeks of delivery. Since vitamin A is associated with a teratogenic effect it should be given in smaller doses (no more than 10 000 units/day) to women of child-bearing age. It is also used in the treatment of active xerophthalmia. Doses of vitamin A should be administered orally immediately upon diagnosis of xerophthalmia and thereafter patients with acute corneal lesions should be referred to a hospital on an emergency basis. In women of child-bearing age there is a need to balance the possible teratogenic effects of vitamin A should they be pregnant with the serious consequences of xerophthalmia. Where there are severe signs of xerophthalmia high dose treatment as for patients over 1 year should be given. When less severe symptoms are present (for example night blindness) a much lower dose is recommended. Vitamin A therapy should also be given during epidemics of measles to reduce complications.

Vitamin B is composed of widely differing substances which are, for convenience, classed as ‘vitamin B complex’. Thiamine (vitamin B\textsubscript{1}) is used orally for deficiency due to inadequate dietary intake. Severe deficiency may result in ‘beri-beri’. Chronic dry ‘beri-beri’ is characterized by peripheral neuropathy, muscle wasting and weakness, and paralysis; wet ‘beri-beri’ is characterized by cardiac failure and oedema. Wernicke-Korsakoff syndrome (demyelination of the CNS) may develop in severe deficiency. Thiamine is given
by IV injection in doses of up to 300 mg daily (parenteral preparations may contain several B group vitamins) as initial treatment in severe deficiency states. Potentially severe allergic reactions may occur during, or shortly after parenteral administration, therefore IV injections should be administered slowly (over 10 minutes) and should be used only if parenteral treatment is essential. Facilities for resuscitation should be immediately available. Riboflavin (vitamin B\textsubscript{2}) deficiency may result from reduced dietary intake or reduced absorption due to liver disease, alcoholism, chronic infection or probenecid therapy. It may also occur in association with other deficiency states such as pellagra. Pyridoxine (vitamin B\textsubscript{6}) deficiency is rare as the vitamin is widely distributed in foods, but deficiency may occur during isoniazid therapy and is characterized by peripheral neuritis. It is also used in sideroblastic anaemia. Pyridoxine and thiamine also have a role in status epilepticus (see section 4.04). Nicotinic acid inhibits the synthesis of cholesterol and triglyceride and is used in some hyperlipidaemias. Nicotinic acid and nicotinamide are used to prevent and treat nicotinic acid deficiency (pellagra). Nicotinamide is generally preferred as it does not cause vasodilation. Hydroxocobalamin is the form of vitamin B\textsubscript{12} used to treat vitamin B\textsubscript{12} deficiency due to dietary deficiency or malabsorption.

Folic acid is essential for the synthesis of DNA and certain proteins. Deficiency of folic acid or vitamin B\textsubscript{12} is associated with megaloblastic anaemia. Folic acid should not be used in undiagnosed megaloblastic anaemia unless vitamin B\textsubscript{12} is administered concurrently, otherwise neuropathy may be precipitated (see section 8.02 WHO notes). Supplementation with folic acid 400 micrograms daily is recommended for women of child-bearing potential in order to reduce the risk of serious neural tube defects in their offspring.

Ascorbic acid (vitamin C) is used for the prevention and treatment of scurvy. Claims that ascorbic acid is of value in the treatment of common colds are unsubstantiated.

The term vitamin D covers a range of compounds including ergocalciferol (vitamin D\textsubscript{2}) and colecalciferol (vitamin D\textsubscript{3}). These two compounds are equipotent and either can be used to prevent and treat rickets. Simple deficiency of vitamin D occurs in those who have an inadequate dietary intake or who fail to produce enough colecalciferol (vitamin D\textsubscript{3}) in their skin from the precursor 7-dehydrocholesterol in response to ultraviolet light. Children with dark skin must continue vitamin D prophylaxis for up to 24 months because of their inability to produce enough vitamin D\textsubscript{3} in their skin. Dark skin with a high melanin content must be exposed to daylight longer than light skin in order to obtain the same synthesis of vitamin D\textsubscript{3}. Vitamin D is also used in deficiency states caused by intestinal malabsorption or chronic liver disease and for the hypocalcaemia of hypoparathyroidism.

Vitamin K is necessary for the production of blood clotting factors.
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Ascorbic Acid (Vitamin C) Tab 250mg</td>
<td>IDA</td>
<td>By mouth, Adult &amp; Child: Prophylactic, 25-75mg daily. Therapeutic, minimum 250mg daily in divided doses.</td>
</tr>
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<td>EML</td>
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<tr>
<td>Folic Acid 5mg Tab</td>
<td>IDA</td>
<td>By mouth, Folate-deficient megaloblastic anaemia: Adult &amp; Child &gt; 1 yo, initially 5mg daily for 4 months; prophylaxis in chronic haemolytic states: 5mg daily depending on diet/haemolysis rate; Child &lt;1yo 500 micrograms/kg/DAY. Prevention of first occurrence of neural tube defect in pregnancy: 200-500 micrograms daily up to the twelfth week; prevention of reoccurrence 5mg daily from at least 4 weeks before conception until twelfth week of pregnancy.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Phytomenadione (Vitamin K) Inj 10mg/ml, 1ml [Phytonadione]</td>
<td>MSL</td>
<td>Hypoprothrombinaemia, warfarin overdose: severe haemorrhage Adult by slow IV inj 2.5-5mg, max 50mg (dilute in D5, max rate 1mg/minute); less severe bleeding by IM/SC inj undiluted 10-20mg; no or minor bleeding by IM/SC inj undiluted 500 micrograms. NOTE: Some commercial preps unsuitable for IV use.</td>
</tr>
<tr>
<td></td>
<td>IDA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td>[Adult use only, NOT for child &lt; 2 yo, contains benzyl alcohol.]</td>
</tr>
<tr>
<td>Pyridoxine (Vitamin B₆) Tab 50mg</td>
<td>IDA</td>
<td>By mouth, Deficiency states: Adult 25-50mg up to 3 times daily. Isoniazid neuropathy: Adult prophylaxis 10mg daily; therapeutic 50mg 3 times daily. Sideroblastic anaemia: Adult 100-400mg daily in divided doses.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
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<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Retinol (Vitamin A) Tab 50 000 Units &amp; 200 000 Units</td>
<td>IDA</td>
<td>By mouth, Prophylaxis, Infant &lt; 6 months 50 000 units, 6-12 months 100 000 units, every 4-6 months, preferably at measles vaccination; Child &gt; 1 yo (preschool) &amp; Adult, 200 000 units every 4-6 months; Adult pregnant woman, max 10 000 units daily or 25 000 units weekly; Adult mothers, 200 000 units at delivery or within 6 weeks. Treatment of xerophthalmia, Infant &lt; 6 months, 50 000 units on diagnosis, repeated next day and then after 2 weeks; 6-12 months 100 000 units; Child &gt; 1 yo &amp; Adult (except woman of child-bearing age) 200 000 units on diagnosis, repeated next day and then after 2 weeks; Adult (woman of child-bearing age, see notes above), severe signs of xerophthalmia, as for other adults; less severe cases (e.g. night blindness), 5000-10 000 units daily for at least 4 weeks or up to 25 000 units weekly.</td>
</tr>
</tbody>
</table>

**MULTIVITAMIN PREPARATIONS**

| Multivitamin for Adults Tablet | By mouth, Adults & Child >12 yo, one tablet daily or as required. |
| Multivitamin for Children, Chewable Tablet | By mouth, 2-12yo, 1 tab daily or as needed. See product leaflet for detail |
| Multivitamin with Iron for Children, Chewable Tablet | By mouth, 2-12yo, 1 tab daily or as needed. See product leaflet for detail |
| Multivitamin Suspension | By mouth, 2-12yo 5ml daily; <2yo 2.5ml daily, or as needed. See product leaflet for detail |
| Vitamin B Complex Tab | IDA | 1-2 tab daily as required, See product literature for details. |

*Cont. next page*
COMMENT/CAUTIONS:

- RDA: (vitamin B₁/thiamine) < 6 months 0.3mg, 6 months-1 yo 0.4mg, 1-3 yo 0.7mg, 4-6 yo 0.9mg, 7-10 yo 1mg, 11-14 yo 1.1-1.3mg, > 14 yo 1.5mg.
- RDA: (vitamin B₂/riboflavin) Child 0.4-1.8mg, Adult 1.2-1.7mg.
- RDA: (vitamin B₆/pyridoxine) 1-3 yo 0.9mg, 4-6 yo 1.3mg, 7-10 yo 1.6mg, Adult 2mg.
- RDA (vit B₁₂/cyanocobalamin) Child 0.3-2 micrograms, Adult 2 micrograms.
- RDA: (vitamin C/ascorbic acid) < 6 months 30mg, 6 months-1 yo 35mg, 1-3 yo 40mg, 4-10 yo 45mg, 11-14 yo 50mg, Adult 60mg.
- RDA: (vitamin D/alfacalcidol/calcitriol): < 6 months 7.5 micrograms (but if infants breast-fed and not exposed to sunlight an additional supplement of 5-7.5 micrograms should be given), up to 24 yo 10 micrograms, over 24 yo (adult) 5 micrograms, pregnant/lactating women 10 micrograms.
- Conversion: vitamin D 1000 IU is equivalent to 25 micrograms.
- RDA: (folic acid): Neonates to 6 months 25-35 micrograms, 6 months-3 yo 50 micrograms, 4-6 yo 75 micrograms, 7-10 yo 100 micrograms, 11-14 yo 150 micrograms, > 15 yo to Adult 200 micrograms.

8.02 ELECTROLYTES & MINERALS

WHO MODEL FORMULARY 2008 NOTES:

Calcium gluconate. Calcium supplements are usually only required where dietary calcium intake is deficient. This dietary requirement varies with age and is relatively greater in childhood/pregnancy/lactation due to an increased demand, and in old age, due to impaired absorption. In osteoporosis, a calcium intake which is double the recommended daily amount reduces the rate of bone loss. In hypocalcaemic tetany calcium gluconate must be given parenterally but monitor plasma calcium. Calcium gluconate is also used in cardiac resuscitation.

Iron-deficiency Anaemia. Anaemia has many different aetiologies. It occurs when the haemoglobin concentration falls below the normal range for the age and sex of the individual. It is essential that a correct diagnosis is made before initiating therapy. Any serious underlying cause of iron-deficiency anaemia, including gastric erosion and colonic carcinoma, should be excluded before giving iron replacement. Ferrous salts should be given orally wherever possible. They differ only marginally in efficiency of absorption and thus the choice of preparation is usually decided by incidence of adverse effects and cost. Ferric salts are much less well absorbed. The oral dose of elemental iron for treatment of iron deficiency anaemia in adults should be 100–200 mg daily with meals.

Approximate elemental iron content: ferrous fumarate 210 mg (68 mg iron), ferrous gluconate 300 mg (35 mg iron), ferrous succinate 100 mg (35 mg iron), ferrous sulfate 300 mg (60 mg iron), dried ferrous sulfate 200 mg (65 mg iron).
The haemoglobin concentration should rise by about 100–200 mg/100 ml per day or 2 g/100 ml over 3-4 weeks. After the haemoglobin has risen to normal, treatment should be continued for a further 3 months to replenish the iron stores. Iron intake in the evening has been reported to improve its absorption. Iron intake with meals may reduce bioavailability but improve tolerability and adherence. If adverse effects occur, either the dosage can be reduced or an alternative iron salt used, but an improvement in tolerance may be due to lower content of elemental iron. Gastrointestinal irritation may occur with iron salts. Nausea and epigastric pain are dose-related. Iron preparations taken orally may be constipating, particularly in the elderly, occasionally leading to faecal impaction. Oral iron may exacerbate diarrhoea in patients with inflammatory bowel disease but care is also needed in patients with intestinal strictures and diverticular disease. Iron as iron dextran (a complex of ferric hydroxide with dextrans) [not included on WHO Model List] or iron sucrose (a complex of ferric hydroxide with sucrose) [not included on WHO Model List] may be given parenterally if the patient cannot tolerate oral iron, or does not take it reliably or if there is continuing severe blood loss or malabsorption. Many patients with chronic renal failure who are receiving haemodialysis (and some on peritoneal dialysis) require intravenous iron on a regular basis. Parenteral iron may cause more harm than benefit. With the exception of patients on haemodialysis the haemoglobin response is not significantly faster with the parenteral route than the oral route.

**Megaloblastic anaemias** result from a lack of either vitamin B$_{12}$ (hydroxocobalamin) or folate or both. The clinical features of folate-deficient megaloblastic anaemia are similar to those of vitamin B$_{12}$ deficiency except that the accompanying severe neuropathy does not occur; it is essential to establish the underlying cause in every case. **Hydroxocobalamin** [not on Mercy Ships list] is used to treat vitamin B$_{12}$ deficiency whether due to dietary deficiency or malabsorption including pernicious anaemia (due to a lack of intrinsic factor, which is essential for vitamin B$_{12}$ absorption).

**Folate** deficiency due to poor nutrition, pregnancy, antiepileptics or malabsorption is treated with **folic acid** but this should never be administered without vitamin B$_{12}$ in undiagnosed megaloblastic anaemia because of the risk of precipitating neurological changes due to vitamin B$_{12}$ deficiency. Preparations containing a **ferrous salt and folic acid** are used for the prevention of megaloblastic anaemia in pregnancy. The low doses of folic acid in these preparations are inadequate for the treatment of megaloblastic anaemias. See section 8.01 for folic acid dose detail. To reduce risk of **neural tube defects** in babies, supplement folic acid in women planning a pregnancy (in diet or as supplement 400-500 micrograms daily) before conception and in the first 12 weeks of pregnancy. Women of increased risk (e.g. history of neural tube defect in a previous child) should receive 5mg folic acid daily. Women taking antiepileptic drugs should be counselled by their doctor before starting folic acid.
Compensation for potassium loss is necessary in patients taking digoxin or antiarrhythmic drugs (potassium depletion may induce arrhythmias); in patients with secondary hyperaldosteronism (renal artery stenosis, liver cirrhosis, the nephrotic syndrome, severe heart failure); and with excessive loss of potassium in faeces (chronic diarrhoea associated with intestinal malabsorption or laxative abuse). Consider also in the elderly since they often take inadequate amounts in the diet (but caution on use in renal insufficiency). Consider during long-term administration of drugs known to induce potassium loss (e.g. corticosteroids). Potassium supplements are seldom required with the small doses of diuretics given to treat hypertension. Potassium-sparing diuretics (rather than potassium supplements) are recommended for prevention of hypokalaemia due to diuretics such as furosemide or the thiazides when these are given to eliminate oedema (see section 2.01). Potassium depletion is frequently associated with metabolic alkalosis and chloride depletion and these disorders require correction.

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<tr>
<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Calcium Carbonate Cap 250mg [elemental Ca = 100mg/cap = 2.5mmol/cap = 5mEq/cap]</td>
<td>By mouth, deficiency: Adult 250-500mg 3-4 times daily. <strong>Dose in elemental calcium for Hypocalcaemia:</strong> Neonate 50-150 mg/kg/DAY daily in 4-6 divided doses (max 1g/DAY); Child 45-65mg/kg/DAY in 4 divided doses, Adult 1-2g or more/DAY.</td>
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</tr>
<tr>
<td>Calcium Carbonate Cap 500mg [elemental Ca = 200mg/cap = 5mmol/cap = 10mEq/cap]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium Chloride Inj 10% 1g/10ml [elemental Ca = 273mg/10ml =6.8mmol/10ml =13.6mEq/10ml]</td>
<td>Acute hypocalcaemia: <em>By slow IV inj</em> 0.5-1g (undiluted at 0.5-1ml/minute); <em>or IV infusion</em> in doses up to 1g (dilute in 50ml NS give over 1 hour).</td>
<td></td>
</tr>
<tr>
<td>Calcium Lactate 300mg Tab [elemental Ca = 40mg/tab = 1mmol/tab = 2mEq/tab]</td>
<td><strong>IDA</strong> By mouth, Osteoporosis: Adult up to 6g daily in divided doses. Usual dose ~20mmol (20 tab) daily.</td>
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<tr>
<th>GENERIC (TRADE) NAME</th>
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| Calcium Gluconate Inj 10% 1g/10ml  
[elemental Ca = 89mg/10ml =2.25mmol/10ml =4.5mEq/10ml]  
[NOT for IM or SC Inj.] | IDA | Acute hypocalcaemia: By slow IV inj 1-2g (2.25-4.5mmol Ca or 10-20ml).  
Cardiac resuscitation: slow IV or intracardiac 1g (2.25mmol Ca, 10ml)  
Hypocalcaemia tetany: slow IV 1g (2.25mmol Ca or 10ml) may be followed by continuous IV infusion of 4g/DAY (9mmol Ca or 40ml/DAY).  
Acute severe hyperkalaemia: By slow IV inj 1-2g (10-20ml 10% solution), see BNF for details.  
Inject slow IV undiluted over 10-20 minutes, max rate 50mg/minute, or IV infusion dilute 1g with 20-50ml D5/NS and infuse over 1 hour or at a rate of 120-240mg/kg/hour. |
| Ferrous Sulphate 200mg Tab  
[elemental iron Fe = 60mg/tab = 1mmol/tab] | IDA | By mouth, Iron-deficiency anaemia: Treatment, Adult & > 12yo, 1 tab 2-3 times daily after food.  
Prophylaxis, Adult (woman) 1 tab daily.  
Alternative treatment dosing:  
< 2yo 1mg/kg elemental iron daily;  
2-12yo 2mg/kg elemental iron daily;  
Adult 60-120mg elemental iron daily. |
| Ferrous Fumarate Suspension 100mg/5ml  
[elemental iron Fe = 33mg/5ml = ~0.5mmol/5ml] | IDA | By mouth, Iron-deficiency anaemia: Treatment, Adult 10-20ml twice daily; 6-12 yo 5-10ml twice daily; up to 6 yo 2.5-5ml twice daily.  
Prevention, Child < 5 yo elemental iron 2mg/kg (max 30mg) daily;  
> 5 yo elemental iron 30mg daily; or  
Alternative treatment dosing:  
< 2yo 1mg/kg elemental iron daily;  
2-12yo 2mg/kg elemental iron daily.  
In women and children > 5 yo folic acid may also be given. To prevent tooth discoloration, administer with a drinking straw, dilute well with water. |

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<tr>
<td>Magnesium Sulfate Inj 50% 5g/10ml [elemental Mg = 500mg/10ml = 20mmol/10ml = 40 mEq/10ml ]</td>
<td>IDA</td>
<td>Serious arrhythmia, emergency, in the presence of hypomagnesaemia: <em>By slow IV inj</em> 1-2g (4-8mmol Mg or 2-4ml) in 50-100ml D5 over 10-15 minutes repeated once if needed; <em>or by IV infusion</em> 2.5g (10mmol or 5ml) in 100ml D5/NS infused over 1 hour. Hypomagnesaemia, emergency: <em>By IV infusion</em> 1-2g (4-8mmol Mg or 2-4ml) in 100ml D5 over 1-2 minutes. Severe deficiency: <em>By IV infusion</em> 5g (20mmol Mg or 10ml) in 1000ml D5/NS, given over 3 hours. For IV inj or infusion dilute dose in 50-100ml D5, max conc 200mg/ml. An IV calcium solution (e.g.10% calcium gluconate) should be readily available when magnesium sulphate injection is administered.</td>
</tr>
<tr>
<td>Potassium Chloride Tab 600mg (Slow K) [elemental K = 313mg/tab = 8mmol/tab = 8mEq/tab]</td>
<td>IDA EML</td>
<td><em>By mouth</em>, Hypokalaemia prevention (see notes above): Adult 20-50 mmol daily in 2-3 divided doses after food, (max 100 mmol/DAY) adjust dose according to clinical response or need, monitor levels regularly.</td>
</tr>
<tr>
<td>Potassium Chloride Inj 10% 1g/10ml (=100mg/ml) [elemental K = 524mg/10ml = 13.4mmol/10ml = 13.4mEq/10ml]</td>
<td>IDA EML</td>
<td><em>By IV infusion</em>, Acute severe hypokalaemia: Adult, 10-20mmol K (~10-20ml), max 40mmol K (~40ml) infuse over 1-3 hours diluted in NS. Child 0.5-1mmol/kg/DOSE, max 30mmol (~30ml) may be infused at 0.3-0.5 mmol/kg/hour diluted in NS. NOTE: MUST dilute IV in NS before use (mix thoroughly), at a max rate of 20mmol/hour, IV concentration max 40mmol/L (peripheral line) and 80mmol/L (central line, with monitoring). ECG monitoring and repeated plasma potassium levels recommended before further doses.</td>
</tr>
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COMMENT/CAUTIONS:

- **Iron therapy:** Give orally unless otherwise indicated. Start with low dose and increase gradually to improve tolerance, administer with food. Adverse effects include nausea, epigastric pain, constipation/diarrhoea, stool discoloration.

- **Iron drug interaction:** Magnesium trisilicate reduces iron absorption; oral iron reduces absorption of tetracyclines and possibly penicillamine and fluoroquinolones such as ciprofloxacin (administer 2 hours later to avoid this).

- **Potassium:** May cause nausea/vomiting, do not combine with spironolactone or other potassium-sparing diuretics, reduce dose in elderly and renal failure. Potassium-rich foods may affect levels (e.g. dates, bananas, mangos, oranges, tomatoes). For **acute severe hyperkalaemia** treatment see Calcium gluconate above and check BNF or other manuals for details.

- **RDA (Elemental calcium):** < 6 months 400mg, 6-12 months 600mg, 1-5 yo 800mg, 6-10 yo 800-1200mg, 11 yo-Adult 1000-1500mg.

- **RDA (Elemental iron):** < 5 months 5mg, 5 months-10 yo 10mg, 11-18 yo (male) 12mg, 11-50 yo (female) 15mg, >18yo (male) or >50yo (female) 10mg.

- **RDA (Elemental magnesium):** < 12 months 40-60mg, 1-6 yo 80-120mg, 7-10 yo 170mg, 11-18 yo (male) 270-400mg (female) 280-300mg, > 19 yo (male) 350mg (female) 280mg.

- **RDA (Elemental potassium):** Neonates 2-6mmol/kg, Child 2-3mmol/kg, Adult 40-80mmol.

### 8.03 PARENTERAL SOLUTIONS

**WHO MODEL FORMULARY 2008 NOTES:**

Solutions of electrolytes are given intravenously, to meet normal fluid and electrolyte requirements or to replenish substantial deficits or continuing losses, when the patient is nauseated or vomiting and is unable to take adequate amounts by mouth. The nature and severity of the electrolyte imbalance must be assessed from the history and clinical and biochemical examination of each individual. Sodium, potassium, chloride, magnesium, phosphate, and water depletion can occur singly and in combination with or without disturbances of acid-base balance.

Isotonic solutions may be infused safely into a peripheral vein. More concentrated solutions, for example 20% glucose, are best given through an indwelling catheter positioned in a large vein. **Sodium chloride** in isotonic solution provides the most important extracellular ions in near physiological concentrations and is indicated in **sodium depletion** which may arise from conditions such as gastroenteritis, diabetic ketoacidosis, ileus and ascites. In a severe deficit of from 4 to 8 litres, 2-3 litres of isotonic sodium chloride may be given over 2-3 hours then reduce rate. Excessive administration should be avoided; the jugular venous pressure should be assessed; the bases of the lungs
should be examined for crepitations, and in elderly or seriously ill patients it is often helpful to monitor the right atrial (central) venous pressure.

*Chronic hyponatraemia* should ideally be managed by fluid restriction. However, if sodium chloride is required, the deficit should be corrected slowly to avoid risk of osmotic demyelination syndrome; the rise in plasma-sodium concentration should not exceed 10mmol/litre in 24 hours. In severe hyponatraemia, intravenous infusion of sodium chloride 1.8% may be used with caution.

The more physiologically appropriate **compound solution of sodium lactate** (Ringers or Hartmann’s solution) can be used instead of isotonic sodium chloride solution during surgery or in the initial management of the injured or wounded.

**Sodium chloride and glucose** solutions are indicated when there is *combined water and sodium depletion*. A 1:1 mixture of isotonic sodium chloride and 5% glucose allows some of the water (free of sodium) to enter body cells which suffer most from dehydration while the sodium salt with a volume of water determined by the normal plasma Na⁺ remains extracellular. Combined sodium, potassium, chloride, and water depletion may occur (e.g. severe diarrhea or persistent vomiting); replacement is carried out with sodium chloride IV infusion 0.9% and glucose IV infusion 5% with potassium as appropriate.

**Glucose** solutions (5%) are mainly used to replace *water deficits* and should be given alone when there is no significant loss of electrolytes. Average water requirement in a healthy adult are 1.5 to 2.5 litres daily and this is needed to balance unavoidable losses of water through the skin and lungs and to provide sufficient volume for urinary excretion. Water depletion (dehydration) tends to occur when these losses are not matched by a comparable intake, as for example may occur in coma or dysphagia or in the elderly or apathetic who may not drink water in sufficient amount on their own initiative.

Excessive loss of water without loss of electrolytes is uncommon, occurring in fevers, hyperthyroidism, and in uncommon water-losing renal states such as diabetes insipidus or hypercalcaemia. The volume of glucose solution needed to replace deficits varies with the severity of the disorder, but usually lies within the range of 2 to 6 litres.

Glucose solutions are also given in regimens with calcium, bicarbonate, and insulin for the emergency treatment of *hyperkalaemia*. They are also given, after correction of hyperglycaemia, during treatment of diabetic ketoacidosis, when they must be accompanied by continuing insulin infusion.

If glucose or sugar cannot be given orally to treat *hypoglycaemia*, glucose 50% may be given intravenously into a large vein through a large-gauge needle; this concentration is very irritant on extravasation and it is also viscous and difficult to
administer. Larger volumes of less concentrated glucose solutions (10% or 20%) can be used as alternatives and are less irritant.

**Sodium hydrogen carbonate** (sodium bicarbonate) is used to control severe *metabolic acidosis* (as in renal failure). Since this condition is usually attended by sodium depletion, it is reasonable to correct this first by the administration of isotonic sodium chloride intravenous infusion, provided the kidneys are not primarily affected and the degree of acidosis is not so severe as to impair renal function. In these circumstances, isotonic sodium chloride alone is usually effective as it restores the ability of the kidneys to generate bicarbonate. In renal acidosis or in severe metabolic acidosis of any origin, for example blood pH < 7.1, sodium hydrogen carbonate (1.4%) may be infused with isotonic sodium chloride when the acidosis remains unresponsive to correction of anoxia or fluid depletion; a total volume of up to 6 litres (4 litres of sodium chloride and 2 litres of sodium hydrogen carbonate) may be necessary in the adult. In severe shock due for example to cardiac arrest, metabolic acidosis may develop without sodium depletion; in these circumstances sodium hydrogen carbonate is best given in a small volume of hypertonic solution (for example 50 ml of 8.4% solution intravenously); plasma pH should be monitored. Sodium hydrogen carbonate is also used in the emergency management of *hyperkalaemia*.

Intravenous **potassium chloride** in sodium chloride infusion is the initial treatment for the correction of *severe hypokalaemia* when sufficient potassium cannot be taken by mouth. Potassium chloride concentrate may be added to sodium chloride 0.9% infusion, *thoroughly mixed*, and given slowly over 2 to 3 hours with specialist advice and ECG monitoring in difficult cases. Repeated measurements of plasma potassium are necessary to determine whether further infusions are required and to avoid the development of hyperkalaemia which is especially likely to occur in renal impairment. Initial potassium replacement therapy should **not** involve glucose infusions because glucose may cause a further decrease in the plasma-potassium concentration.

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<tbody>
<tr>
<td>Dextrose Inj 5% 500ml &amp; 1000ml (Glucose)</td>
<td>EML</td>
<td>Fluid replacement: <em>By IV infusion</em> according to patient’s requirements.</td>
</tr>
<tr>
<td>Dextrose Injection Prefilled Syringe 50% 5g/10ml, 50mls (Glucose)</td>
<td>EML</td>
<td>Hypoglycaemia: <em>By IV infusion</em> Adult up to 25ml as 50% solution, or preferably diluted in WFI to 10-20% solution and given into a large vein through a large gauge needle.</td>
</tr>
<tr>
<td><strong>GENERIC (TRADE) NAME</strong></td>
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</tr>
<tr>
<td>Ringers Lactate Solution (Hartmann’s or Compound Sodium Lactate Inj) [Na = 131, K = 5, Ca = 2, Cl = 111, HCO3 = 29 mmol/L]</td>
<td>EML</td>
<td>Fluid replacement or surgical use: <em>By IV infusion</em> according to patient’s requirements. Contains CaCl 0.027%, KCl 0.04%, NaCl 0.6% &amp; sodium lactate 0.25%.</td>
</tr>
<tr>
<td>Sodium Bicarbonate Inj 8.4% 10ml [Na = 230mg/10ml = 10mmol/10ml = 10mEq/10ml]</td>
<td>EML</td>
<td>Metabolic acidosis: <em>by slow IV inj</em> (undiluted) or <em>by cont IV infusion</em> (diluted in D5/NS), according to individual patient condition, usually 2-5 mmol/kg over 4-8 hours; in emergency e.g. cardiac arrest give initial dose of 1 mmol/kg (1 ml/kg of 8.4% solution) followed by not more than 0.5 mmol/kg every 10 minutes.</td>
</tr>
<tr>
<td>Sodium Bicarbonate Inj 8.4% 50ml [Na = 1150mg/50ml = 50mmol/50ml = 50mEq/50ml]</td>
<td>EML</td>
<td>For reconstitution use, or fluid/electrolytes replacement as required.</td>
</tr>
<tr>
<td>Sodium Chloride Inj 0.9% 10ml, 100ml &amp; 500ml [Na = 9g/L = 154mmol/L = 154mEq/L]</td>
<td>EML</td>
<td>For VVF patients, treatment of hyponatraemia: <em>By IV infusion</em> via a large vein, 100ml given over 1 hour, (max rate 100ml/hour); before additional amounts are administered, serum electrolyte concentrations should be checked, including chloride and bicarbonate, to assess need for additional sodium chloride. Confirm with current VVF standing orders and guidelines.</td>
</tr>
<tr>
<td>Water for injection, Sterile 10ml</td>
<td>EML</td>
<td>For reconstitution of injections as required.</td>
</tr>
</tbody>
</table>
8.04 PLASMA SUBSTITUTES

WHO MODEL FORMULARY 2008 NOTES:

Dextran 70 and polygeline are macromolecular substances which are metabolized slowly; they may be used to expand and maintain blood volume in shock arising from conditions such as burns or septicaemia. They are rarely needed when shock is due to sodium and water depletion as, in these circumstances, the shock responds to water and electrolyte repletion. Plasma substitutes should not be used to maintain plasma volume in conditions such as burns or peritonitis where there is loss of plasma protein, water and electrolytes over periods of several days. In these situations, plasma or plasma protein fractions containing large amounts of albumin should be given. Plasma substitutes may be used as an immediate short-term measure to treat massive haemorrhage until blood is available, but large volumes of some plasma substitutes can increase the risk of bleeding by depleting coagulation factors. Dextran may interfere with blood group cross-matching or biochemical measurements and these should be carried out before the infusion is started. Plasma substitutes are often used in very ill patients whose condition is unstable. Therefore, close monitoring is required and fluid and electrolyte therapy should be adjusted according to patients’ condition at all times.

[Mercy Ships note: Dextran 70 is not on the Mercy Ships list. Gelatin is stocked in place of polygeline, gelatin has similar activity to polygeline but please refer to the individual product literature for detail. Polygeline is available from IDA.]

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gelatin 3.5% or 4% 500ml Inj (Haemaccel or Gelofusine)</td>
<td></td>
<td>Correction of low blood volume, by IV infusion, initially 500-1000 ml of a 3.5-4% solution. See product literature for details.</td>
</tr>
</tbody>
</table>
8.05 IRRIGATION SOLUTIONS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balanced Salt Solution for Eye Irrigation, 500ml &amp; Eye Drops, 18ml (BSS &amp; BSS Plus)</td>
<td></td>
<td>For intra-ocular and topical eye irrigation during surgical procedures. See product literature for detail.</td>
</tr>
<tr>
<td>Sodium Chloride 0.9% for Irrigation 1000ml</td>
<td>IDA</td>
<td>For irrigation use.</td>
</tr>
<tr>
<td>Water for Irrigation 1000ml</td>
<td></td>
<td>For irrigation use.</td>
</tr>
</tbody>
</table>
WHO MODEL FORMULARY 2008 NOTES:

Preparations for the eye should be sterile when issued. Use of single-application containers is preferable; multiple-application preparations include antimicrobial preservatives and when used particular care should be taken to prevent contamination of the contents, including the avoidance of contact between the applicator and the eye or other surfaces. Eye drops are generally instilled into the lower conjunctival sac which is accessed by gently pulling down the lower eyelid to form a pocket into which one drop is instilled. The eye should be kept closed for as long as possible after application, preferably 1-2 minutes. A small amount of eye ointment is applied similarly; the ointment melts rapidly and blinking helps to spread it. When two different eye drops are required at the same time, dilution and overflow may occur when one immediately follows the other; an interval of 5 minutes should be allowed between the two applications. Systemic absorption, which may occur after topical application of eye drops, can be minimized by using the finger to compress the lacrimal sac at the medial canthus for at least one minute after instillation of the drops. This helps block the passage of the drops through the naso-lacrimal duct.

SKILLED TASKS. Application of eye preparations may cause blurring of vision which is generally transient; patients should be advised not to carry out skilled tasks such as operating machinery or driving until their vision has cleared.

9.01 ANTI-INFECTIVE EYE PREPARATIONS

WHO MODEL FORMULARY 2008 NOTES:

Blepharitis, conjunctivitis, keratitis and endophthalmitis are common acute infections of the eye and can be treated topically. However, in some cases, for example, in gonococcal conjunctivitis, both topical and systemic anti-infective treatment may be necessary. Blepharitis and conjunctivitis are often caused by staphylococcus, while keratitis and endophthalmitis may be bacterial, viral or fungal. Bacterial blepharitis is treated with an antibacterial eye ointment or drops. Although most cases of acute bacterial conjunctivitis may resolve spontaneously, anti-infective treatment shortens the infectious process and prevents complications. Acute infective conjunctivitis is treated with antibacterial eye drops by day and eye ointment applied at night. A poor response may indicate viral or allergic conjunctivitis. Keratitis requires immediate specialist care.
**Aciclovir** is an antiviral used in the treatment of keratitis due to herpes simplex virus. Lesions usually heal after 5–9 days of treatment. For systemic treatment with antivirals, such as aciclovir, see section 6.06.

**Gentamicin** is a broad-spectrum bactericidal aminoglycoside antibiotic with particular activity against *Pseudomonas aeruginosa*, *Neisseria gonorrhoea* and other bacteria that may be implicated in blepharitis or conjunctivitis. Topical application may lead to systemic absorption and possible adverse effects.

**Tetracycline** is a broad spectrum antibiotic with activity against many Gram-positive and negative bacteria including *N. gonorrhoea*, and most chlamydia, rickettsia, mycoplasma and spirochetes. Ophthalmic tetracycline is used in blepharitis, conjunctivitis, and keratitis produced by susceptible bacteria. Tetracycline is also used in the treatment of trachoma caused by *Chlamydia trachomatis* and in the prophylaxis of neonatal conjunctivitis (ophthalmia neonatorum) caused by *N. gonorrhoea* and *C. trachomatis*.

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aciclovir Eye Ointment 3%, 4.5g (Zovirax) [Acyclovir]</td>
<td>IDA EML</td>
<td>Herpes Simplex keratitis: Adult &amp; Child, Apply 1cm of ointment 5 times daily, continue for at least 3 days after complete healing.</td>
</tr>
<tr>
<td>Chloramphenicol Eye Drops 0.5% 10ml Eye Ointment 1% 5g (CMC, Chloromycetin) [Contains thiomersal]</td>
<td>IDA</td>
<td>Eye drops: Apply 1-2 drops at least every 2 hours then reduce frequency as infection is controlled and continue for 48 hours after healing. Eye ointment: Apply either at night (if eye drops used during the day) or 3-4 times daily if used alone.</td>
</tr>
<tr>
<td>Ciprofloxacin Eye Drops 0.3% 10ml (Ciloxan) [Contains benzalkonium chloride]</td>
<td>MSL</td>
<td>NOT for Child &lt; 1 yo. Bacterial infection: Apply 1-2 drops at least every 2 hours, reduce to 3-4 times daily as infection is controlled, continue for 48 hours after healing. Corneal ulcer: Apply throughout day and night, first day 2 drops every 15 minutes for 6 hours then every 30 minutes, day 2 apply 2 drops every hour, days 3-14 apply 2 drops every 4 hours, max duration 21 days.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gentamicin Eye Drops 0.3% 5ml</td>
<td>IDA</td>
<td>Adult/Child, apply 1-2 drops every 2 hours, reduce frequency to 3-6 times daily as infection is controlled and continue for 48 hours after healing.</td>
</tr>
<tr>
<td>[Contains benzalkonium chloride]</td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Neomycin 3500 units &amp; Polymixin B 6000 units &amp; Dexamethasone 0.1% / ml Eye Drops, 5ml (Maxitrol)</td>
<td>MSL</td>
<td>Adult/Child, apply 1-2 drops every 2 hours, reduce frequency to 4-6 times daily as infection is controlled and continue for 48 hours after healing.</td>
</tr>
<tr>
<td>[Contains benzalkonium chloride]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetracyline Eye Ointment 1% 3.5g (Terramycin)</td>
<td>MSL</td>
<td>Bacterial infection: Adult/Child &gt; 8 yo, apply into the conjunctival sac of the affected eye 3-4 times daily. Trachoma continuous intensive treatment: Adult/Child 1 application into each eye twice daily for 6 weeks</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Tobramycin Eye Drops 0.3%, 5ml Eye Ointment 3.5g (Tobrex)</td>
<td></td>
<td>Eye drops: Apply 1-2 drops every 4 hours, reduce frequency as infection is controlled and continue for 48 hours after healing. Eye ointment: mild to moderate infection, Apply 2-3 times daily; severe infection, Apply every 3-4 hours until improvement then reduce frequency.</td>
</tr>
<tr>
<td>[Contains benzalkonium chloride]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tobramycin 0.3% with Dexamethasone 0.1% Eye Drops 5ml, Eye Ointment 3.5g (Tobradex)</td>
<td></td>
<td>Adult/Child &gt; 2 yo, Eye drops: Apply 1-2 drops 4 hourly reduce frequency as infection is controlled and continue for 48 hours after healing. Eye ointment: Apply a half-inch of ointment 4 hourly or at night only if eye drops are used in the daytime.</td>
</tr>
<tr>
<td>[Contains benzalkonium chloride]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trifluridine 1% Eye Drops 5ml (Viroptic)</td>
<td></td>
<td>Herpes Simplex keratitis: Adult/Child &gt; 6yo, Apply 1 drop every 2 hours while awake to a max daily dosage of 9 drops until the cornea ulcer has completely re-epithelialized, then continue treatment for 7 more days of 1 drop every 4 hours (min daily dose 5 drops) recommended.</td>
</tr>
<tr>
<td>[Contains thiomersal]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cont. next page
COMMENT/CAUTIONS:

- **Eye drops or ointment** should be applied frequently in the acute phase of infection (at least 2 hourly unless otherwise directed), then reduce frequency as infection is controlled, continuing for 48 hours after healing.

- **Eye ointment**: A thin coating should be applied into the conjunctival sac of the affected eye 4 hourly, or at night only if using eye drops during the day.

- **Chloramphenicol**: drug of choice since allergic skin reactions are rare. However, do not give long term or use if family history of blood dyscrasias (rare aplastic anaemia side effects).

- **Antibiotics with corticosteroids** are primarily indicated for post-op use for risk of infection. **Dexamethasone 0.1%** should thus not be used without direct ophthalmologist supervision. Prolonged use may result in posterior subcapsular cataract formation and glaucoma in steroid-responding patients.

- **Tetracycline** eye drops/ointment is indicated for ocular trachoma but should be combined with oral tetracycline for a curative effect.

- **DISCARD TOPICAL EYE PREPARATIONS 4 WEEKS AFTER OPENING FOR OUTPATIENTS AND 7 DAYS AFTER OPENING FOR INPATIENTS.**

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9.02 CORTICOSTEROID EYE PREPARATIONS

WHO MODEL FORMULARY 2008 NOTES:

**Ophthalmic corticosteroids** should only be used under supervision of an ophthalmologist as inappropriate use is potentially blinding. Dangers include the development of open-angle glaucoma (chronic simple glaucoma) and cataracts, and the aggravation of a simple herpes simplex epithelial lesion into an extensive corneal ulcer and subsequent permanent corneal scarring, with possible damage to vision and even loss of the eye. Corticosteroids such as **prednisolone** are useful in the treatment of inflammatory conditions including uveitis and scleritis. They are also used for reducing postoperative ocular inflammation. Before administration of an ophthalmic corticosteroid, the possibility of bacterial, viral or fungal infection should be excluded. Treatment should be the lowest effective dose for the shortest possible time; if long-term therapy (> 6 weeks) is unavoidable, withdrawal should be gradual to avoid relapse.
Dexamethasone Eye Drops
0.1%, 10ml
(as sodium phosphate)

Prednisolone Eye Drops
1%, 5ml
(Pred-Forte)
[Contains benzalkonium chloride]

**COMMENT/CAUTIONS:**
- Corticosteroids should be used under the supervision of an ophthalmologist. They are contraindicated in herpes simplex corneal ulceration. 
  **Corticosteroids with antibiotics** are primarily indicated for post-op use for the risk of infection (see Section 9.01 above).
- **Prednisolone 1%** is the most potent followed by **dexamethasone 0.1%**. Use more potent items only for serious inflammation.
- **DISCARD TOPICAL EYE PREPARATIONS 4 WEEKS AFTER OPENING FOR OUTPATIENTS AND 7 DAYS AFTER OPENING FOR INPATIENTS.**

**WHO MODEL FORMULARY 2008 NOTES:**
Glaucoma is normally associated with raised intra-ocular pressure and eventual damage to the optic nerve which may result in blindness. The rise in pressure is almost always due to reduced outflow of aqueous humour, the inflow remaining constant. The most common condition is chronic open-angle glaucoma (chronic simple glaucoma) in which the intra-ocular pressure increases gradually and the condition is usually asymptomatic until well advanced. In contrast, angle-closure glaucoma (closed-angle glaucoma) usually occurs as an acute emergency resulting from a rapid rise in intra-ocular pressure; if treatment is delayed, chronic angle-closure glaucoma may develop. In ocular hypertension intra-ocular pressure is raised without signs of optic nerve damage.

Drugs used in the treatment of glaucoma lower the intra-ocular pressure by a variety of mechanisms including reduction in secretion of aqueous humour by the ciliary body, or increasing the outflow of the aqueous humour by opening of the trabecular network. Antiglaucoma drugs used include topical application of a beta-blocker (beta-adrenoceptor antagonist), a miotic, or a sympathomimetic such as epinephrine; systemic administration of a carbonic anhydrase inhibitor may be used as an adjunct.
Timolol is a non-selective beta-blocker that reduces the secretion of aqueous humour. A beta-blocker is usually the drug of choice for initial and maintenance treatment of chronic open-angle glaucoma. If further reduction in intra-ocular pressure is required a miotic, a sympathomimetic or a systemic carbonic anhydrase inhibitor may be used with timolol. In angle-closure glaucoma, timolol should be used with a miotic and not alone. Since systemic absorption can occur, an ophthalmic beta-blocker should not be used in patients with asthma or a history of obstructive airways disease, unless no alternative is available; in such cases precautions should be taken to guard against bronchospasm.

A miotic such as pilocarpine (parasympathomimetic action) contracts the iris sphincter muscle and ciliary muscle, and opens the trabecular network. It is used in chronic open-angle glaucoma either alone or, if required, with a beta-blocker, epinephrine or a systemic carbonic anhydrase inhibitor. Pilocarpine is used with systemic acetazolamide in an acute attack of angle-closure glaucoma prior to surgery; however, it is not advisable to use pilocarpine after surgery because of a risk of posterior synechiae forming. Systemic absorption of topical pilocarpine can occur producing muscarinic adverse effects.

The sympathomimetic drug epinephrine (adrenaline) probably acts by reducing the rate of production of aqueous humour and increasing the outflow through the trabecular network. Epinephrine is usually used with a miotic, a beta-blocker or a systemic carbonic anhydrase inhibitor in the treatment of chronic open-angle glaucoma; however, because epinephrine is also a mydriatic, it is contraindicated for angle-closure glaucoma unless an iridectomy has been carried out.

Acetazolamide, by reducing carbonic anhydrase in the eye, reduces the production of aqueous humour and so reduces intra-ocular pressure. It is used systemically as an adjunct in chronic open-angle glaucoma unresponsive to treatment with topically applied antiglaucoma drugs. Prolonged therapy with acetazolamide is not normally recommended, but if treatment is unavoidable blood count and plasma electrolyte concentration should be monitored. Acetazolamide is also used as part of emergency treatment for an acute attack of angle-closure glaucoma; however it should not be used in chronic angle-closure glaucoma as it may mask deterioration of the condition.
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetazolamide Tab 250mg (Diamox)</td>
<td>IDA</td>
<td>Chronic open-angle glaucoma, secondary glaucoma: <strong>By mouth</strong>, Adult 0.25-1 g daily in divided doses.</td>
</tr>
<tr>
<td>[Carbonic anhydase inhibitor (CAI)]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acetylcholine Ophthalmic Injection 1%</td>
<td>IDA</td>
<td>To produce miosis: <em>Instil</em> 0.5-2ml of the 1% solution into the anterior chamber parallel to the iris face, tangential to pupil border.</td>
</tr>
<tr>
<td>(Miochol)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Betaxolol Eye Drops 0.5%, 5ml (Betoptic)</td>
<td>D</td>
<td>Beta-blocker. <strong>Apply</strong> 1-2 drops twice daily.</td>
</tr>
<tr>
<td>[Contains benzalkonium chloride]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brinzolamide Eye Drops 1% (10mg/ml),</td>
<td>D</td>
<td>Adjunct to beta-blocker or used alone for glaucoma: <strong>Apply</strong> 1 drop twice daily, up to max 3 times daily.</td>
</tr>
<tr>
<td>5ml (Azopt) [CAI] [Contains benzalkonium chloride]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbachol Ophthalmic Injection 0.01%</td>
<td>D</td>
<td>To produce miosis: <em>Instil</em> 0.4-0.5ml into the anterior chamber.</td>
</tr>
<tr>
<td>(Miostat)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latanoprost Eye Drops 0.005% (50micrograms/ml), 2.5ml (Xalatan) [Contains benzalkonium chloride]</td>
<td>D</td>
<td>Prostaglandin analogue, for open-angled glaucoma and ocular hypertension patients intolerant or unresponsive to other medicines: <strong>Apply</strong> 1 drop in the evening.</td>
</tr>
<tr>
<td>Pilocarpine HCl Eye Drops 2%, 10ml</td>
<td>MSL</td>
<td>Chronic open-angle glaucoma: Adult <strong>apply</strong> 1 drop up to 4 times daily. Acute angle-closure glaucoma before surgery: Adult <strong>apply</strong> 1 drop every 10 minutes for 30-60 minutes, then 1 drop every 1-3 hours until intra-ocular pressure subsides.</td>
</tr>
<tr>
<td>[Contains benzalkonium chloride]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timolol Eye Drops 0.5%, 5ml (Timoptol)</td>
<td>IDA</td>
<td>Beta-blocker. Ocular hypertension, chronic open-angle glaucoma, aphakic glaucoma, some secondary glaucomas: Adult <strong>apply</strong> 1 drop 1-2 times daily.</td>
</tr>
<tr>
<td>[Contains benzalkonium chloride]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Cont. next page*
COMMENT/CAUTIONS:

- **Carbonic anhydrase inhibitors**: Use in patients resistant/contraindicated to beta-blockers. **Acetazolamide adverse effects** include drowsiness or malaise, hypokalaemia (long-term use).
- Cardioselective **beta-blockers** (e.g. betaxolol) are preferable to non-selective ones (e.g. timolol) in elderly/heart disease/asthma; but caution is still advised.
- **Latanoprost (Xalatan)**: may cause brown pigmentation in the iris and change in eye colour.
- **Pilocarpine** causes difficulty with dark adaptation. Pupil sphincter spasm may cause pain on administration. Advise patients to be cautious in night driving or hazardous occupations and to not carry out skilled tasks until vision is clear.
- **DISCARD TOPICAL EYE PREPARATIONS 4 WEEKS AFTER OPENING FOR OUTPATIENTS AND 7 DAYS AFTER OPENING FOR INPATIENTS.**

9.04 MYDRIATICS & CYCLOPLEGICS

**WHO MODEL FORMULARY 2008 NOTES:**

Antimuscarinics, by blocking the cholinergic effects of acetylcholine, paralyse the pupillary constrictor muscles causing dilation of the pupil (mydriasis) and paralyse the ciliary muscles resulting in paralysis of accommodation (cycloplegia). Mydriasis may precipitate acute angle-closure glaucoma particularly in elderly or long-sighted patients. In patients with dark iridic pigmentation, higher concentrations of mydriatic drugs are usually required and care should be taken to avoid overdosing.

**Atropine** is a long-acting antimuscarinic used for cycloplegic refraction procedures, particularly in children. It is also used to immobilize the ciliary muscle and iris and to prevent formation of posterior synechiae in the treatment of inflammatory eye disorders such as iritis and uveitis.

**Tropicamide** is a short-acting relatively weak mydriatic that dilates the pupil and paralyses the ciliary muscle. It facilitates examination of the fundus of the eye.

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atropine Sulphate Eye Drops 1%, 10ml [Contains benzalkonium chloride]</td>
<td>IDA EML</td>
<td>Refraction: Adult, apply 1 drop 1 hour before procedure. Iritis, uveitis: Adult, apply 1 drop up to 4 times daily; Child apply 1 drop up to 3 times daily.</td>
</tr>
</tbody>
</table>

*Cont. next page*
## GENERIC (TRADE) NAME  |  CAT.  | INDICATION/DOSE
--- | --- | ---
**Cyclopentolate Eye Drops 2%, 15ml (Cyclogyl)**  
[Contains benzalkonium chloride]  |  | Refraction: *Apply* 1-2 drops; Uveitis: *Apply* 1-2 drops 2-3 times daily.

**Phenylephrine Eye Drops 2.5% & 10%, 10ml (Analux/Neosynephrine)**  |  | Pupil dilation for examination, *apply* 1-2 drops as needed. Avoid or use 2.5% prep in patients with cardiovascular disease, avoid 10% preparation in children or elderly.

**Tropicamide Eye Drops 1%, 15ml (Mydriacyl)**  

### COMMENT/CAUTIONS:
- Relative potencies and duration of action: Tropicamide [3 hours], cyclopentolate [up to 24 hours], atropine [7 days or longer, so use only on ophthalmologist advice].
- SKILLED TASKS. May cause sensitivity to light and blurred vision. Patients should be advised to avoid carrying out skilled tasks e.g. operating machinery or driving, until vision is clear.
- **Atropine & Cyclopentolate** eye drops may cause systemic reactions in the very young or very old (monitor for cardiac/central nervous symptoms).
- **DISCARD TOPICAL EYE PREPARATIONS 4 WEEKS AFTER OPENING FOR OUTPATIENTS AND 7 DAYS AFTER OPENING FOR INPATIENTS.**

### 9.05 PERI-OPERATIVE EYE PREPARATIONS

| GENERIC (TRADE) NAME  | CAT.  | INDICATION/DOSE |
--- | --- | ---
**Alcohol, Dehydrated Inj) (USP27)**  |  | Specialist use only. Inject 1ml (1cc) retrobulbar for relief of pain, see product leaflet for detail. |

**Apraclonidine HCl Eye Drops 0.5%, 5ml (Iopidine)**  
[Contains benzalkonium chloride]  |  | Control/prevention of postoperative elevation of intra-ocular pressure after anterior segment laser surgery: Adult, *Apply* 1 drop 1 hour before laser procedure then 1 drop immediately after completion of procedure. Child not recommended. |
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balanced Salt Solution for Eye Irrigation, 500ml Eye Drops, 18ml (BSS &amp; BSS Plus)</td>
<td></td>
<td>For intra-ocular and topical irrigation of the eye during surgical procedures.</td>
</tr>
<tr>
<td>Diclofenac Sodium Eye Drops 0.1%, 5ml (Voltaren Ophthalmic) [NSAID]</td>
<td></td>
<td><em>Apply</em> 1 drop 4 times daily 24 hours after cataract surgery and continue for 2 weeks.</td>
</tr>
<tr>
<td>Fluorescein Disodium 0.4 moles in H2O Medium, Strips for Ophthalmic Use (Fluorescite)</td>
<td>MSL</td>
<td>For diagnosis of corneal epithelial defects. For single use only, externally, <em>applied to the conjunctiva or conjunctival sac</em> where tears will dissolve the strip, then leave in contact for 5 seconds. Do not use on damaged eye tissue, and do not touch the fluorescein-coated tissue. See product leaflet for details.</td>
</tr>
<tr>
<td>Gonioscopic Lens Solution (Goniosol)</td>
<td>D</td>
<td>For use during laser procedures to improve visualization. See product leaflet for details.</td>
</tr>
<tr>
<td>Hyaluronate Sodium, Ophthalmic Injection, various strengths &amp; molecular weights (e.g. Viscoat) [Viscoelastic agents]</td>
<td></td>
<td><em>Inject</em> 0.5ml slowly and carefully into the anterior chamber during ophthalmic surgery. See product leaflet for details.</td>
</tr>
<tr>
<td>Hydroxypropylmethylcellulose Ophthalmic Injection 2% (Hypromellose Cellugel)</td>
<td></td>
<td><em>Inject</em> into the anterior chamber during ophthalmic surgery. See product leaflet for details.</td>
</tr>
<tr>
<td>Lidocaine HCl Inj 1% 10mg/ml preservative-free (Xylocaine MPF) [Lignocaine]</td>
<td></td>
<td>Intraocular injection up to 0.3ml, see product leaflet for details. [Note. Other lidocaine preparations are listed in Chapter 13 Anaesthetics Section 13.02 Local Anaesthetics.]</td>
</tr>
<tr>
<td>Lubricant, Eye Ointment, various preparations (e.g. Lacrilube)</td>
<td></td>
<td><em>Apply</em> a thin coating when needed, see product leaflet for detail.</td>
</tr>
<tr>
<td>Olopatadine Eye Drops 0.1%, 5ml (Patanol) [Contains benzalkonium chloride]</td>
<td>D</td>
<td>Allergic conjunctivitis: Adult/Child &gt; 3yo, <em>Apply</em> one drop into each affected eye twice daily at an interval of 6-8 hours.</td>
</tr>
</tbody>
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<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Povidone-Iodine Sterile Ophthalmic Prep Solution 5% (Betadine)</td>
<td></td>
<td>Apply to eyelashes and lid margins using a sterile, cotton tip applicator using one or more applicators per lid; repeat once. To prep lids, brow and cheek, use a circular ever-expanding fashion until the entire field is covered; repeat prep 3 times. While separating the lids, irrigate the cornea, conjunctiva and palpebral forniceus using a sterile bulb syringe; leave in contact for two minutes, then use sterile NS in a bulb syringe to flush away residual prep solution.</td>
</tr>
<tr>
<td>Proparacaine Eye Drops 0.5%, 15ml (Ophthetic) [Contains benzalkonium chloride]</td>
<td></td>
<td>Local anaesthetic: Apply 1-2 drops as required.</td>
</tr>
<tr>
<td>Sodium Chloride Eye Drops 5% (Muro 128)</td>
<td>D</td>
<td>Post-cataract surgery for corneal oedema to restore vision and relieve pain: Instil 1-2 drops in the affected eye(s) every 3-4 hours, or as directed by eye surgeon.</td>
</tr>
<tr>
<td>Tears, Artificial, Eye Drops or Eye Ointment, various preps</td>
<td></td>
<td>Apply 1-2 drops several times daily, see product leaflet for details.</td>
</tr>
<tr>
<td>Tetracaine Eye Drops 0.5%, 5ml [Amethocaine]</td>
<td>MSL IDA EML</td>
<td>Local anaesthetic: Adult/Child apply 1-2 drops as required.</td>
</tr>
<tr>
<td>Trypan Blue Eye Solution 0.06% Prefilled-syringe (Vision Blue)</td>
<td></td>
<td>For management of poor visibility of the lens capsule during cataract surgery, 0.1-0.3ml as needed, see product leaflet for details.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**

- **Anaesthetics:** Warn patients not to rub or wipe the anaesthetised eye(s) for at least 30 minutes after procedure. Respect the ‘one inch’ rule (distance between dropper & eye) to avoid cross-infection if a multi-dose bottle is used.
- **Fluorescein:** may cause temporary yellowish discoloration of skin and urine.
- **Tetracaine:** provides a rapid local anaesthesia which lasts for 15 minutes or more. Prolonged or unsupervised use is not recommended.
- **DISCARD TOPICAL EYE PREPARATIONS 4 WEEKS AFTER OPENING FOR OUTPATIENTS AND 7 DAYS AFTER OPENING FOR INPATIENTS.**
10 EAR, NOSE & THROAT

10.01 EAR PREPARATIONS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin Eye Drops 0.3%, 5ml (Ciloxan)</td>
<td></td>
<td>NOT for Child &lt; 1 yo. May be used for ear application: Apply 2 drops 3 times daily, reduce frequency when relief is obtained.</td>
</tr>
<tr>
<td>[Contains benzalkonium chloride]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ciprofloxacin 0.3% with Dexamethasone 0.1% Ear Drops 10ml (Ciprodex)</td>
<td>D</td>
<td>NOT for Child &lt;1yo. Otitis media and externa: Apply 3-4 drops into the canal of the affected ear(s) twice daily for 7 days.</td>
</tr>
<tr>
<td>[Contains benzalkonium chloride]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gentamicin Eye Drops 0.3%, 10ml</td>
<td>IDA</td>
<td>May be used for ear application: Bacterial infection in otitis externa, Apply 3-4 drops 3-4 times daily and at night, reduce frequency when relief is obtained.</td>
</tr>
<tr>
<td>[Contains benzalconium chloride]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olive Oil Ear Drops</td>
<td>EML</td>
<td>Ear wax removal: Apply 3-4 drops 3-4 times daily. [Note. In house preparation, expiry 14 days.]</td>
</tr>
<tr>
<td>Prednisolone Eye Drops 1% (Pred-Forte)</td>
<td>EML</td>
<td>For ear application for eczematous inflammation in otitis externa: Apply 1-2 drops 2-4 times daily.</td>
</tr>
<tr>
<td>[Contains benzalconium chloride]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

COMMENT/CAUTIONS:

- Exclude underlying chronic otitis media before starting treatment for otitis externa (many recover with thorough cleansing or gentle syringing).
- Acute otitis media in children: most uncomplicated cases resolve without antibiotics (just paracetamol for pain); if there is no improvement with topical treatment after 72 hours, consider systemic antibacterial. For chronic otitis media, ciprofloxacin eye drops may be used if needed (unlicensed).
- The patient should be encouraged to lie with affected ear uppermost for about 10 minutes after the eardrops have been applied to ensure droplet penetration to the affected skin. Warm ear drops to room temperature before use unless otherwise directed.

Cont. next page
COMMENT/CAUTIONS (CONT.):

- Preparations containing aminoglycosides (e.g. gentamicin/neomycin) or polymixins should be used cautiously if the eardrum is perforated, due to an increased risk of drug-induced deafness. Prolonged use should be avoided.
- DISCARD ALL ANTIBACTERIAL EAR PREPARATIONS 4 WEEKS AFTER OPENING FOR OUTPATIENTS AND 7 DAYS AFTER OPENING FOR INPATIENTS.

### 10.02 TOPICAL NASAL PREPARATIONS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclomethasone Dipropionate Aqueous Nasal Spray 50 micrograms/dose (0.05% w/w) (Beconase) [Contains benzalkonium chloride]</td>
<td>Adult &amp; Child &gt; 6 yo: 100 micrograms (2 sprays) into each nostril twice daily or 50 micrograms (1 spray) into each nostril 3-4 times daily; max 400 micrograms (8 sprays)/DAY.</td>
<td></td>
</tr>
<tr>
<td>Xylometazoline Nasal Drops or Nasal Spray 0.05% &amp; 0.1% (Otraspray, Otrivine) [Sympathomimetic]</td>
<td>MSL</td>
<td>Adult &amp; child &gt; 12 yo: Apply 1 spray or instil 2-3 drops of 0.1% into each nostril 2-3 times daily when needed for 3 days; Child over 3 months instil 1-2 drops of 0.05% into each nostril 1-2 times daily when needed; max duration 1 week.</td>
</tr>
</tbody>
</table>

COMMENT/CAUTIONS:

- Sodium chloride 0.9% given as nasal drops may relieve nasal congestion by helping to liquefy mucous secretions. Inhalation of warm moist air is also useful, adding menthol or eucalyptus may encourage its use.
- **Corticosteroids** must be used regularly for allergic or vasomotor rhinitis.
- **Xylometazoline**: more potent with long duration, may cause rebound nasal congestion, may cause a hypertensive crisis if used with a monoamine-oxidase inhibitor.
- DISCARD ALL NASAL PREPARATIONS 3 MONTHS AFTER OPENING FOR OUTPATIENTS & 1 MONTH AFTER OPENING FOR INPATIENTS.

NOTE. For other decongestant preparations, see Chapter 03 Respiratory System Section 3.03 Antihistamines.
### 10.03 MEDICINES FOR ORAL ULCERATION & INFLAMMATION

<table>
<thead>
<tr>
<th>GENERIC (TRADE NAME)</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorhexidine gluconate 0.1% oral rinse 125ml &amp; 250ml</td>
<td>IDA</td>
<td>15ml to use as oral rinse or gargle for 30 seconds, twice daily. [Note. In-house preparation, expiry 7 days after dilution. To dilute, take 40ml of 5% concentrate or 10ml of 20% concentrate and top up with water to 2000ml, then repack in 300ml bottles if needed. ]</td>
</tr>
<tr>
<td>Choline salicylate 8.7% &amp; Cetalkonium 0.01% Gel 15g (Bonjela)</td>
<td>D</td>
<td>Apply to sore area with gentle massage not more often than every 3 hours, max 6 applications daily: Adult ½ inch of gel, child &gt; 4 month old ¼ inch of gel.</td>
</tr>
<tr>
<td>Throat &amp; Cough Lozenges (various)</td>
<td>D</td>
<td>See individual product leaflet for details.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- Throat & Cough Lozenges: may irritate and cause sore tongue and lips, some preparations with local anaesthetics for pain-relief may cause sensitisation.
- Use choline salicylate (Bonjela) gel sparingly in children to avoid salicylate poisoning, may cause transient stinging when applied, do not apply to dentures – leave at least 30 minutes before re-insertion of dentures.
11 DERMATOLOGICALS

11.01 TOPICAL ANTI FUNGALS

WHO MODEL FORMULARY 2008 NOTES:

RINGWORM. Benzoic acid and methylrosanilinium chloride (gentian violet) solution [both not on Mercy Ships list] are inexpensive and effective fungistatic compounds for the treatment of dermatophyte infections such as ringworm. Minor skin lesions due to ringworm can be cleared with repeated applications of compound benzoic acid ointment (Whitfield ointment) [not on Mercy Ships list], which combines the fungistic action of benzoic acid with the keratolytic action of salicylic acid. However, the most effective topical treatment for dermatophyte infections is a cream containing an imidazole such as miconazole or clotrimoxazole (section 6.02), which is effective for long-established lesions but is more expensive than compound benzoic acid ointment. Extensive and generalized infections of the skin, nails and scalp should be treated systemically for several weeks with griseofulvin or fluconazole (see section 6.02).

Scalp ringworm (tinea capitis) typically appears as a patch of scaling alopecia, or a swollen inflammatory area (tinea kerion). Mild forms may remit spontaneously at puberty. Infamed lesions should be treated systemically with griseofulvin. Application of miconazole cream may accelerate healing of scaly lesions. Ringworm on the body (tinea corporis) can also be cleared with compound benzoic acid ointment or a topical imidazole such as miconazole. In resistant cases a 4-week course of oral griseofulvin is required.

Foot ringworm (tinea pedis or athlete’s foot) is usually treated topically. Compound benzoic acid ointment should be applied twice daily to all infected areas and all toe clefts for at least 4 weeks. Systemic therapy with griseofulvin or fluconazole may be required if the foot is extensively infected. Tinea pedis commonly recurs and may be treated with miconazole cream. Severe weeping lesions respond to frequent soaking in solutions of 1:10000 potassium permanganate, and systemic antifungals may also be needed.

Nail infections (onychomycosis, tinea unguium) are difficult to treat; fingernails may require 6 months treatment with oral griseofulvin and toenails may require 12 months or more of this treatment. Approximately 60% of nail infections either do not respond or relapse after treatment with griseofulvin.

Ringworm of the groin (tinea cruris) is usually limited to the skin of the inner thigh in contact with the scrotum. Flexural eczema, often superinfected with candida or bacteria, occurs in the same site. The latter is frequently treated with combined antifungal/corticosteroid preparations, but must not be treated with a
corticosteroid alone, which will worsen the condition. An imidazole cream such as **miconazole** applied daily for 2 weeks is usually effective. Lesions unresponsive to topical preparations can usually be cleared with a 4-week course of **griseofulvin**.

**CANDIDOSIS.** Candida can infect the oral cavity, the vagina or the skin. Cutaneous lesions tend to occur in patients with diabetes mellitus and some chronic debilitating conditions, including hypoparathyroidism and various congenital disorders of the immune system. The most severe infections of candida are now seen in patients with HIV infection.

**CUTANEOUS CANDIDOSIS** usually responds to **miconazole** or **clotrimoxazole** cream as a twice daily application. Chronic candida paronychia, which can result ultimately in nail dystrophy, is more difficult to treat. Treatment should be based on determination of the underlying cause and its reduction or elimination; hands and folds of the nail must be kept dry and daily application of an imidazole cream for several months may be required, ensuring penetration of the cleft between the nail plate and the swollen skin around the nail.

**PITYRIASIS (TINEA) VERSICOLOR** is caused by a commensal yeast. Application of **sodium thiosulfate** [not on Mercy Ships list] twice daily for 4 weeks is usually effective although areas of depigmentation on darker skins remain after completion of treatment. Relapses can be frequent, however, probably because much of the infected area may appear normal and be left untreated. Better results have been reported with topical applications of **miconazole** or **selenium sulfide**.

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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</thead>
<tbody>
<tr>
<td><strong>Clotrimazole Cream 1%, 20g (Canesten)</strong></td>
<td>IDA</td>
<td>Vulvovaginal candidiasis: apply cream to affected area 2-3 times daily for 7 days. Note. Vaginal tablet available, see Section 6.02 pg 83.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td><strong>Miconazole Nitrate 2% Cream (Daktarin)</strong></td>
<td>MSL</td>
<td>Nail infections: apply 1-2 times daily. Skin infections: apply twice daily to clean dry lesions, continuing for at least 10 days after the condition has cleared.</td>
</tr>
<tr>
<td></td>
<td>IDA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
</tbody>
</table>
11.02 TOPICAL ANTIBACTERIALS

WHO MODEL FORMULARY 2008 NOTES:

Staphylococcal infections of the skin such as impetigo, folliculitis, and furunculi and streptococcal infections such as cellulitis and erysipelas are very common where the climate is hot and humid, where standards of hygiene are compromised, and in immunodeficient patients.

In all skin infections, an important part of treatment is cleansing and thorough drying. Washing with soap and water will often help to prevent infection. Light localized infections can often be treated effectively with an antiseptic solution such as chlorhexidine (section 11.06). Superficial crusts should be gently washed with soap and water or a weak solution of aluminium acetate or a 0.01% solution of potassium permanganate [Note: both items not on Mercy Ships list]. Infected burns should be treated with silver sulfadiazine, which is bactericidal against both Gram-positive and Gram-negative organisms.

Topical formulations containing 2% mupirocin or 2% fusidic acid [neither included on WHO Model List] can be used to treat bacterial infections of the skin such as impetigo and folliculitis. To prevent the development of resistance, mupirocin and fusidic acid should not be used for more than 10 days. Topical preparations containing neomycin and bacitracin are also widely used but these carry a risk of sensitization particularly with continued or repeated use. Topical use of preparations containing antimicrobials which are widely used systemically should be avoided. These include penicillins, sulfonamides, streptomycin and gentamicin, which should be reserved for the systemic treatment of infections because of the possibility of inducing sensitivity and favouring the emergence of resistant organisms. Only widespread superficial or deep-seated infections associated with fever require treatment with a systemic antibiotic (Chapter 06). Whenever possible, the choice of an antimicrobial should be based on the results of sensitivity tests.

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mupirocin Ointment 2% 15g (Bactroban)</td>
<td></td>
<td>For MRSA infection, apply up to 3 times daily max 10 days. NOT for intranasal use.</td>
</tr>
<tr>
<td>Neomycin 0.5% (5mg) with Bacitracin 250 IU/g Cream (Cicatrin)</td>
<td>MSL IDA EML</td>
<td>Superficial bacterial skin infection: Adult &amp; Child &gt; 2 yo, apply thin layer 3 times daily (short-term use).</td>
</tr>
</tbody>
</table>

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Silver Sulfadiazine Cream 1% (SSD) (Flammazine)

<table>
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<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver Sulfadiazine Cream 1% (SSD)</td>
<td>MSL</td>
<td>Infection in burns: Apply using aseptic technique daily (more frequently if volume of exudate is large) whilst there is a possibility of infection, or until healing is complete.</td>
</tr>
<tr>
<td>(SSD) (Flammazine)</td>
<td>IDA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**

- **Neomycin adverse effects:** Avoid application to substantial areas of skin or to broken skin (risk of significant systemic absorption causing ototoxicity, particularly in children/elderly/renal impairment).
- **Silver Sulfadiazine adverse effects:** Allergic reactions include rashes, burning and itching; argyria and sulfonamide-induced systemic toxicity, including blood disorders following application to large areas or prolonged use; transient leukopenia reported.

NOTE. See Section 11.06 for topical antiseptics/disinfectants (e.g. povidone-iodine).

### 11.03 TOPICAL ANTI-INFLAMMATORY & ANTIPRURITICS

**WHO MODEL FORMULARY 2008 NOTES:**

CONTACT DERMATITIS can result from an allergic or irritant skin reaction. Removal of the substance provoking the reaction is the first step in treating this condition. Mild cases of contact dermatitis can be treated with topical hydrocortisone which suppresses inflammation. A short course of oral prednisolone or a topical corticosteroid such as betamethasone should be considered for more severe cases and for suppression of severe acute reactions associated with blistering, exudation and oedema. Soaking in clean water or mild saline solution is recommended in the acute stages of severe dermatitis.

PRURITUS or itching is a common symptom of many skin diseases. However, systemic disease, contact with certain substances, conditions that dry the skin, stress, and extremes of temperature may also be a cause. Thus, an important part of treatment is to eliminate or minimize the reason for the irritation. Emollients are of value in pruritus associated with dry skin or in pruritus occurring in an otherwise healthy elderly individual; the value of calamine lotion is uncertain. Systemic antihistamines, such as oral chlorphenamine (section 3.03), may relieve generalized pruritus. Topical corticosteroids, such as hydrocortisone or betamethasone applied topically, are appropriate for treating insect stings.
ATOPIC DERMATITIS (or ECZEMA) is a common skin disorder, which mainly occurs in infants and children; it is associated with intense itching, with areas of red skin. Pruritus may be partially relieved by applying astringent aluminium acetate lotion [not on Mercy Ships list] to exudative lesions and emollients to lichenified plaques. Topical hydrocortisone should be applied in short courses of 1-2 weeks to treat even mild areas of involvement. The use of betamethasone should be considered in the treatment of persistent localized dermatitis in adults. Topical antihistamines are not effective and should be avoided because of the risk of sensitization. However, a sedative antihistamine can be given at night to calm pruritus and facilitate sleep (section 3.03). A secondary infection, often involving Staphylococcus aureus, may be responsible for exacerbations; in such cases, an oral antibiotic such as erythromycin can be given for 7-10 days (section 6.01d).

SEBORRHOEIC DERMATITIS. Use of a keratolytic shampoo and exposure to ultraviolet light reduce both inflammation and scaling resulting from seborrhoelic dermatitis of the scalp (DANDRUFF). The shampoo should be massaged into the scalp, immediately rinsed off and then reapplied until a foam is produced, leaving the second application in contact with the scalp for at least 5 minutes. Selenium sulfide, [not on Mercy Ships list, but try the ship shop ☺] which has both antifungal and keratolytic properties, is widely used in many proprietary shampoos. A combination of sulfur and salicylic acid, which has an additional antimicrobial action, is also effective.

ICHTHYOSIS. Emollients such as aqueous creams and emulsifying creams should be applied daily (or more frequently in severe cases) to affected skin. The addition of a keratolytic, such as salicylic acid 5% can be helpful.

LICHEN PLANUS is a chronic, papular, pruritic skin eruption that occurs typically in middle age and later life; the condition is often mild and may need no treatment. In generalized mild cases, a topical corticosteroid may relieve pruritus. In severe forms systemic treatment may be necessary; oral corticosteroids, ciclosporin and retinoids have been used.

PITYRIASIS ROSEA is a common self-limiting dermatosis that is probably of infective origin, calamine lotion helps to relieve pruritus in most cases. If it does not, topical application of hydrocortisone in a concentration not exceeding 1% may be tried.
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betamethasone 17-valerate Cream/Ointment 0.1% (Betnovate Full Strength)</td>
<td>IDA</td>
<td>Potency: potent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inflammatory skin conditions: Adult &amp; Child &gt; 2 yo, apply small quantity to the affected area 1-2 times daily until improvement occurs, then less frequently.</td>
</tr>
<tr>
<td>Betamethasone 17-valerate Cream/Ointment 0.05% (Betnovate 1:2)</td>
<td>EML</td>
<td>Potency: moderately potent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application: as above. [In-house preparation: Dilute full strength (0.1%) with equal volume of aqueous cream or emulsifying ointment. Expiry 2 weeks.]</td>
</tr>
<tr>
<td>Betamethasone 17-valerate Cream/Ointment 0.025% (Betnovate 1:4)</td>
<td>EML</td>
<td>Potency: moderate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application: as above. [In-house preparation: Dilute 1 part full strength (0.1%) with 3 parts of aqueous cream or emulsifying ointment. Expiry 2 weeks.]</td>
</tr>
<tr>
<td>Calamine Lotion</td>
<td>IDA</td>
<td>Potency: very potent</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td>Mild pruritus, apply liberally 3-4 times daily but see Cautions below.</td>
</tr>
<tr>
<td>Clobetasol Propionate Cream/Oint 0.05% (Dermovate)</td>
<td>D</td>
<td>Potency: very potent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inflammatory skin conditions: Adult &amp; Child &gt; 2 yo, apply a small quantity to the affected area 1-2 times daily until improvement occurs, then less frequently.</td>
</tr>
<tr>
<td>Hydrocortisone Acetate Cream 1%</td>
<td>MSL</td>
<td>Potency: mild</td>
</tr>
<tr>
<td></td>
<td>IDA</td>
<td>Inflammatory skin conditions: Apply a small quantity to the affected area 1-2 times daily until improvement occurs, then less frequently.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Ketoconazole Shampoo 2% 120ml (Nizoral)</td>
<td>D</td>
<td>Potency: mild</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seborrheic dermatitis/dandruff: use as shampoo twice weekly (at least 3 days between uses) for 4 weeks, and then intermittently as needed.</td>
</tr>
<tr>
<td>Zinc Oxide Ointment 10%</td>
<td>MSL</td>
<td>Potency: mild</td>
</tr>
<tr>
<td></td>
<td>IDA</td>
<td>Napkin/urinary rash &amp; eczematous conditions: apply twice daily to the affected area.</td>
</tr>
</tbody>
</table>

*Cont. next page*
COMMENT/CAUTIONS:

- Topical corticosteroids according to potency:
  
  **Mild** - Hydrocortisone acetate 1%;
  **Moderate** - Clobetasone butyrate 0.05%;
  **Potent** - Betamethasone valerate 0.1% or dipropionate 0.05%, Hydrocortisone butyrate 0.1%;
  **Very Potent** - Clobetasol propionate 0.05%.

- Generally the least potent preparation effective should be used as there is greater risk of side effects with potent or very potent steroids. Potent topical steroids should be reserved for recalcitrant conditions such as chronic discoid lupus erythematosus, and avoided in psoriasis unless under specialist care.

- Potent preparations should not be used on the face, with rare exceptions.

- Topical steroids are of no value in treating urticaria and acne. They are contraindicated in rosacea and ulcerative conditions, and should not be used indiscriminately for pruritus.

- Children/babies are especially susceptible to side effects and more potent preparations are contraindicated in infants (< 1 yo). Generally topical steroids are avoided in paediatric treatment or limited to use over short periods. For Fingertip dosing units of topical corticosteroids for children see Appendix I.

- Suitable quantities of corticosteroid topical cream or ointment to be prescribed for adults, for a twice daily application for 1 week: face and neck (15-30g), both hands (15-30g), scalp (15-30g), both arms (30-60g), both legs (100g), trunk (100g), groins and genitalia (15-30g).

- Calamine lotion: Use with discretion, may reduce lesions healing rate and dry the skin thus exacerbating itch, no longer recommended in some nations.

11.04 SCABICIDES & PEDICULICIDES

**WHO MODEL FORMULARY 2008 NOTES:**

SCABIES is caused by a mite, Sarcoptes scabiei, that burrows into the skin. It is readily transmitted from person to person; therefore the entire household must be treated at the same time to prevent reinfection. It is not necessary to take a bath before treatment with an acaricide, but all clothing and bedding should be washed to prevent reinfection. Benzyl benzoate is an inexpensive scabicide. It must be applied to all skin surfaces, from the scalp to the soles of the feet, avoiding contact with the eyes; it is too irritant for use on children. Permethrin is less irritant and more effective than benzyl benzoate, but also more expensive; it may be used on children. Young infants can be treated with a cream containing precipitated sulfur 6-10% applied once daily for 1 week [not on Mercy Ships list].

PEDICULOSIS of the head & body is caused by Pediculus humanus capitis and Pediculus humanus corporis respectively; pubic LICE (crab lice) infestations are caused by Pthirus pubis, which may also affect the eye lashes and brows. All are transmitted by person to person contact, and may also contaminate clothing and
bedding. All members of the affected household (and sexual contacts) must be treated at the same time, and clothing and bedding should be washed or exposed to the air; in head lice infestations, hair brushes and combs should also be disinfected. Head and body lice are readily treated with **permethrin**; **malathion** [not on Mercy Ships list] is effective against pubic lice. **Benzyl benzoate** may be used for all lice infestations.

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Benzyl Benzoate Emulsion 25% (EBB Solution)</td>
<td>IDA</td>
<td>Scabies: Adults only, <em>apply</em> over whole body omitting head &amp; neck. Repeat application without bathing on the following day, and wash off 24 hours later. A third application may be needed in some cases. [Note. Mercy Ships recommends 3 whole body applications as standard] Pediculosis: Adults only, <em>apply</em> to affected area and wash off 24 hours later, further applications possibly needed after 7 and 14 days.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Lindane 1% Lotion [Gamma benzene hexachloride]</td>
<td>EML</td>
<td>Second line treatment of pediculosis or head lice: rub into dry hair and scalp or affected area; allow drying for at least 4 minutes, then rinse. Repeat after 7 days. Scabies: Adult, <em>apply</em> lotion to skin for 8-12 hours, then rinse. Child, <em>apply</em> for 6-8 hours, then rinse.</td>
</tr>
<tr>
<td>Permethrin Cream 5%</td>
<td>MSL</td>
<td>Scabies in children: <em>apply</em> over whole body including face, neck, scalp and ears, then wash off after 8-12 hours; if hands are washed with soap within 8 hours of application they should be treated again. [Note. Mercy Ships recommends 2 whole body applications one week apart as standard regime.]</td>
</tr>
<tr>
<td></td>
<td>IDA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Permethrin Shampoo 1%</td>
<td>EML</td>
<td>Pediculosis/head lice: <em>apply</em> shampoo to clean damp hair and rinse off after 10 minutes.</td>
</tr>
</tbody>
</table>

*Cont. next page*
COMMENT/CAUTIONS:

- Avoid contact with eyes and mucous membranes; do not use on broken or secondarily infected skin; pregnancy and breast-feeding.
- Benzyl Benzoate Emulsion (EBB) application may need to be extended to areas including the scalp, neck, face and ears in the elderly, the immunocompromised and those who have experienced treatment failure. Reapply after each hand washing session. Mercy Ships note: EBB may be diluted with clean water to 12.5% for children and 6.25% for infants for scabies treatment as a last resort when permethrin cream is unavailable.

11.05 PREPARATIONS FOR WARTS & CALLUSES

WHO MODEL FORMULARY 2008 NOTES:

WARTS most commonly affect the hands, feet (plantar warts, verrucas), and anogenital region (condylomata acuminata); all are caused by the human papilloma virus. They may regress spontaneously at any time within months or years of their first appearance; however, particularly in immunosuppressed patients, they may spread and be difficult to cure. Many common, plane and plantar warts can reasonably be left untreated, but painful or unsightly lesions generally respond to application of preparations containing salicylic acid. Where available, cryotherapy using liquid nitrogen applied with a cotton-tip or a spray is highly effective; however, freezing the skin can produce temporary or permanent depigmentation (particularly on dark skin), and should be used with caution. Anogenital warts are usually transmitted by sexual contact; they should always be treated, although they frequently recur, because of the increased risk of cervical cancer. [Mercy Ships note: Podophyllum resin is not on the Mercy Ships list so related WHO notes are edited from here.]

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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</thead>
<tbody>
<tr>
<td>Salicylic acid 16.7%, Lactic acid 16.7% in Flexible Collodion BP 15ml (Duofilm)</td>
<td>D</td>
<td>Corns, calluses, warts: soak lesion in hot water for 5 minutes, dry thoroughly and apply to affected area only once daily until healed.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Silver Nitrate Sticks or Caustic Pencils (various)</td>
<td></td>
<td>Common warts/verrucas: Apply moistened caustic pencil tip for 1-2 minutes, repeat after 24 hours, warts max 3 applications, verrucas max 6 applications. Also used for hypergranulation in wounds. See product leaflet for details.</td>
</tr>
</tbody>
</table>
COMMENT/CAUTIONS:
- Use pumice stone or emery board to remove hardened skin after soaking in hot water, and cover with plaster after keratolytic application. Protect surrounding healthy skin at affected area with petroleum jelly or white soft paraffin before applying keratolytics if needed.

### 11.06 ANTISEPTICS & DISINFECTANTS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic Acid Solution 0.5% &amp; 5%</td>
<td></td>
<td>Use as disinfectant/antiseptic especially in jellyfish stings (3-5%) or <em>Ps. aeruginosa</em> infection of wound/burns (0.5-5%). See The Martindale for details.</td>
</tr>
<tr>
<td>Chlorhexidine Gluconate 5% &amp; 20% Concentrated Solution (Hibitane) Diluted to give:</td>
<td></td>
<td>Pre-op skin disinfection &amp; emergency instrument disinfection: Dilute 1 part 20% concentrate with 3 parts water to give 5% concentrate. Dilute 10ml of 5% concentrate with 15ml water and top up to 100ml with 95% alcohol, for use as directed.</td>
</tr>
<tr>
<td>Chlorhexidine Gluconate Scrub 4% (Hibiscrub)</td>
<td></td>
<td>For pre-op skin preparation and hand washing, apply 3-5ml over hands, forearms or skin area, rub vigorously for 1-2 minutes, rinse and dry, then repeat procedure.</td>
</tr>
<tr>
<td>Chlorhexidine 1:200 in Alcohol with Emollient (Hibisol 0.5%)</td>
<td></td>
<td>For pre-op skin prep/hand washing, apply 3-5ml over hands/forearms/skin area, then rub vigorously for 2-5 minutes. When dry reapply and repeat procedure.</td>
</tr>
<tr>
<td>Chlorhexidine 1.5% with Cetrimide 15% Concentrated Solution (Savlon)</td>
<td></td>
<td>For disinfection of skin, burns, wounds &amp; instruments: dilute 20ml concentrated solution in 1 litre of water to give 0.03% chlorhexidine and 0.3% cetrimide.</td>
</tr>
<tr>
<td>GENERIC (TRADE) NAME</td>
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</tr>
<tr>
<td><strong>Hydrogen Peroxide 7% Solution</strong></td>
<td></td>
<td>Use as 3.5-7% solution for disinfection of instruments/laundry. For skin disinfection and cleansing of crusted/odorous wounds or ulcers, dilute to 1.75% before use (add 1 part hydrogen peroxide 7% to 3 parts of water). Dilution from 35% concentrate: measure 400ml of 35% concentrate and top up with water to 2000ml to give a 7% solution.</td>
</tr>
<tr>
<td><strong>Povidone Iodine 10% in Aqueous Solution or Ointment (Betadine) (available Iodine 1% w/v)</strong></td>
<td>EML</td>
<td>To be applied undiluted in pre- and post-op skin disinfection/preparation or as directed. For use in eye surgery see chapter 09 section 9.05 peri-operative preps.</td>
</tr>
<tr>
<td><strong>Povidone Iodine 7.5% Scrub (Betadine)</strong></td>
<td></td>
<td>Use as pre-op scrub as directed.</td>
</tr>
</tbody>
</table>

**Note**: Use antiseptics/disinfectants according to current Infection Control Guidelines, store in clean area. Procurement: Some items listed above are not on the pharmacy needs list but on the general needs list, please check.

### 11.07 OTHER TOPICAL PREPARATIONS

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diclofenac Topical Gel 1% or 5% (Voltarol Emulgel)</strong></td>
<td>MSL D</td>
<td>Apply with gentle massage 3-4 times daily, see product leaflet for detail.</td>
</tr>
<tr>
<td><strong>Emollient, various</strong> (e.g. Aqueous Cream, Emulsifying Ointment, White Soft Paraffin or Vaseline)**</td>
<td></td>
<td>Apply generously as often as required.</td>
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<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine HCl Topical Gel or Jelly 2% [Lignocaine]</td>
<td>MSL</td>
<td>Local skin anaesthesia, apply as directed, see current guidelines or product leaflet for detail.</td>
</tr>
<tr>
<td>Lidocaine 2.5% with Prilocaine 2.5%, 5g cream &amp; patch (EMLA) [Lignocaine]</td>
<td>IDA</td>
<td>Venipuncture (for Child &gt; 1 yo): apply one patch or cream as a thick layer under an occlusive dressing, 1 hour before procedure.</td>
</tr>
<tr>
<td>Lidocaine Hydrochloride Topical Solution 4% 40mg/ml (Xylocaine 4% Topical)</td>
<td>EML</td>
<td>Local skin anaesthesia. Use minimal effective dosage according to area to be anaesthetised and procedure. See respective product leaflets for dosing detail.</td>
</tr>
<tr>
<td>Lidocaine Hydrochloride Topical Spray 10% 10mg/metered dose of 0.1ml (Xylocaine Spray)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle Rub (various)</td>
<td>MSL</td>
<td>Apply as directed; see individual product leaflets for detail.</td>
</tr>
</tbody>
</table>
12 IMMUNOLOGICALS

12.01 ANTISERA & IMMUNOGLOBULINS

WHO MODEL FORMULARY 2008 NOTES:

Antibodies of human origin are usually termed immunoglobulins. Material prepared from animals is called antiserum. Because of serum sickness and other allergic-type reactions that may follow injections of antisera, this therapy has been replaced wherever possible by the use of immunoglobulins. All immunoglobulins and antisera should comply with WHO requirements for blood and plasma products. **Contraindications/Precautions:** Anaphylaxis, although rare, can occur and epinephrine (adrenaline) must always be immediately available during immunization. Immunoglobulins may interfere with the immune response to live virus vaccines which should normally be given *either at least 3 weeks before or at least 3 months after* the administration of the immunoglobulin. **Adverse reactions:** Intramuscular injection. Local reactions including pain and tenderness may occur at the injection site. Hypersensitivity reactions may occur including, rarely, anaphylaxis. Intravenous injection. Systemic reactions including fever, chills, facial flushing, headache and nausea may occur, particularly following high rates of infusion. Hypersensitivity reactions may occur including, rarely, anaphylaxis.

**Rabies immunoglobulin** is a preparation containing immunoglobulins derived from the plasma of adults immunized with rabies vaccine. It is used as part of the management of potential rabies following exposure of an unimmunized individual to an animal in or from a high-risk country. It should be administered as soon as possible after exposure without waiting for confirmation that the animal is rabid. The site of the bite should be washed with soapy water and the rabies immunoglobulin should be infiltrated in and around the site of the bite. In addition rabies vaccine (see section 12.02) should be administered at a different site.

**Antitetanus immunoglobulin** of human origin is a preparation containing immunoglobulins derived from the plasma of adults immunized with tetanus toxoid. It is used for the management of tetanus-prone wounds in addition to wound toilet and if appropriate antibacterial prophylaxis and adsorbed tetanus vaccine (see section 12.02).

[Mercy Ships note: Please refer to the WHO Formulary 2008 for the full notes including anti-D immunoglobulin & antivenom sera, both not on Mercy Ships list.]
### Immunologicals

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td><strong>Hepatitis B Immunoglobulin, Human, Injection</strong>&lt;br&gt;Single Dose (Adult)  °Fridge Item</td>
<td></td>
<td>Post-exposure prophylaxis ONLY (e.g. needle-stick injury/surgical/lab exposure): By IM inj, Adult 500 units within 12 hours of percutaneous or permucosal exposure, see also product leaflet &amp; current guidelines.</td>
</tr>
<tr>
<td><strong>Rabies Immunoglobulin, Human, Injection 150units/ml, 2ml vial</strong>&lt;br&gt;[Antirabies Immunoglobulin]  °Fridge Item</td>
<td>IDA</td>
<td>Immunization against rabies, post-exposure or suspected exposure; high risk wound: Adult &amp; Child, 20 units/kg by infiltration in and around the cleansed wound. If wound is not visible or healed or infiltration of whole volume not possible, give remainder by IM inj into anterolateral thigh. Consider antibacterial prophylaxis, wound cleaning and rabies vaccine.</td>
</tr>
<tr>
<td><strong>Tetanus Immunoglobulin, Human, Injection 1500IU/ml (Tetuman Berna)</strong>&lt;br&gt;[Antitetanus Immunoglobulin]  °Fridge Item</td>
<td>MSL IDA</td>
<td>Management of tetanus-prone wounds: By IM inj, Adult/Child 250 units, increased to 500 units if wound is older than 24 hours or there is risk of heavy contamination (see Comment/Cautions below), or following burns. Tetanus treatment: 150units/kg given IM at multiple sites. Consider antibacterial prophylaxis, wound cleaning and tetanus vaccine.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- Please refer to current local & national guidelines as well.
- If vaccine and immunoglobulin needs to be administered at the same time, they should be administered using separate syringes and separate sites.
- Wounds are considered to be tetanus-prone if they are sustained either more than 6 hours before surgical treatment of the wound or at any interval after injury and show one or more of the following: a puncture-type wound, a compound fracture, a wound containing foreign bodies, a significant degree of devitalized tissue, clinical evidence of sepsis, contamination with soil/manure likely to contain tetanus organisms. All wounds should receive thorough cleansing. Consider antibacterial prophylaxis (benzylpenicillin, co-amoxiclav or metronidazole) for tetanus-prone wounds.
12.02 VACCINES

WHO MODEL FORMULARY 2008 NOTES:

All vaccines should comply with WHO recommendations for the production, control, and evaluation of vaccines and other biological substances; these recommendations provide guidance for national regulatory authorities and for vaccine manufacturers and are available from the WHO website: www.who.int/biologicals/publications/trs/areas/en/index.html. WHO publishes regularly-updated advice on vaccines against diseases of international relevance; the advice deals primarily with large-scale immunization programmes. The advice is available from the WHO website: www.who.int/immunization/documents/positionpapers_intro/en/index.html. The Strategic Advisory Group of Experts on Immunization (SAGE) regularly reports on a range of issues, including vaccine research and immunization against all vaccine-preventable diseases. The current SAGE reports and recommendations are also available from the WHO website: www.who.int/immunization/sage_conclusions/en/index.html. The Global Advisory Committee on Vaccine Safety (GACVS) reports on vaccine safety issues. The current GACVS reports are available via the WHO website: www.who.int/vaccine_safety/en/. The WHO website also has links to further information about the use of vaccines; go to: www.who.int/immunization/en.

Vaccines may consist of a live attenuated or inactivated form of a virus or bacteria, or an extract of or detoxified exotoxin produced by a 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 (pain, erythema and inflammation), fever and malaise, generally occurring within 1–2 days of immunization. However, systemic symptoms that may arise with measles or measles, mumps and rubella vaccine (MMR) vaccine occur 5–12 days after vaccination. Serious reactions are rare, but may include hypersensitivity reactions including anaphylaxis (see section 3 for management). If a serious adverse event occurs (severe allergy or anaphylaxis) following a dose of any vaccine, subsequent doses should not be given. In addition, certain components of the vaccine (e.g. aluminium adjuvant, antibiotics, excipients or preservatives) occasionally cause reactions. Some vaccines are prepared using hens’ eggs, so caution is required when egg sensitivity is known. 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. See under individual vaccines for specific precautions and contraindications in HIV infection.
LIVE VACCINES. When two 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, followed if necessary by a second dose 4–6 hours later. If fever persists after the second dose, medical advice should be sought. For post-immunization pyrexia in an infant 2–3 months of age, the dose of paracetamol is 60 mg. When there is a personal or family history of febrile convulsions, there is an increased risk of these occurring during fever from any cause, including immunization. When immunization of these children is recommended, advise on prevention of fever before vaccine administration.

Diphtheria is a bacterial infection caused by Corynebacterium diphtheriae and is transmitted from person to person through close physical and respiratory contact. Diphtheria vaccine is given as part of primary immunization schedule in fixed combinations with tetanus, or tetanus and pertussis vaccines. Combinations with other antigens such as Haemophilus influenzae type b, poliomyelitis, and hepatitis B vaccines are available in some countries. Immunization against diphtheria should be considered for healthcare workers who are at risk of occupational exposure to Corynebacterium diphtheriae. A two-component diphtheria vaccine with tetanus exists in two forms. The form containing a low dose of diphtheria toxoid is associated with less frequent local reactions in adults and older children than the standard dose diphtheria preparation, and should be used for adults and children 7 years of age and older. When tetanus prophylaxis is needed following tetanus injuries, use combined diphtheria and tetanus preparations rather than tetanus alone to promote immunity against diphtheria.

Haemophilus influenzae type b (Hib) causes serious infection such as bacterial pneumonia and meningitis, especially in young children. The bacteria are transmitted from person to person by droplets from nasopharyngeal secretions. WHO recommends the inclusion of Hib vaccine in all routine infant immunization programmes. The risk of infection decreases in older children and therefore Hib vaccine is not generally offered to children over 2 years of age. However, older children and adults at an increased risk of Hib infection should be vaccinated, including individuals with HIV or immunoglobulin deficiency, stem cell transplant recipients, patients with malignant neoplasms receiving chemotherapy, and those with asplenia (for example, due to sickle-cell disease or splenectomy).

Hepatitis A is caused by hepatitis A virus. It is transmitted via the faecal-oral route from person to person through close physical contact and ingestion of contaminated food and water. Those at increased risk of infection include parenteral drug abusers, individuals who change sexual partners frequently,
individuals exposed to untreated sewage, those living in closed communities, travellers to endemic countries, laboratory staff working with the virus, patients with haemophilia treated with plasma-derived clotting factors, and individuals who work with primates. Patients with chronic liver disease including chronic hepatitis B or chronic hepatitis C are at risk of severe liver disease if infected with hepatitis A. In highly endemic countries, exposure is almost universal before 10 years of age and large-scale immunization programmes should not be undertaken. In areas of intermediate endemicity with periodic outbreaks, control of hepatitis A may be achieved through widespread vaccination programmes, but is most successful in small, self-contained communities. In countries with low endemicity, vaccination for high-risk populations may be recommended. Several vaccines are available, which provide long-lasting protection, but none are licensed for use in children under one year of age; the dose of the vaccine and vaccination schedule varies between manufacturers. A single dose of vaccine provides a protective antibody response within a month; the manufacturers recommend a second dose 6–18 months later to ensure long term protection.

**Hepatitis B** is caused by hepatitis B virus. It is transmitted in blood and blood products, by sexual contact and by contact with infectious body fluids. Persons at increased risk of infection because of their life-style, occupation or other factors, include parenteral drug abusers, individuals who change sexual partners frequently, staff and inmates of custodial institutions, healthcare workers who are at risk of injury from blood-stained sharp instruments, dialysis patients and haemophiliacs. Also at risk are babies born to mothers who are HbsAg-positive (hepatitis B virus surface antigen positive), those having medical or dental procedures in countries with high prevalence, and travellers to endemic countries. WHO recommends hepatitis B vaccine given as part of the national infant immunization programme. Catch-up immunization should be considered for older age groups, or high-risk individuals who have not been previously immunized in countries with intermediate or low hepatitis B endemicity.

**Measles** is an acute viral infection transmitted by close respiratory contact. Immunization against measles is recommended for all infants and young children, and also for adolescents and adults who are susceptible or at high risk of exposure. Immunization should be considered for individuals with early signs of HIV-induced immunosuppression in endemic areas or during outbreaks. Large scale vaccination to control ongoing outbreaks is of limited value, but for high-risk individuals immunization within 2 days of exposure vaccine may improve the clinical course of measles. The measles vaccine is a live, attenuated vaccine, available either as a single antigen vaccine or combined with either rubella (MR), or mumps and rubella (MMR) vaccines; the combined vaccines are usually given as part of the primary immunization schedule. No evidence has been found for the alleged associations between measles or MMR immunization and serious developmental disorders including autism, or chronic bowel disease.
Neisseria meningitidis causes meningococcal disease including meningitis and septicaemia and primarily affects young children. The bacteria are transmitted from person to person via respiratory secretions. Immunization against meningococcal disease is recommended as part of the routine childhood immunization programme, for outbreak situations, for individuals at high-risk including those in military camps and boarding schools, travellers to epidemic areas, and for those with a predisposition to meningococcal disease (such as asplenia and inherited immune deficiencies). Meningococcal vaccines are available as combinations of capsular polysaccharide antigens (serogroups A and C, or A, C, W135 and Y) or as a polysaccharide of serogroup C conjugated to a protein carrier; other variants of the vaccine are available in some countries. Group C conjugate vaccine is recommended for national childhood immunization programmes. A single dose of either A and C, or A, C, W135 and Y polysaccharide vaccine is recommended to control outbreaks and for at-risk individuals including travellers to epidemic areas. Groups A and C, and A, C, W135 and Y vaccines elicit a suboptimal response in infants under 2 years old and are not recommended for routine immunization but they may given in emergency outbreak situations.

Pertussis (whooping cough) is a bacterial respiratory infection caused by Bordetella pertussis and is transmitted through droplets. Pertussis vaccine is usually administered in fixed-dose combinations with diphtheria, tetanus and other vaccines as part of the primary immunization programme. WHO recommends 3 doses, each to be given at 6, 10 and 14 weeks of age. Booster doses are recommended 1–6 years after the primary series in countries where the incidence of pertussis has been reduced by immunization. Single component pertussis vaccines are available in some countries.

Streptococcus pneumoniae causes serious infection such as pneumonia and meningitis, especially in young children under 2 years of age, the elderly, and individuals with immunodeficiency. The bacteria are transmitted via respiratory secretions. WHO recommends that pneumococcal conjugate vaccine should be included in national routine childhood immunization programmes. The 7-valent conjugate vaccine (PCV-7) provides effective protection in young children; the primary schedule usually consists of 3 doses, each administered at intervals of at least 4 weeks; other 3-dose schedules have been shown to be effective and are in use in some countries. A booster dose given after 12 months of age may improve the immune response. Immunization should be initiated before 6 months of age and may start as early as 6 weeks of age. The vaccine can be given to HIV-infected individuals. A single dose of PCV-7 can be given to children aged 12–24 months of age who have not been previously vaccinated and children 2–5 years of age at high risk of pneumococcal disease. A 23-valent (unconjugated) polysaccharide vaccine is also available for adults and children over 2 years of age at risk of pneumococcal infection (note suboptimal response in infants).
**Poliomyelitis** is an acute viral infection spread by the faecal-oral or oral-oral route which can cause paralysis of varying degrees. There are two types of vaccines. **Oral poliomyelitis vaccine (OPV)** contains three types of live attenuated poliomyelitis viruses; monovalent live oral vaccines are also available. **Injectable inactivated poliomyelitis vaccine (IPV)** contains three types of inactivated strains. For primary immunization using oral poliomyelitis vaccine, a 3-dose schedule is used. The vaccine may need to be repeated in patients with diarrhoea or vomiting. HIV-infected individuals can receive the live oral vaccine, but it must **not** be used for those with primary immunodeficiency, those who are immunosuppressed or their close contacts. The need for **strict personal hygiene** must be stressed as the vaccine virus is excreted in the faeces; the contacts of a recently vaccinated baby should be advised of the need to wash their hands after changing the baby’s nappies. Reinforcing doses can be given after primary immunization.

**Rabies** is a virus transmitted to humans by rabid animals via a bite or scratch. It is invariably fatal once signs of disease occur. WHO recommends **preexposure** immunization of individuals at increased risk of contracting rabies either due to occupational exposure such as laboratory workers, veterinary surgeons, animal handlers and health workers or people living or travelling to enzootic areas—in such areas children aged 5–15 years are at particular risk of exposure. Cell-derived vaccines are used for both pre-exposure and post exposure protection. Vaccines of nerve cell tissue origin should **not be used** because they are less potent and are frequently associated with adverse events. **Rabies vaccine** is used as part of the post-exposure treatment to prevent rabies in patients who have been bitten by rabid animals or animals suspected of being rabid. The bite wound or scratch should be thoroughly cleansed. Treatment is dependent upon the individual’s immune status and upon the level of risk of rabies in the country concerned (consult national immunization schedule). In certain circumstances, such as patients with incomplete prophylaxis or unimmunized individuals, **passive immunization** with rabies immunoglobulin can be given (see Rabies Immunoglobulin, section 19.2). Post-exposure treatment with rabies vaccine and rabies immunoglobulin is necessary for individuals who are immunocompromised, HIV-positive, taking malaria chemoprophylaxis or under anaesthesia; antibody response should be monitored.

**Neonatal tetanus** due to infection of the baby’s umbilical stump during unclean delivery is the cause of many deaths of newborn infants. Control of neonatal tetanus may be achieved by ensuring adequate hygiene during delivery and by ensuring protective immunity of mothers in late pregnancy. **Tetanus vaccine** is highly effective and the efficacy of two doses during pregnancy in preventing neonatal tetanus ranges from 80-100% (2 doses of 0.5ml during pregnancy at interval of 4 weeks, second dose at least 2 weeks before delivery, and 1 dose during each of subsequent 3 pregnancies, max 5 doses). Women of childbearing age may be immunized by a course of 5 doses of tetanus vaccine: 3
primary doses of 0.5ml at 0, 1 and 6 months intervals; then 2 reinforcing doses of 0.5ml at 1 and 2 years after the primary doses.

**Wounds** are considered to be tetanus-prone if they are sustained *either* more than 6 hours before surgical treatment of the wound *or* at any interval after injury and show one or more of the following: a puncture-type wound, a significant degree of devitalized tissue, clinical evidence of sepsis, contamination with soil/manure likely to contain tetanus organisms. All wounds should receive thorough surgical toilet. Antibacterial prophylaxis may also be required for tetanus-prone wounds.

For *clean wounds*, fully immunized individuals (total 5 doses of tetanus vaccine at appropriate intervals) and those whose primary immunization is complete (with boosters up to date) do not require tetanus vaccine; individuals whose primary immunization is incomplete or whose boosters are not up to date require a reinforcing dose of tetanus vaccine (followed by further doses as required to complete the schedule); non-immunized individuals (or whose immunization status is not known) should be given a dose of the vaccine immediately (followed by completion of the full course of the vaccine if records confirm the need).

For *tetanus-prone wounds*, management is as for clean wounds with the addition of a dose of antitetanus immunoglobulin (section 12.01) given at a different site; in fully immunized individuals and those whose primary immunization is complete (see above) the immunoglobulin is needed only if the risk of infection is especially high (for example, contamination with manure). Antibacterial prophylaxis (with benzylpenicillin, or amoxicillin with clavulanic acid, or metronidazole) may also be required for tetanus-prone wounds.

**Typhoid vaccine** is used for active immunization against typhoid fever and is advised for those travelling to endemic areas. The efficacy of the vaccine is not complete and the importance of maintaining scrupulous attention to food and water hygiene as well as personal hygiene must also be emphasized. Typhoid vaccine is available as a capsular polysaccharide injection. In children under 2 years the injection may show sub-optimal response. Immunization is also recommended for laboratory workers handling specimens from suspected cases. A live oral typhoid vaccine containing an attenuated strain of *Salmonella typhi* (Ty21a) may also be available.
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<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria, Tetanus and Pertussis Adsorbed Vaccine</td>
<td>D-crew</td>
<td>Primary immunisation: <em>By IM inj</em>, Infant 0.5ml at 6, 10 and 14 weeks; reinforce at school entry: 0.5ml. (see WHO schedule, section 12.03).</td>
</tr>
<tr>
<td>10 doses/5ml (DTPer/Vac/Ads)</td>
<td>clinic</td>
<td></td>
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<td>EML</td>
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<tr>
<td></td>
<td>° Fridge Item</td>
<td></td>
</tr>
<tr>
<td>Diphtheria and Tetanus Vaccine Single Dose (Adult)</td>
<td>D-crew</td>
<td>Primary immunisation of Adults/Child &gt; 10 y/o not previously immunized: <em>By IM inj</em> 0.5ml, 3 doses to be given at intervals of 4 weeks.</td>
</tr>
<tr>
<td>(Td/Vac/Ads(Adult))</td>
<td>clinic</td>
<td>Booster dose: Child &lt; 10 y/o, 0.5ml at least 3 years after completion of primary course of DPT or DT immunisation.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td></td>
<td>° Fridge Item</td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenzae type b</td>
<td>D-crew</td>
<td>Primary immunisation of children &lt; 13 month old: <em>By deep SC/IM inj</em> 0.5ml 3 doses at 4 week intervals. Primary immunisation of children 13 month-4 y/o or high risk/asplenia: single dose 0.5ml.</td>
</tr>
<tr>
<td>Single Dose Vaccine (HIB)</td>
<td>clinic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td></td>
<td>° Fridge Item</td>
<td></td>
</tr>
<tr>
<td>Hepatitis A Vaccine Injection Single Dose (Adult &amp; Paediatric)</td>
<td>D-crew</td>
<td>By IM inj, Adults: 1ml single dose, booster dose 1ml 6-18 months after first dose. Child 1-15 y/o: 0.5ml single dose, booster dose 0.5ml 6-18 months after first dose.</td>
</tr>
<tr>
<td>(Havrix Monodose)</td>
<td>clinic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td></td>
<td>° Fridge Item</td>
<td></td>
</tr>
<tr>
<td>Hepatitis B Vaccine Injection Single Dose (Adult) (Engerix B)</td>
<td>D-crew</td>
<td>Primary immunisation of adults: By IM inj in the deltoid region, 3 doses of 1ml, give first dose, second dose 1 month after the first dose, third dose 5 months after second dose.</td>
</tr>
<tr>
<td>(Euvax)</td>
<td>clinic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td></td>
<td>° Fridge Item</td>
<td></td>
</tr>
<tr>
<td>Hepatitis B Vaccine Injection Single Dose (Paediatric)</td>
<td>EML</td>
<td>Primary immunisation of children 6 weeks-15 y/o: By IM inj at anterolateral thigh site (not buttock), 3 doses of 0.5ml given at intervals of 4 weeks. Alternatively, 0.5ml dose given at birth, followed by two 0.5ml doses each given at 6 and 14 weeks of age. Use SC route in patients with bleeding disorders/thrombocytopenia</td>
</tr>
<tr>
<td>(Euvax)</td>
<td>° Fridge Item</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
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</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis A &amp; B Vaccine Injection Single Dose (Adult)</td>
<td>D-crew clinic</td>
<td>Primary immunisation of adults: By IM inj, 3 doses of 1ml, give first dose, then second dose 1 month after the first dose, and third dose 5 months after the second dose. Booster dose 1ml 5 years after.</td>
</tr>
<tr>
<td>(Twinrix)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>° Fridge Item</td>
<td></td>
</tr>
<tr>
<td>Hepatitis A &amp; B Vaccine Injection Single Dose (Paediatric)</td>
<td>D- crew clinic</td>
<td>Primary immunisation of children 1-15 yo: By IM inj, 3 doses of 1ml, give first dose, then second dose 1 month after first dose, and third dose 5 months after the second dose.</td>
</tr>
<tr>
<td>(Twinrix)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>° Fridge Item</td>
<td></td>
</tr>
<tr>
<td>Measles, Mumps &amp; Rubella Vaccine Single Dose (MMR)</td>
<td>D- crew clinic</td>
<td>Primary immunisation of children: By SC/IM inj, 0.5ml given after 12 months of age, second dose 0.5ml given four weeks later or at up to 6 years of age (before starting school). Prophylaxis in susceptible patients after exposure to measles, within 72 hours of contact: Adult/Child over 9 months of age, 0.5ml (see WHO notes above). Note: MMR vaccine is not suitable for prophylaxis following exposure to mumps or rubella since the antibody response to the mumps &amp; rubella components is too slow for effective prophylaxis.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Meningitis A &amp; C Vaccine Single Dose (Mengivac A+C)</td>
<td>D- crew clinic</td>
<td>Adult &amp; Child over 1 yo: By deep SC/IM inj, 0.5ml as a single dose. (See manufacturer’s leaflet for detail)</td>
</tr>
<tr>
<td>(° Fridge Item)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meningitis A, C, W135 &amp; Y Vaccine Single Dose (ACWY Vax)</td>
<td>D- crew clinic</td>
<td>Adult &amp; Child over 1 yo: By deep SC inj, 0.5ml as a single dose. (See manufacturer’s leaflet for detail)</td>
</tr>
<tr>
<td>(° Fridge Item)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GENERIC (TRADE) NAME</td>
<td>CAT.</td>
<td>INDICATION/DOSE</td>
</tr>
<tr>
<td>----------------------</td>
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</tr>
</tbody>
</table>
| **Pneumococcal Vaccine**
Single Dose
*Fridge Item* | D-crew clinic | Infant primary immunisation: By IM inj in the anterolateral thigh area 0.5ml, 3 doses given at intervals of 4 weeks, usually started at the same time as routine immunisation against diphtheria, tetanus and pertussis; or 2 doses given at 8 weeks interval; booster doses recommended at school entry. Child 1-5 yo single dose 0.5ml (in the deltoid region). |
| **Poliomyelitis Vaccine,**
Live Oral (OPV)
or
Inactivated Single Dose
Injection (IPV)
*Fridge Item* | D-crew clinic | Child primary immunisation: IPV By SC inj 0.5ml, OPV By mouth 3 drops (may be given with a lump of sugar); 3 doses given at intervals of 4 weeks, usually started at the same time as routine immunisation against diphtheria, tetanus and pertussis; booster doses recommended at school entry and school leaving. Adult primary immunisation: IPV By SC inj 0.5ml, OPV By mouth 3 drops (may be given with a lump of sugar); 3 doses given at intervals of 4 weeks; 1 booster dose 10 years after completion of the primary course. |
| **Rabies Vaccine Single Dose Injection**
*Fridge Item* | IDA | Post-exposure prophylaxis ONLY. By deep SC/IM injection into the deltoid region, Adult/Child, in previously un-immunised individuals: 5 doses of 1ml on days 0, 3, 7, 14 and 28; if high risk, give rabies immunoglobulin on day 0 as well. In previously immunised individuals: 2 doses of 1ml separated by 3-7 days. See also WHO notes above. |
| **Typhoid Vaccine (Typhim VI)**
*Fridge Item* | D-crew clinic | By deep SC/IM inj, Adult/Child over 2 yo, 0.5ml for 3 years’ protection. (Cautions on oral typhoid vaccine, see next page.) |

*Cont. next page*
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetanus Vaccine/Tetanus Toxoid Inj 0.5ml/dose (Tet/Vac/Ads) °Fridge Item</td>
<td>MSL</td>
<td>Primary immunisation: <em>By deep SC or IM inj</em>, 0.5ml 3 doses given in intervals of 4 weeks, booster dose recommended every 10 years. Prevention in clean wounds: if &gt; 10 years since last dose give single booster dose; in unimmunised individuals give full course. High risk wounds: as above plus a dose of tetanus immunoglobulin. See also WHO notes above.</td>
</tr>
<tr>
<td></td>
<td>IDA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**

- If schedule requires a vaccine and its immunoglobulin to be administered at the same time (for example for tetanus), they should be administered using separate syringes and separate sites.
- Please refer to current local & national guidelines as well.
- **Hepatitis A vaccine** – Generally recommended for travellers to high-risk areas, hospital/lab staff with direct contact risk, haemophiliacs (risk through transfusions), high-risk sexual behaviours.
- **Hepatitis B vaccine** – Generally recommended for travellers to high-risk areas, hospital/lab staff with direct blood contact risk, IV drug abuse/high risk sexual behaviours, close family contact of a case/carer, infants borned to Hep B positive mothers, haemophiliacs/chronic renal failure (risk through transfusions/dialysis).
- **Meningococcal vaccine** – Recommended for travellers to high-risk areas, lab staff with direct contact, close contacts (see local guidelines for secondary prevention of meningitis).
- **Poliomyelitis vaccine** – Oral vaccine contraindicated in vomiting & diarrhea and immunodeficiency disorders, not to be given with foods which contain preservatives. Either live oral or inactivated injection vaccine may be used to complete a course started with the other.
- **Typhoid vaccine** – Mercy Ships does not stock oral typhoid vaccine, but in case please note that the administration of oral typhoid vaccine should be coordinated so that *mefloquine* is not taken for at least 12 hours before or after a dose; vaccination should be completed at least 3 days before the first dose of mefloquine or other antimalarials (except proguanil hydrochloride in combination with atovaquone, which may be given concomitantly). Oral typhoid vaccine is inactivated by concomitant administration of *antibacterials*; if possible antibacterials should be avoided 3 days before or 3 days after vaccination.
### 12.03 GENERAL IMMUNISATION SCHEDULE (BNF MAR 2009)

Note: This is the UK schedule, please follow patient’s home country schedule where possible. Not all vaccines listed in this schedule are Mercy Ship formulary items and certain may not be available or in current stock. For WHO recommendations see the following links:

- [http://www.who.int/immunization/policy/Immunization_routine_table2.pdf](http://www.who.int/immunization/policy/Immunization_routine_table2.pdf)

<table>
<thead>
<tr>
<th>AGE</th>
<th>VACCINE</th>
<th>NO. OF DOSES</th>
<th>FIRST DOSE</th>
<th>INTERVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infants</strong></td>
<td>DTP, HIB, Polio</td>
<td>3</td>
<td>2 months old</td>
<td>4 weeks</td>
</tr>
<tr>
<td></td>
<td>Pneumoccal</td>
<td>2</td>
<td>2 months old</td>
<td>8 weeks</td>
</tr>
<tr>
<td></td>
<td>Meningococcal C</td>
<td>2</td>
<td>3 months old</td>
<td>4 weeks</td>
</tr>
<tr>
<td></td>
<td>Consider BCG, Hep B</td>
<td>1</td>
<td>Neonates at risk only</td>
<td></td>
</tr>
<tr>
<td><strong>12 months old</strong></td>
<td>HIB, Meningococcal C</td>
<td>Single booster</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>13 months old</strong></td>
<td>MMR</td>
<td>1</td>
<td>First dose 12-15 mths old</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pneumococcal, HIB</td>
<td>Single booster</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Between 3 yo and 4 months, and 5 yo</strong></td>
<td>MMR, DTP, HIB, Polio</td>
<td>Single booster</td>
<td>Dose preferably 3 years after first vaccine regime</td>
<td></td>
</tr>
<tr>
<td><strong>12-13 yo females only</strong></td>
<td>Consider Human Papilloma virus vaccine</td>
<td>3</td>
<td>Second dose 1-2 months, third dose 6 months after first dose</td>
<td></td>
</tr>
<tr>
<td><strong>Before leaving school or before employment or further education</strong></td>
<td>Diphtheria &amp; Tetanus (adult), Polio</td>
<td>Single booster</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adult</strong></td>
<td>Consider Polio if not given previously</td>
<td>3</td>
<td></td>
<td>4 weeks</td>
</tr>
<tr>
<td></td>
<td>Consider Rubella for sero-negative women</td>
<td></td>
<td>Single dose.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consider Tetanus if not given previously</td>
<td>3</td>
<td></td>
<td>4 weeks</td>
</tr>
<tr>
<td></td>
<td>Consider Diphtheria if not given previously</td>
<td>3</td>
<td></td>
<td>4 weeks</td>
</tr>
<tr>
<td><strong>High risk (See Comment)</strong></td>
<td>Consider BCG, Hep A &amp; B, Influenza, Pneumococcal, Tetanus vaccines.</td>
<td></td>
<td>See individual product details.</td>
<td></td>
</tr>
</tbody>
</table>
13 ANAESTHETICS

13.01 INHALATIONAL & IV ANAESTHETICS

WHO MODEL FORMULARY 2008 NOTES:

This section describes drugs used in anaesthesia. The reader is referred to WHO. Model Prescribing Information. Drugs used in Anaesthesia. Geneva: WHO; 1989 for more detailed information.

To produce a state of prolonged full surgical anaesthesia reliably and safely, a variety of drugs is needed. Special precautions and close monitoring of the patient are required. These drugs may be fatal if used inappropriately and should be used by non–specialized personnel only as a last resort. Irrespective of whether a general or conduction (regional or local) anaesthetic technique is used, it is essential that facilities for intubation and mechanically assisted ventilation are available. A full preoperative assessment is required including, if necessary, appropriate fluid replacement.

Anaesthesia may be induced with an intravenous barbiturate, [propofol available with Mercy Ships], parenteral ketamine, or a volatile agent. Maintenance is with inhalational agents often supplemented by other drugs given intravenously. Specific drugs may be used to produce muscle relaxation. Various drugs may be needed to modify normal physiological functions or otherwise to maintain the patient in a satisfactory condition during surgery.

LONG-TERM MEDICATION. The risk of stopping long-term medication before surgery may be greater than the risk of continuing it. It is essential that the anaesthetist is told of all drugs that the patient is (or has been) taking; for further advice see section 2.10 (oral anticoagulants), section 7.01 (corticosteroids), section 7.05 (hormonal contraceptives), and section 7.03/7.04 (diabetic patients).

INTRAVENOUS ANAESTHETICS. IV anaesthetics may be used alone to produce anaesthesia for short surgical procedures but are more commonly used for induction only. They can produce apnoea and hypotension and thus facilities for adequate resuscitation must be available. They are contraindicated if the anaesthetist is not confident of being able to maintain an airway. Before intubation is attempted, a muscle relaxant must be given. Individual requirements vary considerably; lesser dosage is indicated in the elderly, debilitated or hypovolaemic patients. IV induction using thioental is rapid and excitement does not usually occur [propofol available with Mercy Ships]. Anaesthesia persists for about 4-7 minutes; large or repeated doses severely depress respiration and delay recovery.
Anaesthesia with ketamine persists for up to 15 minutes after a single IV injection and is characterized by profound analgesia. It may be used as the sole agent for diagnostic and minor surgical interventions. Subanaesthetic concentrations of ketamine may be used to provide analgesia for painful procedures of short duration such as the dressing of burns, radiotherapeutic procedures, marrow sampling and minor orthopaedic procedures. Recovery from ketamine anaesthesia is associated with a high incidence of hallucinations and other emergence reactions. Ketamine is of particular value in children, in whom hallucinations are believed to be less significant.

VOLATILE INHALATIONAL AGENTS. One of the volatile anaesthetics like ether or halothane (with or without nitrous oxide), must be used for induction when IV agents are contraindicated and particularly when intubation is likely to be difficult. [Sevoflurane is on the Mercy Ships list and should be considered in place of halothane or ether. Ether is no longer on the WHO list]. Excess bronchial and salivary secretion can be avoided by premedication with atropine. Laryngeal spasm may occur during induction and intubation. Localized capillary bleeding can be troublesome and postoperative nausea and vomiting are frequent; recovery time is slow particularly after prolonged administration. If intubation is likely to be difficult, halothane [or sevoflurane] is preferred. It does not augment salivary or bronchial secretions and the incidence of postoperative nausea and vomiting is low. Severe hepatitis sometimes occur and is more likely in patients who are repeatedly anaesthetized with halothane within a short period of time.

INHALATIONAL GASES. Nitrous oxide is used for the maintenance of anaesthesia. It is too weak to be used alone, but it allows the dosage of other anaesthetic agents to be reduced. It has a strong analgesic action. Oxygen should be added routinely during anaesthesia with inhalational agents, even when air is used as the carrier gas, to protect against hypoxia. Oxygen is also used in the management of anaphylaxis (section 3.02), myocardial infarction (section 2.10), and severe acute asthma (chapter 3 WHO and BNF notes).

Identification of cylinders for inhalation gases

An ISO standard (International Standard 32, Gas cylinders for medical use, 1977) requires that cylinders containing nitrous oxide should bear the name of the contents in legible and permanent characters and, preferably, also the chemical symbol N\textsubscript{2}O. The neck, from the valve to the shoulder, should be coloured blue. Cylinders containing oxygen intended for medical use should bear the name of the contents in legible and permanent characters and, preferably, also the chemical symbol O\textsubscript{2}. The neck, from the valve to the shoulder, should be coloured white. Cylinders containing nitrous oxide and oxygen mixtures should be similarly labelled, and the neck coloured white and blue.
[Mercy Ships note: Please refer to current Mercy Ships anaesthesia guidelines as well. Note that nitrous oxide & oxygen are under the general needs list, not the pharmacy needs list nor the formulary list.]

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoflurane (Forane) 250ml</td>
<td>IDA</td>
<td>Induction, using a specifically calibrated vaporiser: gradually increase from 0.5-3% in oxygen or nitrous oxide-oxygen; maintenance 1-2.5% in nitrous oxide-oxygen.</td>
</tr>
<tr>
<td><strong>Ketamine (as HCl) Inj 50mg/ml, 10ml (Ketalar)</strong></td>
<td>IDA</td>
<td>Induction: <em>By deep IM inj</em> undiluted Adult/Child 6.5-13mg/kg (10mg/kg usually produces 12-25 minutes of anaesthesia). <em>By slow IV inj</em> over at least 1 minute (undiluted), Adult/Child 1-4.5mg/kg (2mg/kg usually produces 5-10 minutes of anaesthesia), maintenance 50-100% of induction dose as required. <em>By IV infusion</em> of a 1mg/ml solution (dilute 500mg/10ml with 490ml D5/NS), Adult/Child total induction dose 0.5-2mg/kg; maintenance (using microdrip infusion) 10-45 micrograms/kg/minute, rate adjusted according to response. Analgesia: <em>By IM inj</em>, Adult/Child initially 4mg/kg.</td>
</tr>
<tr>
<td>Nitrous Oxide Inhalation Gas</td>
<td>IDA</td>
<td>Anaesthesia: Adult/Child, nitrous oxide 70% mixed with 30% oxygen. Analgesia: 50% nitrous oxide mixed with 50% oxygen.</td>
</tr>
<tr>
<td>[Cylinder neck: colour code blue]</td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>Oxygen Inhalation Gas</td>
<td>MSL</td>
<td>Concentration of oxygen in inspired anaesthetic gases should never be less than 21% (but &gt; 80% toxic risk). Note: Fire hazard, see Comments.</td>
</tr>
</tbody>
</table>
[Mercy Ships note: Nitrous oxide & oxygen are under the general needs list, not the pharmacy needs list nor the formulary list.]

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propofol Inj 1% 10mg/ml 20ml, (Diprivan)</td>
<td>Induction: By IV inj (undiluted) or IV infusion; Adult 1-2mg/kg at the rate of 20-40mg every 10 seconds; Child &gt; 3 yo, 2.5mg/kg adjust to response. Maintenance: By IV infusion Adult 4-12mg/kg/hour, Child 9-15mg/kg/hr. For IV infusion, dilute 200mg in 80ml D5 to a solution of not less than 2mg/ml to preserve the emulsion.</td>
<td></td>
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<tr>
<td>°Fridge Item</td>
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</tr>
<tr>
<td>Sevoflurane 250ml (Sevorane)</td>
<td>Induction, using a specifically calibrated vaporiser: up to 5% in oxygen or nitrous oxide-oxygen. Maintenance 0.5-3%.</td>
<td></td>
</tr>
<tr>
<td>Thioptental Sodium Inj 500mg vial [Thiopentone]</td>
<td>IDA</td>
<td>Induction: By slow IV inj diluted Adult 100-150mg (reduced in elderly or debilitated patients) repeated if necessary according to response after 30-60 seconds; or up to 4mg/kg (max 500mg); Child 2-7mg/kg repeated if necessary according to response after 60 seconds. For IV injection reconstitute 500mg vial with 20ml WFI and give over 10-15 seconds, max conc 25mg/ml (2.5% solution). Discard reconstituted solution within 24 hours or if there is cloudiness, precipitation or crystallisation.</td>
</tr>
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<td>EML</td>
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</table>

**COMMENT/CAUTIONS:**

- All inhalation agents must only be used in specifically calibrated vaporisers.
- **Halothane** hepatotoxicity: recommendations: Take careful anaesthetic history to determine previous exposure/reactions to halothane; avoid repeated exposure within 3 months unless there are overriding clinical circumstances; absolutely contraindicated in patients with a history of unexplained jaundice/pyrexia following halothane exposure.

*Cont. next page*
COMMENT/CAUTIONS (CONT.):

- **Ketamine contraindications**: Thyrotoxicosis, hypertension (including pre-eclampsia), history of cerebral or psychiatric disorders, eye injury.
- **Ketamine & Thiopental**: Warn patients not to perform skilled tasks, for example operating machinery or driving, and avoid alcohol, for 24 hours.
- **Nitrous oxide contraindications**: Discontinue if there is demonstrable collection of air in pleural, pericardial or peritoneal space; intestinal obstruction; occlusion of middle ear; arterial air embolism; decompression sickness; chronic obstructive airway disease or emphysema.
- **Oxygen**: FIRE HAZARD: Avoid use of cautery when oxygen is used with ether; do not grease reducing valves on oxygen cylinders (risk of explosion).
- **NOTE**: Nitrous oxide & oxygen are under the general needs list, not the pharmacy needs list neither the formulary list.

### 13.02 LOCAL ANAESTHETICS

**WHO MODEL FORMULARY 2008 NOTES:**

Drugs used for conduction anaesthesia (also termed local or regional anaesthesia) act by causing a reversible block to conduction along nerve fibres. Local anaesthetics are used very widely in dental practice, for brief and superficial interventions, for obstetric procedures, and for specialized techniques of regional anaesthesia calling for highly developed skills. Where patient cooperation is required the patient must be psychologically prepared to accept the proposed procedure. Facilities and equipment for resuscitation should be readily available at all times. Local anaesthetic injections should be given slowly in order to detect inadvertent intravascular injection.

**LOCAL INFILTRATION.** Many simple surgical procedures that neither involve the body cavities nor require muscle relaxation can be performed under local infiltration anaesthesia. Lower-segment caesarean section can also be performed under local infiltration anaesthesia. The local anaesthetic drug of choice is **lidocaine** 0.5% with or without epinephrine. No more than 4 mg/kg of plain lidocaine or 7 mg/kg of lidocaine with epinephrine should be administered on any one occasion. The addition of **epinephrine** (adrenaline) diminishes local blood flow, slows the rate of absorption of the local anaesthetic, and prolongs its effect. Care is necessary when using epinephrine for this purpose since, in excess, it may produce ischaemic necrosis. It should **not** be added to injections used in digits or appendages.

**SURFACE ANAESTHESIA.** Topical preparations of **lidocaine** are available and topical eye drop solutions of **tetracaine** (section 9.05) are used for local anaesthesia of the cornea and conjunctiva.
REGIONAL BLOCK. A regional nerve block can provide safe and effective anaesthesia but its execution requires considerable training and practice. Nevertheless, where the necessary skills are available, techniques such as axillary or ankle blocks can be invaluable. Either **lidocaine** 1% or **bupivacaine** 0.5% is suitable. Bupivacaine has the advantage of a longer duration of action.

SPINAL ANAESTHESIA. This is one of the most useful of all anaesthetic techniques and can be used widely for surgery of the abdomen and the lower limbs. It is a major procedure requiring considerable training and practice. Either **lidocaine** 5% in glucose or **bupivacaine** 0.5% in glucose can be used but the latter is often chosen because of its longer duration of action.

<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bupivacaine Hydrochloride Inj 0.25% (2.5mg/ml)</td>
<td>Local infiltration, using 0.25% solution: Adult up to 150mg (60ml). Peripheral nerve block, using 0.5% solution: Adult up to 150mg (30ml). Epidural block in surgery, partial to moderate motor block, using 0.5% solution: Adult 50-100mg (10-20ml); complete motor block, using 0.75% solution: Adult 75-150mg (10-20ml). Lumbar epidural block in labour, using 0.25-0.5% solution: Adult female up to 60mg (max 12ml). Caudal block in surgery, using 0.25-0.5% solution: Adult up to 150mg (max 30ml). Caudal block in labour, using 0.25-0.5% solution: Adult female up to 100mg (max 20ml). Retrobulbar block, using 0.75% solution: Adult 15-30mg (2-4ml).</td>
<td></td>
</tr>
<tr>
<td>0.5% (5mg/ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.75% (7.5mg/ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Marcain)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preparations both with preservative and preservative-free are available. Please check. Use preservative-free preps for spinal, epidural, caudal or IV regional anaesthesia.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Max cumulative safe dose for Adult &amp; Child of 0.25% bupivacaine is 1.5mg/kg, lower dose for debilitated, elderly, epileptic or acutely ill patients]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bupivacaine Hydrochloride Inj 0.5% (5mg/ml) with Dextrose 8.25% (82.5mg/ml), 4ml (Marcain Heavy)</td>
<td>IDA</td>
<td>Spinal anaesthesia: 2-4ml.</td>
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<td></td>
<td>EML</td>
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<tr>
<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Bupivacaine Hydrochloride Inj 0.5% (5mg/ml) with Epinephrine 1:200,000, 20ml (sterile pack) (Marcain-Adrenaline)</td>
<td></td>
<td>Adjusted to the site of operation and patient response. NOT FOR dorsal nerve of penis or digital nerve block or wrist &amp; ankle blocks.</td>
</tr>
<tr>
<td>Lidocaine Hydrochloride Inj 1% (10mg/ml) 2% (20mg/ml) or 2% 1.8ml dental cartridge (Xylocaine) [Lignocaine]</td>
<td>MSL IDA</td>
<td>Local infiltration and peripheral nerve block, using 0.5% solution: Adult up to 250mg (up to 50ml). Local infiltration and peripheral nerve block, using 1% solution: Adult up to 250mg (up to 25ml). Dental: For infiltration and nerve block in maxillary and mandibular area: 36mg (1.8ml undiluted). A second dose may be given to give adequate anaesthesia after allowing up to 10 minutes for onset. Inject slow IV over 2-3 minutes. For IV infusion further dilute with D5/NS to give 4-5mg/ml (0.4-0.5%) solution.</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td>Note. Preservative-free preparation for eye surgery is listed in Chapter 9 Eye under Section 9.05; minijet prep for cardiac use is listed in Chapter 2 CVS under Section 2.08.</td>
</tr>
<tr>
<td>Lidocaine Hydrochloride Inj 1% (10mg/ml) &amp; 2% (20mg/ml) with Epinephrine 1:100 000 20ml or 50 ml vials, or 2% with Epinephrine 1:80 000 1.8ml dental cartridge (Xylocaine/Adrenaline) [Lignocaine]</td>
<td>IDA</td>
<td>Local infiltration and peripheral nerve block, using 0.5-1% solution with epinephrine: Adult up to 400mg (diluted with NS, up to 40ml 1% solution or 80ml 0.5% solution). Dental anaesthesia, using 2% solution with epinephrine: Adult 20-100 mg (1-5 ml); Child 4-5mg lidocaine per kg body weight, or 20-150mg as a single dose, undiluted or diluted in NS.</td>
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<td>EML</td>
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<tr>
<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Lidocaine HCl Topical Gel or Jelly 2% [Lignocaine]</td>
<td>MSL IDA EML</td>
<td>Local skin anaesthesia, apply as directed, see current guidelines or product leaflet for detail.</td>
</tr>
<tr>
<td>Lidocaine 2.5% with Prilocaine 2.5%, 5g cream &amp; patch (EMLA) [Lignocaine]</td>
<td></td>
<td>Venipuncture (for Child &gt; 1 yo): apply one patch or cream as a thick layer under an occlusive dressing, 1 hour before procedure.</td>
</tr>
<tr>
<td>Lidocaine Hydrochloride Topical Solution 40mg/ml (Xylocaine 4% Topical)</td>
<td></td>
<td>Surface anaesthesia of pharynx, larynx, trachea, using 4% solution: Adult 40-200mg (1-5ml) Surface anaesthesia of urethra, using 4% solution: Adult 400mg (10ml). Use minimal effective dosage according to area to be anaesthetised and procedure. See product leaflets for dosing detail.</td>
</tr>
<tr>
<td>Lidocaine Hydrochloride Topical Spray 10% 10mg/metered dose of 0.1ml (Xylocaine Spray) [Lignocaine]</td>
<td>EML</td>
<td>Using 10% solution with metered dose pump: broncho/laryngoscopy, oesophagoscopy, endotracheal intubation, up to 20 doses; maxillary sinus puncture, 3 doses; Child up to 3mg/kg</td>
</tr>
<tr>
<td>Tetracaine Hydrochloride Spinal Inj 1% 2ml vial (Pontocaine/Niphanoid)</td>
<td>D</td>
<td>Spinal anaesthesia for procedures requiring two to three hours, refer to manufacturer’s leaflet for dose detail.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**
- **Lidocaine dosing:** Max dose of plain lidocaine is 4mg/kg or 200mg; max lidocaine dose when used with epinephrine is 7mg/kg or 500mg.
- When **epinephrine (adrenaline)** is used with local anaesthetics max epinephrine total dose is 500 micrograms (Adult), and higher doses of lidocaine may be used (see above, and see product leaflets).
13.03 VASOCONSTRICTORS USED IN SURGERY

WHO MODEL FORMULARY 2004 NOTES:

The sympathetic block from spinal or epidural anaesthesia may cause hypotension, which can be managed by giving IV fluids (usually prophylactically) and oxygen, and elevating legs and giving a pressor drug such as ephedrine. In addition to vasoconstriction, ephedrine also accelerates the heart rate and can counter bradycardia (but use atropine sulfate to reverse persistent bradycardia).

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<tr>
<th>GENERIC (TRADE) NAME</th>
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<th>INDICATION/DOSE</th>
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<tbody>
<tr>
<td>Ephedrine HCl Inj 30mg/ml</td>
<td>IDA</td>
<td>To prevent hypotension during delivery under spinal anaesthesia:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>By slow IV inj</em> (diluted in WFI to a solution of 3mg/ml), Adult 3-6 mg</td>
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<td></td>
<td>(max single dose 9mg), repeated if necessary every 3-4 minutes; to a max</td>
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<td></td>
<td>cumulative dose of 30mg.</td>
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<tr>
<td>Epinephrine Inj 1mg/ml</td>
<td>MSL</td>
<td>Anaphylaxis: <em>By SC/IM inj</em> undiluted,</td>
</tr>
<tr>
<td>[Adrenaline 1:1000]</td>
<td>IDA</td>
<td>Adult 500 micrograms (0.5ml), 6-12 yo 250 micrograms (0.25ml), 6 mth-6 yo</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120 micrograms (0.12ml), &lt; 6 months 50 micrograms (0.05ml).</td>
</tr>
<tr>
<td>Epinephrine Inj 100 micrograms/ml,</td>
<td>MSL</td>
<td>To retard systemic absorption of infiltrated local anaesthetics:</td>
</tr>
<tr>
<td>prefilled syringe 10ml</td>
<td>IDA</td>
<td>according to response, given as</td>
</tr>
<tr>
<td>[Adrenaline 1:10 000]</td>
<td></td>
<td>5 micrograms/ml (1 in 200 000) solution diluted in NS; in dental surgery</td>
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<td></td>
<td></td>
<td>in which small volumes are injected, concentrations of up to 12.5 micrograms</td>
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<tr>
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<td>/ml (1 in 80 000) commonly used; total dose should not exceed 500 micrograms.</td>
</tr>
<tr>
<td>Phenylephrine Inj 1% (10mg/ml)</td>
<td>EML</td>
<td>Acute mild-moderate hypotension:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>By SC/IM inj</em> undiluted 2-5mg, repeat dose at 10-15 minutes intervals, max</td>
</tr>
<tr>
<td></td>
<td></td>
<td>total dose 10mg; <em>by slow IV inj</em> (diluted in D5/NS as 1mg/ml solution</td>
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<tr>
<td></td>
<td></td>
<td>given over 3 minutes) 0.2-0.5mg (200-500 micrograms), repeat dose at</td>
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<td></td>
<td></td>
<td>10-15 minutes intervals.</td>
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COMMENT/CAUTIONS:
- **Ephedrine**: Use with caution in hyperthyroidism; diabetes mellitus; ischaemic heart disease, hypertension; angle-closure glaucoma; renal impairment.
- **Epinephrine**: Contraindicated in ring block of digits, penis or other situations where there is risk of local ischaemia. Use with caution in hypertension, atherosclerotic heart disease, cerebral vascular insufficiency, heart block; thyrotoxicosis or diabetes mellitus.

13.04 MUSCLE RELAXANTS USED IN SURGERY

**WHO MODEL FORMULARY 2008 NOTES:**

Muscle relaxants used in surgery are classified according to their mode of action as depolarizing or non-depolarizing neuromuscular blocking drugs. Their use allows abdominal surgery to be carried out under light anaesthesia. They should never be given until it is certain that general anaesthesia has been established and ventilation must be mechanically assisted until they have been completely inactivated. **Suxamethonium** is the only widely used depolarizing muscle relaxant. It produces rapid, complete paralysis, which is very short-lasting in most patients and is of particular value for laryngoscopy and intubation. Should paralysis be prolonged, ventilation must be assisted until muscle function is fully restored. Suxamethonium normally produces a phase I (depolarizing) neuromuscular block. After high doses or prolonged use, the nature of the block changes to a phase II (non-depolarizing) block; this phase II block (also known as dual block) is associated with prolonged neuromuscular blockade and apnoea. [Mercy Ships note: **Alcuronium** is not on Mercy Ships list so WHO notes edited from here, **Atracurium** is available as a non-depolarizing muscle relaxant with duration of action of about 20-30 minutes]. Its effects may be rapidly reversed after surgery by the anticholinesterase neostigmine, provided atropine is given to prevent excessive autonomic activity. **Vecuronium**, a non-depolarizing muscle relaxant, has a shorter duration of action (20-30 minutes); it causes minimal adverse cardiovascular effects.

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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td><strong>Atracurium Besylate Inj 50mg/5ml (Tracrium) [Non-depolarising]</strong></td>
<td>Adult/Child by rapid IV Inj undiluted initially 300-600 micrograms/kg, then 100-200 micrograms/kg if needed; IV infusion 400-600 microgram/kg/hour at 5-10 micrograms/kg/minute, dilute 50mg with 95ml D5/NS to give a solution of 0.5mg/ml concentration.</td>
</tr>
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</table>
### GENERIC (TRADE) NAME

<table>
<thead>
<tr>
<th>Suxamethonium Chloride Inj 50mg/ml, 2ml or 500mg vial [Succinylcholine] (Celocurine) [Depolarising]</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
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</table>
| IDA | Short acting muscle relaxation:  
*By IM inj*, Infant up to 5mg/kg/DOSE; Child up to 4mg/kg; max 150mg.  
*By IV inj*, Adult/Child 1mg/kg, followed if necessary by supplements of 0.5-1mg/kg at 5-10 minute intervals; Infant 2mg/kg.  
Muscle relaxation in prolonged procedures:  
*by IV infusion* (dilute 500mg with 250-500ml D5/NS to give a solution of 1-2mg/ml), Adult 2.5-4mg/minute; max 500 mg/hour; Child reduce infusion rate according to body weight and response. | EML |

| Vecuronium Bromide Inj 4mg/ml or 10mg vial (Norcuron) [Non-depolarising] | IDA | Intubation:  
*By slow IV inj*, Adult & Child > 5 months, initially 80-100 micrograms/kg; maintenance of relaxation 20-30 micrograms/kg; Child up to 4 months, initially 10-20 micrograms/kg, followed by increments according to response.  
Muscle relaxation:  
*by IV infusion*, Adult initial bolus 40-100 micrograms/kg then 0.8-1.4 micrograms/kg/minute.  
For slow IV injection, dilute 4mg in 5-10ml diluent or NS (max 2mg/ml solution), for IV infusion dilute 4mg in 20-40ml D5/NS/RL (max 1mg/ml). | EML |

Note: All non-depolarising and polarising neuromuscular blocking agents should be used only if artificial ventilation for the patient is available.

### COMMENT/CAUTIONS:
- **Suxamethonium contraindications:** Inability to maintain clear airway; history of malignant hyperthermia or congenital myotonic disease; neurological disease involving acute wasting of major muscle, prolonged immobilization (risk of hyperkalaemia); glaucoma, ocular surgery; liver disease; burns; hyperkalaemia. Caution: Atropine must be available as bradyarrhythmias may occur (especially with halothane).
13.05 ANTIMUSCARINICS/ANTICHOLINESTERASES

WHO MODEL FORMULARY 2008 NOTES:

Anticholinergic (more correctly antimuscarinic) drugs such as atropine are also used before general anaesthesia. They inhibit excessive bronchial and salivary secretions induced, in particular, by ether and ketamine. IM administration is most effective, but oral administration is more convenient in children. Lower doses should be used in cardiovascular disease or hyperthyroidism.

REVERSAL OF BLOCK. Cholinesterase inhibitors, such as neostigmine, are used at the end of an operation to reverse the muscle paralysis produced by non-depolarizing blocking drugs, such as alcuronium and vecuronium. Neostigmine must not be used with depolarizing blocking drugs, such as suxamethonium, since neostigmine will prolong the muscle paralysis. Neostigmine is also used to treat postoperative non-obstructive urinary retention.

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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td>Atropine Sulphate Inj 100 micrograms/ml &amp; 1mg/ml [Antimuscarinic]</td>
<td>IDA</td>
<td>Premedication: by SC or IM inj (undiluted) 30-60 minutes before induction, Adult 300-600 microgram Child 20 micrograms/kg (max 600 micrograms); by IV inj (undiluted) immediately before induction, Adult 300-600 micrograms, Child 20 micrograms/kg (max 600 microgram) Intraoperative bradycardia: by slow IV inj (undiluted), Adult 300-600 micrograms (larger dose in emergency), Child 1-12yo 10-20 micrograms/kg. Control of muscarinic side-effects of neostigmine in reversal of competitive neuromuscular block: by IV inj (undiluted 2-3 minutes before neostigmine), Adult 0.6-1.2mg, Child 20 micrograms/kg. Atropine has a shorter duration of action than neostigmine, late unopposed bradycardia may result; need to monitor patient closely.</td>
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<th>GENERIC (TRADE) NAME</th>
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<tbody>
<tr>
<td>Glycopyrronium Bromide Inj 200 micrograms/ml (Robinul) [Glycopyrrolate] [Antimuscarinic]</td>
<td></td>
<td>Premed, intraoperative: by IV/IM inj Adult 200 micrograms (undiluted or IV diluted in D5/NS) to max dose of 400 micrograms, Child by IV inj only 4-8 micrograms/kg to max dose of 200 micrograms. Reversal of non-depolarising neuromuscular block: By IV inj, Adult 200 micrograms per 1 mg of neostigmine; Child 10 micrograms/kg with neostigmine 50 micrograms/kg (may be mixed with neostigmine in syringe).</td>
</tr>
<tr>
<td>Neostigmine Methylsulphate Inj 1mg/ml, 10ml (Prostigmine) [Anticholinesterase]</td>
<td></td>
<td>Reversal of non-depolarizing block: By slow IV inj (undiluted over 1 minute), Adult 0.5-2.5 mg, followed if necessary by supplements of 500 micrograms to maximum total dose of 5 mg; Child 40 micrograms/kg (titrate using peripheral nerve stimulator). To reduce muscarinic effects give atropine sulphate by IV inj Adult 0.6-1.2 mg, Child 20 micrograms/kg, with or before neostigmine. Postoperative urinary retention: By SC/IM inj, Adult 500 micrograms to 1mg, (exclude mechanical obstruction, catheterization required if urine not passed within 1 hour); doses should be repeated every 3 hours for 5 doses after the bladder has been emptied.</td>
</tr>
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</table>

**COMMENT/CAUTIONS:**
- **Neostigmine** acts within 1 minute of IV injection and lasts for 20-30 minutes.
- **Neostigmine** must be used combined with atropine or glycopyrrrolate to prevent muscarinic effects occurring.
13.06 PERI-OPERATIVE MEDICATION

WHO MODEL FORMULARY 2008 NOTES:

Pre-anaesthetic medication is often advisable prior to both conduction and general anaesthetic procedures [but not routine on Mercy Ships as patients may need to be walked to OR on board].

SEDATION. Sedatives improve the course of subsequent anaesthesia in apprehensive patients. Diazepam and promethazine are effective. **Diazepam** can be administered by mouth, by rectum, or by intravenous injection. **Promethazine**, which has antihistaminic and antiemetic properties as well as a sedative effect, is of particular value in children. [Mercy Ships note: Midazolam is available on Mercy Ships list and should be considered.]

ANALGESIA. A potent analgesic such as **morphine** (section 5.02) should be administered preoperatively to patients in severe pain or for analgesia during and after surgery.

FLUIDS. Fluid requirements must be assessed before, during and after major surgery. Replacement fluids should correspond as nearly as possible in volume and composition to those lost.

**Blood transfusion** is essential to restore oxygen-carrying capacity when more than 15% of the circulating blood volume is lost but should be avoided whenever screening for human immunodeficiency viruses and hepatitis B virus is impracticable.

Isotonic sodium chloride solution may be used for short-term volume replacement. Plasma expanders such as dextran 70 or polygeline may be useful (section 8.04). Provided renal function is maintained, fluid is most simply replaced by IV **sodium chloride solution** (sodium chloride 9mg/ml, 0.9%) or the more physiologically appropriate **compound solution of sodium lactate** (section 8.03).

In emergency cases, there is usually an existing fluid deficit, which must be assessed and corrected before surgery. Isotonic **glucose/sodium chloride** mixtures (most commonly glucose 4%/ sodium chloride 0.18%) are preferred in children to avoid the danger of sodium overload and hypoglycaemia. When fluids are administered IV for more than 24 hours, potassium chloride is required to prevent potassium depletion. In order to avoid serious arrhythmias (especially in impaired renal function) the required dose of potassium should be determined, whenever possible, by monitoring plasma concentrations of potassium.
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<th>GENERIC (TRADE) NAME</th>
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<tr>
<td>Dantrolene Inj 20mg vial or Infusion 20mg/70ml (Dantrium)</td>
<td></td>
<td>Malignant hyperthermia: <em>By rapid IV injection</em>, 1mg/kg repeat as required until symptoms subside or to a cumulative max dose of 10mg/kg. Reconstitute 20mg vial in 60ml WFI, shake well to give 0.33mg/ml solution, keep at 15-30°C, protect from direct light and use within 6 hours following reconstitution.</td>
</tr>
<tr>
<td>Dehydrobenzperidol Inj 2.5mg/ml, 2ml (Droperidol)</td>
<td></td>
<td>Note. Use only in patients for whom other treatments are ineffective or inappropriate. Max recommended initial dose is 2.5mg <em>by slow IV/IM inj</em>. Additional 1.25mg doses must be administered with caution due to the potential risk for cardiac arrhythmias. Premedication: <em>By slow IV/IM inj</em> 2.5mg 30-60 minutes before surgery. See product leaflet and current guidelines for details. May be diluted to a convenient volume in D5/NS/RL.</td>
</tr>
<tr>
<td>Diazepam Tab 5mg Inj 5mg/ml, 2ml (Valium)</td>
<td>PS MSL IDA EML</td>
<td>Premedication: Adult &amp; Child &gt; 12yo, <em>by mouth</em> 2 hours before surgery, 5-10mg. Sedation: <em>By slow IV inj</em> undiluted over 2-4 minutes into a large vein just before surgery, Adult &amp; Child &gt; 12 yo, 200micrograms/kg. Avoid IM route – unreliable absorption.</td>
</tr>
<tr>
<td>Midzolam Inj 5mg/ml, 3ml (Dormicum/Hypnovel)</td>
<td>PS EML</td>
<td><em>By slow IV inj</em> undiluted or diluted in D5/NS/RL given over 2-5 minutes, Conscious sedation: Adult initially 2.5mg (elderly 0.5-1mg); usual range 3.5-7.5mg (elderly max 3.5mg); Child 6 month-5 yo initially 50-100 micrograms/kg, dose increased if necessary in small steps (max total dose 6mg); 6-12 yo initially 25-50 micrograms/kg, increase dose increase if needed in small steps (max total dose 10mg). Give dose 15 minutes before procedure. MONITOR for rapid respiratory depression; emergency resuscitation equipment must be available.</td>
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N/CD – Drugs subject to international control under the Single Convention on Narcotic Drugs (1961).
PS – Drugs subject to international control under the Convention on Psychotropic Substances (1971).

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<tr>
<td>Morphine Sulphate Inj 10mg/ml [Opiates]</td>
<td>N/CD</td>
<td>Premedication 1 hour before surgery: Adult <em>by SC/IM inj</em> undiluted 150-200 micrograms/kg; Child <em>by IM inj</em> undiluted 50-100 micrograms/kg. Intra-operative analgesia: <em>By IV inj</em>, Adult/Child 100 micrograms/kg, repeat every 40–60 minutes if need. Postoperative analgesia: <em>By IM inj</em> undiluted, Adult 150–300 micrograms/kg every 4 hours, Child 100-200 micrograms/kg; or <em>by IV infusion</em> Adult 8-10 mg over 30 minutes, then 2-2.5 mg/hour. Inject slow IV over 5 minutes, dilute 10mg in 5-10ml WFI, for IV infusion dilute 10mg in 50-100ml of D5/NS.</td>
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<td>MSL</td>
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<tr>
<td>Promethazine Hydrochloride Tab 25mg, Syrup 5mg/5ml, Inj 25mg/ml [Phenergan]</td>
<td>MSL</td>
<td>Premedication: <em>By mouth</em> 1 hour before surgery, Child &gt; 1yo 0.5-1mg/kg, or 2-5 yo 15-20mg, 5-10 yo 20-25mg. <em>By deep IM inj</em> 1 hour before surgery, Adult 25mg.</td>
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<td>IDA</td>
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**COMMENT/CAUTIONS:**
- **PS** Psychotropic Substances. Recording required in pharmacy/ward/OR.

**NOTE.** For Antiemetics, see Chapter 01 Gastrointestinal System Section 1.02.

**NOTE.** For Flumazenil for reversal of sedative effects of benzodiazepines see Chapter 14 Antidotes & Diagnostic Agents Section 14.01 Antidotes.

**NOTE.** For NSAIDs & Paracetamol, see Chapter 05 Musculoskeletal System Section 5.01 Non-opioid analgesics.
14 ANTIDOTES & DIAGNOSTIC AGENTS

14.01 ANTIDOTES

WHO MODEL FORMULARY 2008 NOTES:

These notes are only guidelines and it is strongly recommended that poisons information centres be consulted in cases where there is doubt about the degree of risk or about appropriate management.

GENERAL CARE AND NON-SPECIFIC TREATMENT

All patients who show features of poisoning should generally be admitted to hospital. Patients who have taken poisons with delayed actions should also be admitted, even if they appear well; delayed-action poisons include acetylsalicylic acid, iron, lithium, paracetamol, paraquat, tricyclic antidepressants and warfarin. The effects of modified-release or prolonged-release preparations are also delayed. However, it is often impossible to establish with certainty the identity of the poison and the size of the dose but information on the type and timing of poisoning may be useful for symptomatic management. Few patients require active removal of the poison.

Most patients must be treated symptomatically and monitored. Particular care must be given to maintenance of respiration and blood pressure. Assisted ventilation may be required. Cardiac conduction defects and arrhythmias often respond to correction of underlying hypoxia, acidosis, or other biochemical abnormalities. Hypothermia which may develop in patients who have been unconscious for some hours is best treated by wrapping the patient in blankets to conserve body heat. Convulsions which are prolonged or recurrent may be controlled by IV diazepam. In rare situations removal of the poison from the stomach by gastric lavage may be appropriate (see below). Activated charcoal can bind many poisons in the stomach and therefore prevent absorption. Active elimination techniques such as repeated administration of activated charcoal can enhance the elimination of some drugs after they have been absorbed (see below). Other techniques to enhance elimination of poisons after their absorption are only practical in hospital and are only suitable for a small number of patients and only to a limited number of poisons. Methods include haemodialysis and haemoperfusion. Alkalinization of urine can be used to increase the elimination of salicylates. Forced alkaline diuresis is no longer recommended.
GASTRIC LAVAGE. Gastric lavage is rarely required and should only be considered if a life threatening amount of a substance that cannot be removed effectively by other means (for example, iron), has been ingested within the last hour. Gastric emptying is clearly unnecessary if the risk of toxicity is small or if the patient presents too late. The main risk is with inhalation of stomach contents and gastric lavage should not be undertaken unless the airways can be protected adequately. Gastric lavage must not be attempted after corrosive poisoning or for hydrocarbon products which could be dangerous if aspirated.

EMESIS. Induction of emesis for the treatment of poisoning is not recommended. There is no evidence that it prevents absorption of the poison and it may increase the likelihood of aspiration. Furthermore, the effects of the emetic substance may complicate diagnosis.

PREVENTION OF ABSORPTION. Given by mouth activated charcoal can bind many poisons in the gastrointestinal system, thereby reducing their absorption. The sooner it is given, the more effective it is, but it may be effective for up to 1 hour after ingestion of the poison. It may be effective several hours after poisoning with modified-release preparations or drugs with anticholinergic (antimuscarinic) properties. It is relatively safe and particularly useful for prevention of absorption of poisons which are toxic in small amounts, for example, antidepressants. Furthermore, repeated doses of activated charcoal enhance the faecal elimination of some drugs (that undergo enterohepatic or enteroenteric recycling) several hours after ingestion and after they have been absorbed, for example phenobarbital, theophylline.

SPECIFIC ANTIDOTES

PARACETAMOL OVERDOSAGE. As little as 10-15 g (around 20-30 tablets) or 150 mg/kg of paracetamol taken within 24 hours may cause severe hepatocellular necrosis and less frequently renal tubular necrosis. The only early features of poisoning, nausea and vomiting, usually settle within 24 hours. Persistence beyond this time, often with the onset of right subcostal pain and tenderness, usually indicates the development of liver damage which is maximal 3-4 days after ingestion. In spite of a lack of significant early symptoms, patients who have taken an overdose of paracetamol should be transferred to hospital urgently. Administration of activated charcoal should be considered if paracetamol in excess of 150 mg/kg or 12 g, whichever is smaller, is thought to have been ingested within the previous hour. Acetylcysteine protects the liver if given within 24 hours of ingesting paracetamol. Acetylcysteine, given intravenously is most effective within 8 hours of overdosage, but is effective for up to and possibly beyond 24 hours. Alternatively, in remote areas, if acetylcysteine cannot be given promptly, methionine [not on Mercy Ships list] may be given by mouth provided the overdose was ingested within 10-12 hours and the patient is not vomiting. However, acetylcysteine is the preferred
treatment. Concurrent use of activated charcoal and specific oral antidotes should be avoided. Once the patient is in hospital the need to continue antidote treatment can be assessed from plasma-paracetamol concentrations.

**OPIOID ANALGESIC OVERDOSAGE.** Opioids cause coma, respiratory depression and pinpoint pupils. **Naloxone** is a specific antidote indicated if there is coma or bradypnoea. Naloxone has a shorter duration of action than many opioids so close monitoring and repeated injections are required depending on respiratory rate and depth of coma; naloxone may alternatively be given by continuous intravenous infusion and the rate of infusion adjusted according to vital signs. The effects of some opioids such as buprenorphine are only partially reversed by naloxone. Methadone has a very long duration of action and patients may need to be monitored for long periods after large overdoses. Acute withdrawal syndromes may be precipitated by the use of naloxone in patients with a physical dependence on opioids or in overdosage with large doses; a withdrawal syndrome may occur in neonates of opioid-dependent mothers.

**ORGANOPHOSPHATE AND CARBAMATE POISONING.** Organophosphates are absorbed through the bronchi and intact skin as well as from the gastrointestinal tract. Initial treatment of organophosphate or carbamate poisoning includes prevention of further absorption by emptying the stomach by moving patient to fresh air supply, removing contaminated clothing and washing contaminated skin. A clear airway must be maintained. Gastric lavage may be considered if the airway is protected. Organophosphates inhibit cholinesterases and thus prolong the effects of acetylcholine. Toxicity depends on the particular compound involved, and onset after skin exposure may be delayed. **Atropine** will reverse the muscarinic effects of acetylcholine and is used (in conjunction with oximes such as pralidoxime) with additional symptomatic treatment. Additional treatment for carbamate poisoning is generally symptomatic and supportive. **Atropine** may be given but may not be required because of the rapidly reversible type of cholinesterase inhibition produced.

**METHAEMOGLOBINAEMIA.** **Methylthioninium chloride** can lower the levels of methaemoglobin in red blood cells and is used in the treatment of methaemoglobinaemia. In large doses, it may cause methaemoglobinemia and therefore methaemoglobin levels should be monitored during treatment.
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acetylcysteine Inj 200mg/ml, 10ml (Parvolex)</strong></td>
<td>EML</td>
<td>Paracetamol (Acetaminophen) poisoning: <em>by IV infusion</em> (reduce volume in children if needed to avoid fluid overload), Adult/Child, initial dose 150mg/kg over 15 minutes, then 50mg/kg over 4 hours then 100mg/kg over 16 hours. Dilute requisite dose in glucose 5% (D5) IV infusion as follows: Adult &amp; Child &gt; 12yo initially 200ml given over 15 minutes, then 500ml over 4 hours, then 1000ml over 16 hours. Child &lt; 12yo body weight &gt; 20kg, initially 100ml given over 15 minutes, then 250ml over 4 hours, then 500ml over 16 hours. Child body-weight under 20kg, initially 3ml/kg given over 15 minutes, then 7ml/kg over 4 hours, then 14ml/kg over 16 hours. NOTE: Give within 24 HOURS of ingestion, for its use beyond that time period seek expert advice.</td>
</tr>
<tr>
<td><strong>Atropine Sulphate Inj 100micrograms/ml, 1mg/ml</strong></td>
<td>IDA</td>
<td>Organophosphate poisoning: <em>By IM or IV inj</em> (undiluted) Adult 2mg (Child 20 micrograms/kg) every 5-10 minutes until the skin becomes flushed and dry, the pupil dilates and tachycardia develops. Control of muscarinic side effects of neostigmine in reversal of neuromuscular block: <em>By slow IV inj</em> (undiluted) 0.6-1.2mg</td>
</tr>
<tr>
<td></td>
<td>EML</td>
<td></td>
</tr>
<tr>
<td>GENERIC (TRADE) NAME</td>
<td>CAT.</td>
<td>INDICATION/DOSE</td>
</tr>
<tr>
<td>----------------------</td>
<td>------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Charcoal Powder, Activated 300g</td>
<td>IDA</td>
<td>Reduction of absorption of poisons that are toxic in small amounts (especially aspirin, carbamazepine, dapsone, phenobarbitone, quinine, and theophylline): <em>by mouth</em> Adult 50-100g single dose mixed in 100ml of water initially, then 25-50g every 4-6 hours if needed; Child 1-12 yo give half adult dose, Infant 1g/kg as a single dose then every 4-6 hours. NOTE: Give within 1-2 HOURS of ingestion, or within 4 hours for salicylates/sustained-release drugs.</td>
</tr>
<tr>
<td>Flumazenil Inj 0.5mg/ 5ml (Anexate)</td>
<td>EML</td>
<td>Reversal of sedative effects of benzodiazepines in anaesthesia/ICU: Adult, <em>by slow IV inj</em> 0.2mg (undiluted over 15 seconds), then 0.1-0.2mg every 1 minute if needed, usual range 0.3-0.6mg; max total dose 1mg (2mg in intensive care). Same dosing regimen if resedation occurs (flumazenil has short duration of action), to max 3mg in a one-hour period, or give <em>IV infusion</em> in D5/NS/RL via a large vein 0.1-0.4mg/hour according to level of arousal. Child, <em>by slow IV</em> 10 micrograms/kg (max 0.2mg) inject over 15 seconds, repeat at one-minute intervals up to max 5 doses; or <em>by IV infusion</em> in D5/NS/RL 5-10micrograms/kg/hour.</td>
</tr>
<tr>
<td>Methylthioninium Chloride Inj 1% 10mg/ml (Methylene Blue)</td>
<td>EML</td>
<td>Acute methaemoglobinaemia: <em>by slow IV inj</em> over several minutes, Adult/Child 1-2 mg/kg as a single dose; repeat after 1 hour if needed.</td>
</tr>
<tr>
<td>GENERIC (TRADE) NAME</td>
<td>CAT.</td>
<td>INDICATION/DOSE</td>
</tr>
<tr>
<td>----------------------</td>
<td>------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Naloxone Hydrochloride Inj 0.4mg/ml, 5ml (Narcan)</td>
<td>IDA</td>
<td>Overdosage with opioids: Adult <em>by IV inj</em> undiluted 0.4-2mg every 2-3 minutes to max 10mg or <em>by IV infusion</em> using an infusion pump 10mg diluted in 50ml D5, titrate infusion rate to response, if respiratory function does not improve question diagnosis; Child 10 micrograms/kg, then a subsequent dose of 100 micrograms/kg if no response. Reversal of opioid-induced respiratory depression: Adult <em>by IV inj</em> 1.5-3 micrograms/kg or 100-200 micrograms; if needed give incremental doses of 100 micrograms every 2 minutes, titrate to response, be careful to avoid interference with pain control. Child, <em>by IV inj</em> 5-10 micrograms every 2-3 minutes until adequate ventilation and alertness without significant pain obtained. If needed repeat dose every 1-2 hours.</td>
</tr>
<tr>
<td>Protamine Sulphate Inj 10mg/ml, 5ml (Prosulf)</td>
<td>IDA</td>
<td>Heparin overdose: By slow IV Inj (undiluted or dilute in D5/NS) over 10 minutes, 1mg neutralises 80-100 units heparin when given within 15 minutes; if longer time, less protamine needed (heparin is rapidly excreted); max total dose 50mg.</td>
</tr>
</tbody>
</table>

**COMMENT/CAUTIONS:**

- It is often impossible to establish with certainty the identity of the poison and the dosage, but few poisons have specific antidotes and most patients must be treated symptomatically.

- **Charcoal**: contraindicated in poisoning by hydrocarbons (harm if aspirated) or corrosive substances (may prevent visualization of lesions); use with caution in drowsy or unconscious patients (risk of aspiration, intubate before administration via nasogastric or gastric tube); not effective for poisoning with alcohols, clofenotane (dicophane, DDT), cyanides, malathion and metal salts.
14.02 DIAGNOSTIC AGENTS

WHO MODEL FORMULARY 2008 NOTES:

Radiographic contrast media are needed for delineating soft tissue structures such as blood vessels, stomach, bowel loops and body cavities not otherwise visualized by standard X-ray examination. The contrast media in this group containing heavy atoms (metal or iodine) absorb a significantly different amount of X-rays than the surrounding soft tissue, thereby making the examined structures visible on radiographs.

**Barium sulfate** is a metal salt which is used to delineate the gastrointestinal tract. It is not absorbed by the body and does not interfere with stomach or bowel secretion or produce misleading radiographic artefacts. Barium sulfate may be used in either single- or double-contrast techniques or computer-assisted axial tomography. For double contrast examination gas can be introduced into the gastrointestinal tract by using suspensions of barium sulfate containing carbon dioxide or by using separate gas-producing preparations based on sodium bicarbonate. Air administered through a gastrointestinal tube can be used as an alternative to carbon dioxide to achieve a double-contrast effect.

**Amidotrizoates** (meglumine amidotrizoate and sodium amidotrizoate) are iodinated ionic monomeric organic compounds. Both salts have been used alone in diagnostic radiography including computer-assisted axial tomography but a mixture of both is often preferred to minimize adverse effects and to improve the quality of the examination. Amidotrizoates are used in a wide range of procedures including urography and examination of the gallbladder, biliary ducts and spleen. Owing to their high osmolality and the resulting hypertonic solutions, they are associated with a high incidence of adverse effects. Radiodensity depends on iodine concentration, and osmolality depends on number of particles in a given weight of solvent. The osmolality for a given radiodensity can be reduced by using an ionic dimeric medium such as meglumine iotroxate (not available on the Mercy Ships list) which contains twice the number of iodine atoms in a molecule or by using a non-ionic medium such as iohexol [or ioversol on Mercy Ships list]. Low osmolality media such as iohexol (and ioversol) are associated with a reduction in some adverse effects (see below), but they are generally more expensive. Iohexol is used for a wide range of diagnostic procedures including urography, angiography and arthrography and also in computer-assisted axial tomography.

ANAPHYLACTOID REACTIONS to iodinated radiocontrast media are more common with ionic, high osmolality compounds. Patients with a history of asthma or allergy, drug hypersensitivity, adrenal suppression, heart disease, previous reaction to contrast media, and those receiving beta-blockers are at increased risk. Non-ionic media are preferred for these patients and beta-blockers should be discontinued if possible.
<table>
<thead>
<tr>
<th>GENERIC (TRADE) NAME</th>
<th>CAT.</th>
<th>INDICATION/DOSE</th>
</tr>
</thead>
</table>
| Amidotrizoate sodium (76%)
760mg/ml Solution (Urografin) |
[Radiocontrast media – iodinated] |
**NOTE:** Anaphylaxis risk, observe patients for 30-60 minutes after administration, ensure presence of emergency equipment. |
| IDA | Diagnostic radiography, adult/child: Route and dosage depend on procedure and preparation used. Ensure adequate hydration before and after administration to prevent possible renal failure. Avoid in manifest hyperthyroidism or iodine sensitivity. See product leaflet for dose details. Only by specialist radiographers. |
| | EML |  |
| Diatrizoate sodium 100mg (10%) with meglumine 660mg (66%) per ml Solution (Gastrografin) |
[Radiocontrast media – iodinated] (Iodine content 370mg/ml) |
**NOTE:** Anaphylaxis risk, observe patients for 30-60 minutes after administration, ensure presence of emergency equipment. |
| | EML | For examination of gastrointestinal tract. May be used in patients with risk of obstruction/perforation. Ensure adequate hydration before and after administration. Avoid in manifest hyperthyroidism or iodine sensitivity. See product leaflet for dose details. Only by specialist radiographers.  
 NOTE: Gastrografin must NOT be used by the intravascular or intrathecal route. |
| Iohexol 240mg I/ml or 300mg I/ml (Omnipaque 240 or 300) |
[Radiocontrast media – iodinated] (Iodine content 240mg/ml and 300mg/ml respectively) |
**NOTE:** Anaphylaxis risk, observe patients for 30-60 minutes after administration, ensure presence of emergency equipment. |
| | EML | X-ray & CT scan contrast medium. Ensure adequate hydration before and after administration to prevent possible renal failure. Avoid in manifest hyperthyroidism or iodine sensitivity. 
 IV, intra-arterial, intrathecal, oral, rectal use. (See Cautions page 209). 
 See product leaflet for dose details. Only by specialist radiographers. |

*Cont. next page*


### GENERIC (TRADE) NAME

**Ioversol 240mg I/ml or 300mg I/ml (Optiray 240 or 300)**

**[Radiocontrast media-iodinated]**

(iodine content 240mg/ml and 300mg/ml respectively)

**NOTE:** Anaphylaxis risk, observe patients for 30-60 minutes after administration, ensure presence of emergency equipment.

X-ray & CT scan contrast medium. Ensure adequate hydration before and after administration to prevent possible renal failure. Avoid in manifest hyperthyroidism or iodine sensitivity.

IV or intra-arterial route. NOTE: Optiray must NOT be used by the intrathecal route.

See product leaflet for dose details. Only by specialist radiographers.

**Methylthioninium Chloride Inj 1% or 10mg/ml (Methylene Blue)**

As dye in diagnostic procedures such as fistula detection and for delineation of certain body tissues during surgery.

**Tuberculin PPD Inj, Purified 100iu/ml (Mantoux test, Monotest)**

Routine Mantoux tuberculosis test: Adult/Child 5-10 units (0.05-0.1ml) intradermally, preferably at the flexor surface of the forearm, and examined 48-72 hours later. See product leaflet for detail.

### COMMENT/CAUTIONS:

- **Radiocontrast Media:** Anaphylactoid reactions to iodinated radiocontrast media are more common with high osmolality compounds. Patients with a history of asthma or allergy, drug hypersensitivity, adrenal suppression, heart disease, previous reaction to contrast media, and those receiving beta-blockers are at increased risk. Non-ionic media are preferred for these patients and beta-blockers should be discontinued if possible.

- **Radiocontrast Media:** For patients on biguanides, withdraw biguanides 48 hours before and after administration except in emergent situations where withholding 48 hours after administration is acceptable; restart biguanides only when renal function is stabilised.

- **Iohexol (Omnipaque):** Iohexol is also approved for use in other body cavities such as the urinary bladder (cystograms), uterus and fallopian tubes, bladder/bile ducts, joints etc. Please refer to the specialist radiographer and/or see product leaflet for further details.

*Cont. next page*
COMMENT/CAUTIONS (CONT.):

- **Tuberculin/Mantoux Test:** The *tuberculin test* has limited diagnostic value. A positive tuberculin test indicates previous exposure to mycobacterial antigens through infection with one of the tubercle bacilli, or BCG vaccination. The tuberculin test does not distinguish between tuberculosis and other mycobacterial infection, between active and quiescent disease, or between acquired infection and seroconversion induced by BCG vaccination.

- **Opened vials of tuberculin PPD** should be discarded after 1 month of use.
APPENDIX I

GENERAL INFORMATION ON PRESCRIBING IN CHILDREN

Many drugs used in children are used outside the recommendations of the Summary of Product Characteristic (Data Sheet) i.e. manufacturer’s license. Prescribers must therefore take full responsibility for prescribing outside any licensed dosage, indication & age range.

- Calculating Paediatric Doses (some parts edited from WHO Formulary notes):

**Body weight** may be used to calculate doses expressed in mg/kg. Young children may require a higher dose per kilogram than adults because of their proportionately higher metabolic capacity. Other problems need to be considered. For example, calculation by body weight in an obese child may result in much higher doses being administered than necessary; in such cases, dose should be calculated from an ideal weight, related to height and age.

**Body surface area (BSA) estimates** are more accurate for calculation of paediatric doses than body weight because many physiological phenomena correlate better with body surface area. The average body surface area of a 70-kilogram human is about 1.8 m$^2$. Thus, to calculate the dose for a child the following formula may be used:

\[
\text{Approximate dose for patient} = \text{surface area of child (m}^2\text{)} \times \frac{\text{adult dose}}{1.8}
\]

Nomograms are available to allow more precise body surface values to be calculated from a child’s height and weight (see next page).

Where the dose for children is not readily available, prescribers should seek specialist advice before prescribing for a child.

**Definitions of Age (as a guideline only):**

<table>
<thead>
<tr>
<th>Age</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature baby</td>
<td>Born before 37 weeks gestation</td>
</tr>
<tr>
<td>Term baby</td>
<td>Born at 37-42 weeks gestation</td>
</tr>
<tr>
<td>Neonate</td>
<td>First 4 weeks of life</td>
</tr>
<tr>
<td>Infant</td>
<td>Up to 1 year of age</td>
</tr>
<tr>
<td>Child</td>
<td>From 1-12 to 16 years of age</td>
</tr>
</tbody>
</table>
## Appendix I – Prescribing in Children

<table>
<thead>
<tr>
<th>AGE</th>
<th>MEAN WEIGHT (KG)</th>
<th>MEAN HEIGHT (CM)</th>
<th>MEAN SURFACE AREA (M²)</th>
<th>% OF ADULT DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn (full term)</td>
<td>3.5</td>
<td>50</td>
<td>0.23</td>
<td>12</td>
</tr>
<tr>
<td>1 month</td>
<td>4.2</td>
<td>55</td>
<td>0.26</td>
<td>14.5</td>
</tr>
<tr>
<td>3 months</td>
<td>5.6</td>
<td>59</td>
<td>0.32</td>
<td>18</td>
</tr>
<tr>
<td>6 months</td>
<td>7.7</td>
<td>67</td>
<td>0.40</td>
<td>22</td>
</tr>
<tr>
<td>1 year</td>
<td>10</td>
<td>76</td>
<td>0.47</td>
<td>25</td>
</tr>
<tr>
<td>3 years</td>
<td>15</td>
<td>94</td>
<td>0.62</td>
<td>33</td>
</tr>
<tr>
<td>5 years</td>
<td>18</td>
<td>108</td>
<td>0.73</td>
<td>40</td>
</tr>
<tr>
<td>7 years</td>
<td>23</td>
<td>120</td>
<td>0.88</td>
<td>50</td>
</tr>
<tr>
<td>10 years</td>
<td>30</td>
<td>143</td>
<td>1.10</td>
<td>60</td>
</tr>
<tr>
<td>12 years</td>
<td>39</td>
<td>148</td>
<td>1.25</td>
<td>75</td>
</tr>
<tr>
<td>14 years</td>
<td>50</td>
<td>160</td>
<td>1.50</td>
<td>80</td>
</tr>
<tr>
<td>Adult - female</td>
<td>56</td>
<td>163</td>
<td>1.60</td>
<td>100</td>
</tr>
<tr>
<td>Adult - male</td>
<td>68</td>
<td>173</td>
<td>1.80</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: Estimated Surface Area (m²)  
= Squared Root [Height (cm) x (Weight (kg) /3600)]

NOTE: The figures above are from European statistics, it is recommended to use weight instead of age as a calculation basis for application in African patients. The figures relate to full term and not preterm (premature) infants who may need reduced dosage according to clinical condition.

### Drug Administration and Prescribing in Children:

- Parents must be warned to keep all medicines out of the reach of children.

- **STATE DOSAGE STRENGTH AND DOSE CLEARLY** to avoid over- or under-dosage. For example, paracetamol oral liquid may come in two strengths: 120mg/5ml or 250mg/5ml. Prescribing in volume (e.g. 5ml tds) can thus lead to paracetamol toxicity in young children.

- The parenteral route for children is the most reliable to obtain predictable blood levels. The painful intramuscular route should be avoided in children wherever possible.

- Parenteral doses must be prepared with care, with small volumes measured using graduated syringes or by dilution of injection. When reconstituting freeze-dried injections, the displacement value (i.e. volume of fluid displaced by powder) must be taken into account, especially if part vials are used, otherwise significant errors in the dose drawn up may result.
• The oral route is usually the easiest and most convenient, especially in long-term treatment. Dosage forms (e.g. liquid or tablet) appropriate for administration to different age ranges should be prescribed where possible.

• Oral syringes should be used with liquid oral preparations esp. for doses of less than 5ml.

• Do not mix medications with milk or other oral fluids unless otherwise directed, as there may be drug interactions, dosing errors or wastage if the child does not drink all the contents.

• Some liquid preparations contain sugar – to avoid dental decay teach the child to rinse orally with water after dosing, or wipe the child’s mouth with a clean wet cloth.

• Some flexibility should be allowed in children for drugs with frequent dosing intervals (such as more often than every 6 hourly) to avoid waking them during the night. E.g. night-time dose may be given at parent’s bedtime.

• **Adult Fingertip units (FTU) for topical corticosteroids used in children:**

  - One FTU is equivalent to the amount of ointment expressed from a tube with a 5mm nozzle, applied from the distal crease to the tip, of the palm side of the index finger.

<table>
<thead>
<tr>
<th>AGE</th>
<th>Face &amp; Neck</th>
<th>Arm &amp; Hand</th>
<th>Leg &amp; Foot</th>
<th>Trunk (Front)</th>
<th>Trunk (Back) inc. Buttocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-6 mth</td>
<td>1</td>
<td>1</td>
<td>1.5</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>1-2 yrs</td>
<td>1.5</td>
<td>1.5</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3-5 yrs</td>
<td>1.5</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>6-10 yrs</td>
<td>2</td>
<td>2.5</td>
<td>4.5</td>
<td>3.5</td>
<td>5</td>
</tr>
</tbody>
</table>

**NOTE.** Adapted from the University of Wales College of Medicine Dermatology Guidelines (1998).
WHO MODEL FORMULARY 2008 NOTES – Inhaler Technique:

INHALER USAGE. Main advantage - high concentrations can be delivered more effectively and rapidly to the airways and systemic adverse effects avoided or minimized. It is important that patients receive careful instruction in the use of pressurized (aerosol) inhalation (using a metered-dose inhaler) to obtain optimum results. Before use, the inhaler should be shaken well. After exhaling as completely as possible, the mouthpiece of the inhaler should be placed well into the mouth and the lips firmly closed around it. The patient should inhale deeply through the mouth while actuating the inhaler. After holding the breath for 10 seconds or as long as is comfortable, the mouthpiece should be removed and the patient should exhale slowly.

It is important to check that patients continue to use their inhalers correctly as inadequate technique may be mistaken for drug failure. Spacing devices provide a space between the inhaler and the mouth. They may be of benefit for patients such as the elderly, small children and the asthmatic who find inhalers difficult to use or for those who have difficulty synchronizing their breathing with administration of the aerosol. A large volume spacing device is also recommended for inhalation of high doses of corticosteroids to reduce oropharyngeal deposition which can cause candidosis. The use of metered-dose inhalers with spacers is less expensive and may be as effective as use of nebulizers, although drug delivery may be affected by choice of spacing device. Breath-actuated devices including dry powder inhalers are also available.

• Choice of Inhaler Devices for Children:

<table>
<thead>
<tr>
<th></th>
<th>1-2 years of age</th>
<th>3-5 years</th>
<th>&gt; 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDI + Large volume spacer + mask</td>
<td>1st Choice</td>
<td>2nd Choice</td>
<td>-</td>
</tr>
<tr>
<td>MDI + Large volume spacer</td>
<td>2nd Choice</td>
<td>1st Choice</td>
<td>2nd Choice</td>
</tr>
<tr>
<td>Dry Powder Inhaler (e.g. Turbohaler)</td>
<td>Inappropriate</td>
<td>Occasionally useful</td>
<td>1st Choice</td>
</tr>
</tbody>
</table>

NOTE. Adapted from the British Thoracic Society Guidelines on Asthma Management (1997).
APPENDIX II

GENERAL INFORMATION ON PRESCRIBING IN PREGNANCY & LACTATION

Extra care is required when prescribing during pregnancy and lactation because of the potentially harmful effects of drugs on the fetus in-utero and the breast-fed infant. While most attention has been focused on teratogenic effects of drugs in the early weeks of pregnancy when fetal tissues are forming, the growth and functional development of fetal organs can be affected by some drugs throughout the pregnancy, while drugs administered in late pregnancy and labour may have persisting adverse effects on the newborn infant. Although relatively few drugs have been shown beyond a doubt to be harmful, no drug is entirely safe and as with all prescribing, risks and benefits must be balanced.

On the other hand you will frequently be required to reassure pregnant patients prescribed essential medications and those who have inadvertently taken drugs without realising they were pregnant at the time. This reassurance would be given where appropriate bearing in mind that it is never possible to guarantee a normal outcome in any pregnancy.

The advisability of breast-feeding should be discussed in advance antenatally with patients who will have to continue to take necessary drugs after delivery. It is most important that breast-feeding should not be discouraged unless there is a very good reason.

It must be remembered that many drugs that may be taken by pregnant women are available without prescription (‘over-the-counter’ drugs), such as cough mixtures, analgesics and anti-diarrhoeal agents. Others such as alcohol and cigarette smoking may not be perceived as drugs by the patient. Pregnant and lactating patients should be warned (and indeed the general population) of these potential dangers.
POINTS TO NOTE:

- Prescribing for any woman in the reproductive age group should also take into account the possibility that she might be or become pregnant during the treatment.

- During pregnancy the mother and the fetus form a non-separable functional unit. Maternal well-being is an absolute prerequisite for the optimal functioning and development of both parts of this unit. Consequently, it is important to treat the mother whenever needed while protecting the unborn to the greatest possible extent.

- It is important to know the ‘background risk’ in the context of the prevalence of drug-induced adverse pregnancy outcomes. Major congenital malformations occur in 2-4% of all live births. Up to 15% of all diagnosed pregnancies will result in fetal loss. The cause of these adverse pregnancy outcomes is understood in only a minority of the incidents.

- When a pregnancy is confirmed existing medications taken by the patient should be reviewed. Cessation of therapy, a dose reduction, or change of preparation might be available.

- Where drug therapy is essential, use wherever possible well known preparations whose safety in pregnancy has been reasonably established and reassure the patient about the use of these essential medications. Breast-feeding in this situation should be discussed in advance antenatally.

- Avoid all non-essential drug prescribing during pregnancy and educate the patient about the potential hazards of non-essential drug therapy including non-prescription drugs, excessive alcohol consumption, and cigarette smoking.

- Report adverse drugs reactions in pregnancy in and lactation.

The following WHO list includes 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 newer drugs when its omission might be misleading.

Absence of a drug from the list does not imply safety.
### Table of drugs to be avoided or used with caution in pregnancy:
( WHO Model Formulary 2008)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Comment</th>
</tr>
</thead>
</table>
| Acetazolamide               | Not used to treat hypertension in pregnancy  
  First trimester: Avoid (toxicity in animal studies)                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 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 of newborn; kernicterus in jaundiced neonates  
  First trimester: Avoid (toxicity in animal studies)                                                                                                                                                                                                                                                                                                                                                                                                 |
| Aciclovir                   | Not known to be harmful; limited absorption from topical preparations                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Albendazole                 | Contraindicated in cestode infections; see section 6.05  
  First trimester: avoid in nematode infections; see section 6.05                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Alcohol                     | First, second trimesters: Regular daily drinking is teratogenic (fetal alcohol syndrome) and may cause growth retardation; occasional single drinks are probably safe  
  Third trimester: Withdrawal may occur in babies of alcoholic mothers                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Allopurinol                 | Toxicity not reported; use only if no safer alternative and disease carries risk for mother or child                                                                                                                                                                                                                                                                                                                                                                                                  |
| Aminophylline               | Third trimester: Neonatal irritability and apnoea have been reported                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Amitriptyline               | Manufacturer advises avoid unless essential, particularly during first and third trimesters                                                                                                                                                                                                                                                                                                                                                                                                     |
| Amlodipine                  | No information on use in humans; risk to fetus should be balanced against risk of uncontrolled                                                                                                                                                                                                                                                                                                                                                                                                    |
| Amoxicillin                 | Not known to be harmful                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Amoxicillin + Clavulanic acid| Not known to be harmful                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Ampicillin                  | Not known to be harmful                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Amphotericin B              | Not known to be harmful but use only if potential benefit outweighs risk                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Artemether                  | First trimester: Avoid                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Artemether + Lumefantrine   | See Artemether                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Artesunate                  | First trimester: Avoid                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Atenolol                    | May cause intrauterine growth restriction, neonatal hypoglycaemia, and bradycardia; risk greater in severe hypertension; see also pg 18                                                                                                                                                                                                                                                                                                                                                      |
| Atropine                    | Not known to be harmful                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Beclometasone               | Benefit of treatment, for example in asthma, outweighs risk                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Benzylpenicillin            | Not known to be harmful                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 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                                                                                                                                                                                                                                                                                                                                                                     |
Appendix II – Prescribing in Pregnancy & Lactation

Calcium folinate
Manufacturer advises use only if potential benefit outweighs risk

Carbamazepine
First trimester: Risk of teratogenesis including increased risk of neural tube defects (counselling and screening and adequate folate supplements advised, for example, 5 mg daily); risk of teratogenicity greater if more than one antiepileptic used; see WMF/BNF
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

Cefazolin
Not known to be harmful

Ceftazidime
Not known to be harmful

Ceftriaxone
Not known to be harmful

Chloramphenicol
Third trimester: Neonatal ‘grey’ syndrome

Chloroquine
First, third trimesters: Benefit of prophylaxis and treatment in malaria outweighs risk; important: see also section 6.03

Chlorphenamine
No evidence of teratogenicity

Chlorpromazine
Third trimester: Extrapyramidal effects in neonate occasionally reported

Ciprofloxacin
All trimesters: Avoid—arthritis in animal studies; safer alternatives available

Clindamycin
Not known to be harmful

Cloxacillin
Not known to be harmful

Codeine
Third trimester: Depresses neonatal respiration; withdrawal effects in neonates of dependent mothers; gastric stasis and risk of inhalation pneumonia in mother during labour

Contraceptives, oral
Epidemiological evidence suggests no harmful effects on fetus

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

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)

Diethylcarbamazine
Avoid: Delay treatment until after delivery

Digoxin
May need dosage adjustment

Doxycycline
First trimester: Effects on skeletal development in animal studies
Second, third trimesters: Dental discoloration; maternal hepatotoxicity with large doses

Enalapril
Avoid; may adversely affect fetal and neonatal blood pressure control and renal function; also possible skull defects and oligohydramnios; toxicity in animal studies

Ephedrine
Increased fetal heart rate reported with parenteral ephedrine

Ergocalciferol
High doses teratogenic in animals but therapeutic doses unlikely to be harmful
<table>
<thead>
<tr>
<th>Medication</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ergotamine</td>
<td>All trimesters: Oxytocic effects on the pregnant uterus</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>Not known to be harmful</td>
</tr>
<tr>
<td>Estradiol cypionate</td>
<td>Epidemiological evidence suggests no harmful effects on fetus; see Contraceptives, Oral</td>
</tr>
<tr>
<td>Ethinylestradiol</td>
<td>Epidemiological evidence suggests no harmful effects on fetus</td>
</tr>
<tr>
<td>Fluconazole</td>
<td>Avoid (multiple congenital abnormalities reported with long-term high doses)</td>
</tr>
<tr>
<td>Fluoxetine</td>
<td>Manufacturer advises use only if potential benefit outweighs risk; risk of neonatal withdrawal</td>
</tr>
<tr>
<td>Furosemide</td>
<td>Not used to treat hypertension in pregnancy</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>Second, third trimesters: Auditory or vestibular nerve damage, risk probably very small with gentamicin, but avoid unless essential (if given, serum-gentamicin concentration monitoring essential)</td>
</tr>
<tr>
<td>Glibenclamide</td>
<td>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</td>
</tr>
<tr>
<td>Griseofulvin</td>
<td>Avoid (fetotoxicity and teratogenicity in animals); effective contraception required 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</td>
</tr>
<tr>
<td>Haloperidol</td>
<td>Third trimester: Extrapyramidal effects in neonate occasionally reported</td>
</tr>
<tr>
<td>Halothane</td>
<td>Third trimester: Depresses neonatal respiration</td>
</tr>
<tr>
<td>Heparin</td>
<td>Maternal osteoporosis has been reported after prolonged use; multidose vials may contain benzyl alcohol; some manufacturers advise avoid</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>Avoid during first and second trimesters; no reports of serious harm following use in third trimester</td>
</tr>
<tr>
<td>Hydrochlorothiazide</td>
<td>Not used to treat hypertension in pregnancy</td>
</tr>
<tr>
<td>Hydrocortisone</td>
<td>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</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>Avoid unless potential benefit outweighs risk</td>
</tr>
<tr>
<td>Imipenem + cilastatin</td>
<td>Use only if potential benefit outweighs risk (toxicity in animal studies)</td>
</tr>
<tr>
<td>Indinavir</td>
<td>Avoid if possible in first trimester; theoretical risk of hyperbilirubinaemia and renal stones in neonate if used at term.</td>
</tr>
<tr>
<td>Insulins</td>
<td>All trimesters: Insulin requirements should be assessed frequently by an experienced diabetic clinician</td>
</tr>
</tbody>
</table>
Appendix II – Prescribing in Pregnancy & Lactation

Iodine Second, third trimesters: Neonatal goitre and hypothyroidism
Ipratropium bromide Not known to be harmful
Isoniazid Not known to be harmful
Ketamine Third trimester: Depresses neonatal respiration
Lamivudine Avoid if possible in first trimester; benefit of treatment considered to outweigh risk in second and third trimesters
Levonorgestrel In oral contraceptives, epidemiological evidence suggests no harmful effects on fetus
Levothyroxine Monitor maternal serum thyrotrophin concentration; levothyroxine may cross placenta, excessive dosage can be detrimental to fetus
Lidocaine Third trimester: With large doses, neonatal respiratory depression, hypotonia, and bradycardia after paracervical or epidural block
Magnesium sulfate Third trimester: not known to be harmful for short-term intravenous administration in eclampsia but excessive doses may cause neonatal respiratory depression
Mebendazole Toxicity in animal studies. Contraindicated in cestode infections; First trimester: Avoid in nematode infections; see section 6.05
Medroxyprogesterone 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
Mefloquine Use only if other antimalarials inappropriate, see also Prophylaxis and Treatment of Malaria, section 6.03
Metformin All trimesters: Avoid; insulin is normally substituted in all diabetics
Metoclopramide Not known to be harmful
Metronidazole Avoid high-dose regimens
Morphine Third trimester: Depresses neonatal respiration; withdrawal effects in neonates of dependent mothers; gastric stasis and risk of inhalation pneumonia in mother during labour
Naloxone Use only if potential benefit outweighs risk
Neostigmine Third trimester: Neonatal myasthenia with large doses
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)
Nitrofurantoin Third trimester: May produce neonatal haemolysis if used at term
Nitrous oxide Third trimester: Depresses neonatal respiration
Norethisterone In oral contraceptives, epidemiological evidence suggests no harmful effects on fetus. In higher doses masculinization of female fetuses and other defects reported
Nystatin No information available, but absorption from gastrointestinal tract negligible
Paracetamol Not known to be harmful
<table>
<thead>
<tr>
<th>Medication</th>
<th>Notes and Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phenobarbital</td>
<td>First, 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;</td>
</tr>
<tr>
<td>Phenoxybenzyl-penicillin</td>
<td>Not known to be harmful</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>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; see WMF/BNF</td>
</tr>
<tr>
<td>Phytomenadione</td>
<td>No specific information available; use only if potential benefit outweighs risk</td>
</tr>
<tr>
<td>Polyvidone–iodine</td>
<td>Second, third trimesters: Sufficient iodine may be absorbed to affect the fetal thyroid</td>
</tr>
<tr>
<td>Praziquantel</td>
<td>T. solium infections in pregnancy should be treated immediately; see section 6.05. Benefit of treatment in schistosomiasis outweighs risk. If immediate treatment not considered essential for fluke infections, treatment should be delayed until after delivery</td>
</tr>
<tr>
<td>Prednisolone</td>
<td>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</td>
</tr>
<tr>
<td>Primaquine</td>
<td>Third trimester: Neonatal haemolysis and methaemoglobinemia. Delay treatment until after delivery</td>
</tr>
<tr>
<td>Proguanil</td>
<td>Benefit of prophylaxis and of treatment outweighs risk. Adequate folate supplements should be given to mother</td>
</tr>
<tr>
<td>Promethazine</td>
<td>No evidence of teratogenicity</td>
</tr>
<tr>
<td>Propranolol</td>
<td>May cause intrauterine growth restriction, neonatal hypoglycaemia, and bradycardia; risk greater in severe hypertension; see pg 18</td>
</tr>
<tr>
<td>Propylthiouracil</td>
<td>Second, third trimesters: Neonatal goitre and hypothyroidism</td>
</tr>
<tr>
<td>Quinine</td>
<td>First trimester: High doses are teratogenic; but in malaria benefit of treatment outweighs risk</td>
</tr>
<tr>
<td>Ranitidine</td>
<td>Not known to be harmful</td>
</tr>
<tr>
<td>Retinol</td>
<td>First trimester: Excessive doses may be teratogenic; see also section 8.01 WHO notes</td>
</tr>
<tr>
<td>Salbutamol</td>
<td>Appropriate to use for asthma; high doses should be given by inhalation only — parenteral use can affect the myometrium and possibly cause cardiac problems</td>
</tr>
</tbody>
</table>
Appendix II – Prescribing in Pregnancy & Lactation

Silver sulfadiazine  Third trimester: Neonatal haemolysis and methaemoglobinaemia; fear of increased risk of kernicterus in neonates appears to be unfounded

Simvastatin  Avoid — congenital anomalies reported; decreased synthesis of cholesterol possibly affects fetal development

Sodium nitroprusside  Potential for accumulation of cyanide in fetus — avoid prolonged use

Spironolactone  Toxicity in animal studies

Streptokinase  All trimesters: Possibility of premature separation of placenta in first 18 weeks; theoretical possibility of fetal haemorrhage throughout pregnancy; risk of maternal haemorrhage on postpartum use

Sulfadoxine + Pyrimethamine  First trimester: Possible teratogenic risk (pyrimethamine a folate antagonist)  Third trimester: Neonatal haemolysis and methaemoglobinaemia; fear of increased risk of kernicterus in neonates appears to be unfounded  See also section 6.03 WHO notes pg 100

Sulfamethoxazole + Trimethoprim  First trimester: Teratogenic risk (trimethoprim a folate antagonist)  Third trimester: Neonatal haemolysis and methaemoglobinaemia; fear of increased risk of kernicterus in neonates appears to be unfounded

Suxamethonium  Mildly prolonged maternal paralysis may occur

Tetracycline  First trimester: Effects on skeletal development in animal studies  Second, third trimesters: Dental discoloration; maternal hepatotoxicity with large doses

Thiopental  Third trimester: Depresses neonatal respiration; dose should not exceed 250mg

Trimethoprim  First trimester: Teratogenic risk (folate antagonist)

Vaccine, BCG  First trimester: Theoretical risk of congenital malformations, but need for vaccination may outweigh possible risk to fetus (see also section 12.02 WHO notes pg 175)

Vaccine, Measles  First trimester: Theoretical risk of congenital malformations, but need for vaccination may outweigh possible risk to fetus (see also section 12.02 WHO notes pg 175); avoid MMR

Vaccine, MMR  Avoid; pregnancy should be avoided for 1 month after immunization

Vaccine, Poliomyelitis, live  First trimester: Theoretical risk of congenital malformations, but need for vaccination may outweigh possible risk to fetus (see also section 12.02 WHO notes pg 175)

Vaccine, Rubella  Avoid; pregnancy should be avoided for 1 month after immunization

Vaccine, Yellow fever  First trimester: Theoretical risk of congenital malformations, but need for vaccination may outweigh possible risk to fetus (see also section 12.02 WHO notes pg 175)

Vancomycin  Use only if potential benefit outweighs risk—plasma-vancomycin concentration monitoring essential to reduce risk of fetal toxicity
<table>
<thead>
<tr>
<th>Medication</th>
<th>Prescribing Advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vecuronium</td>
<td>Use only if potential benefit outweighs risk—no information available</td>
</tr>
<tr>
<td>Verapamil</td>
<td>May reduce uterine blood flow with fetal hypoxia; may inhibit labour</td>
</tr>
<tr>
<td>Warfarin</td>
<td>All trimesters: Congenital malformations; fetal and neonatal haemorrhage; <em>See also</em> WMF/BNF</td>
</tr>
<tr>
<td>Zidovudine</td>
<td>Avoid if possible in first trimester; benefit of treatment considered to outweigh risk in second and third trimesters; <em>see</em> WMF/BNF</td>
</tr>
</tbody>
</table>
WHO MODEL FORMULARY 2008 NOTES: Prescribing in Breastfeeding

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).

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 that 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 breastfeeding for the reasons given above;

- which, on present evidence, may be given to the mother during breastfeeding, 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 insufficient evidence is available to provide guidance and it is advisable to administer only drugs essential to a mother during breastfeeding. 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.

WHO POLICY. 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.

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

### Table of drugs present in breast milk (WHO Model Formulary 2008):

<table>
<thead>
<tr>
<th>Drug</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetazolamide</td>
<td>Amount too small to be harmful</td>
</tr>
<tr>
<td>Acetylsalicylic acid</td>
<td>Short course safe in usual dosage; monitor infant; regular use of high doses could impair platelet function and produce hypoprolactinemia in infant if neonatal vitamin K stores low; possible risk of Reye syndrome</td>
</tr>
<tr>
<td>Aciclovir</td>
<td>Significant amount in milk after systemic administration, but considered safe to use</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Large amounts may affect infant and reduce milk consumption</td>
</tr>
<tr>
<td>Allopurinol</td>
<td>Present in milk — not known to be harmful</td>
</tr>
<tr>
<td>Aminophylline</td>
<td>Present in milk—irritability in infant reported</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>Trace amounts in milk; safe in usual dosage; monitor infant</td>
</tr>
<tr>
<td>Amoxicillin + Clavulanic acid</td>
<td>Trace amounts in milk</td>
</tr>
<tr>
<td>Amphotericin B</td>
<td>No information available</td>
</tr>
<tr>
<td>Artemether + Lumefantrine</td>
<td>Discontinue breastfeeding during and for 1 week after stopping treatment; present in milk in animal studies</td>
</tr>
<tr>
<td>Atenolol</td>
<td>Significant amounts in milk; safe in usual dosage; monitor infant</td>
</tr>
<tr>
<td>Atropine</td>
<td>Small amount present in milk; monitor infant</td>
</tr>
<tr>
<td>Beclometasone</td>
<td>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</td>
</tr>
<tr>
<td>Benzylpenicillin</td>
<td>Trace amounts in milk; safe in usual dosage; monitor infant</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>Amount too small to be harmful</td>
</tr>
<tr>
<td>Carbamazepine</td>
<td>Continue breastfeeding; adverse effects possible (severe skin reaction reported in one infant); monitor infant for drowsiness</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>Excreted in low concentrations; safe in usual dosage; monitor infant</td>
</tr>
<tr>
<td>Ceftazidime</td>
<td>Excreted in low concentrations; safe in usual dosage; monitor infant</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>Excreted in low concentrations; safe in usual dosage; monitor infant</td>
</tr>
<tr>
<td>Chloramphenicol</td>
<td>Continue breastfeeding; use alternative drug if possible; may cause bone-marrow toxicity in infant; concentration in milk usually insufficient to cause ‘grey syndrome’</td>
</tr>
<tr>
<td>Chloroquine</td>
<td>At doses used for malaria prophylaxis, amount in milk probably too small to be harmful and inadequate for reliable protection against malaria in the breastfed infant; avoid breastfeeding when used for rheumatic disease</td>
</tr>
<tr>
<td>Medicine</td>
<td>Dosage and Effects</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Chlorphenamine</td>
<td>Safe in usual dosage; monitor infant for drowsiness</td>
</tr>
<tr>
<td>Chlorpromazine</td>
<td>Continue breastfeeding; adverse effects possible; monitor infant for drowsiness</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>Continue breastfeeding; use alternative drug if possible; high concentrations in breast milk</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Amount probably too small to be harmful but bloody diarrhoea reported in 1 infant</td>
</tr>
<tr>
<td>Cloxacillin</td>
<td>Trace amounts in milk; safe in usual dosage; monitor infant</td>
</tr>
<tr>
<td>Codeine</td>
<td>Amount too small to be harmful</td>
</tr>
<tr>
<td>Colchicine</td>
<td>Present in milk but no adverse effects reported; caution because of risk of cytotoxicity</td>
</tr>
<tr>
<td>Contraceptives, oral</td>
<td>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)</td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>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</td>
</tr>
<tr>
<td>Diazepam</td>
<td>Continue breastfeeding; adverse effects possible; monitor infant for drowsiness</td>
</tr>
<tr>
<td>Digoxin</td>
<td>Amount too small to be harmful</td>
</tr>
<tr>
<td>Dopamine</td>
<td>No information available</td>
</tr>
<tr>
<td>Doxycycline</td>
<td>Continue breastfeeding; use alternative drug if possible (absorption and therefore discoloration of teeth in infant probably usually prevented by chelation with calcium in milk)</td>
</tr>
<tr>
<td>Enalapril</td>
<td>Amount probably too small to be harmful</td>
</tr>
<tr>
<td>Ephedrine</td>
<td>Irritability and disturbed sleep reported</td>
</tr>
<tr>
<td>Ergocalciferol</td>
<td>Caution with high doses; may cause hypercalcaemia in infant</td>
</tr>
<tr>
<td>Ergotamine</td>
<td>Use alternative drug; ergotism may occur in infant; repeated doses may inhibit lactation</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>Only small amounts in milk – not known to be harmful</td>
</tr>
<tr>
<td>Estradiol cypionate</td>
<td>Avoid; adverse effects on lactation; see also Contraceptives, Oral</td>
</tr>
<tr>
<td>Ethinylestradiol</td>
<td>May inhibit lactation; use alternative method of contraception; see Contraceptives, Oral</td>
</tr>
<tr>
<td>Fluconazole</td>
<td>Present in milk; safe in usual dosage; monitor infant</td>
</tr>
<tr>
<td>Fluoxetine</td>
<td>Present in milk; manufacturer advises avoid or use lowest effective dose</td>
</tr>
<tr>
<td>Furosemide</td>
<td>Amount too small to be harmful</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>Amount probably too small to be harmful; monitor infant for thrush and diarrhoea</td>
</tr>
<tr>
<td>Glibenclamide</td>
<td>Theoretical possibility of hypoglycaemia in infant</td>
</tr>
<tr>
<td>Griseofulvin</td>
<td>No information available; avoid</td>
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<tr>
<td>Haloperidol</td>
<td>Amount excreted in milk probably too small to be harmful; continue breastfeeding; adverse effects possible; monitor infant for drowsiness</td>
</tr>
<tr>
<td>Halothane</td>
<td>Excreted in milk</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>Present in milk but not known to be harmful; monitor infant</td>
</tr>
<tr>
<td>Hydrochlorothiazide</td>
<td>Continue breastfeeding; may inhibit lactation</td>
</tr>
<tr>
<td>Hydrocortisone</td>
<td>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</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>Amount too small to be harmful; short courses safe in usual doses</td>
</tr>
<tr>
<td>Imipenem + cilastatin</td>
<td>Present in milk; manufacturer advises avoid</td>
</tr>
<tr>
<td>Indinavir</td>
<td>Breastfeeding recommended during first 6 months if no safe alternative to breast milk</td>
</tr>
<tr>
<td>Insulin</td>
<td>Amount too small to be harmful</td>
</tr>
<tr>
<td>Iodine</td>
<td>Stop breastfeeding; danger of neonatal hypothyroidism or goitre; appears to be concentrated in milk</td>
</tr>
<tr>
<td>Isoniazid</td>
<td>Monitor infant for possible toxicity; theoretical risk of convulsions and neuropathy; prophylactic pyridoxine advisable in mother and infant</td>
</tr>
<tr>
<td>Lamivudine</td>
<td>Present in milk; breastfeeding recommended during first 6 months if no safe alternative to breast milk</td>
</tr>
<tr>
<td>Levamisole</td>
<td>Breastfeeding contraindicated</td>
</tr>
<tr>
<td>Levonorgestrel</td>
<td>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)</td>
</tr>
<tr>
<td>Levothyroxine</td>
<td>Amount too small to affect tests for neonatal hypothyroidism</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>Amount too small to be harmful</td>
</tr>
<tr>
<td>Lumefantrine</td>
<td>See Artemether + Lumefantrine</td>
</tr>
<tr>
<td>Mebendazole</td>
<td>Amount too small to be harmful</td>
</tr>
<tr>
<td>Medroxyprogesterone</td>
<td>Present in milk—no adverse effects reported (preferably start injectable contraceptive 6 weeks after birth or later)</td>
</tr>
<tr>
<td>Mefloquine</td>
<td>Present in milk but risk to infant minimal</td>
</tr>
<tr>
<td>Metformin</td>
<td>Present in milk but safe in usual doses; monitor infant</td>
</tr>
<tr>
<td>Methylthioninium chloride</td>
<td>No information available; avoid</td>
</tr>
<tr>
<td>Metoclopramide</td>
<td>Present in milk; adverse effects possible; monitor infant for adverse effects</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>Significant amount in milk; continue breastfeeding; avoid large doses; use alternative drug if possible</td>
</tr>
<tr>
<td>Morphine</td>
<td>Short courses safe in usual doses; monitor infant</td>
</tr>
<tr>
<td>Naloxone</td>
<td>No information available</td>
</tr>
<tr>
<td>Neostigmine</td>
<td>Amount probably too small to be harmful; monitor infant</td>
</tr>
<tr>
<td>Nifedipine</td>
<td>Small amount in milk; continue breastfeeding; monitor infant</td>
</tr>
</tbody>
</table>
Nitrofurantoin Only small amounts in milk but could be enough to produce
haemolysis 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

Paracetamol Small amount present in milk: short courses safe in usual dosage;
monitor infant

Phenobarbital Continue breastfeeding; adverse effects possible; monitor infant for
drowsiness; see also WMF/BNF

Phenoxyimethyl-
penicillin Trace amounts in milk; safe in usual dosage; monitor infant

Phenytoin Small amount present in milk; continue breastfeeding; adverse effects
possible; monitor infant for drowsiness; see also WMF/BNF

Polyvidone–iodine Avoid; iodine absorbed from vaginal preparations is concentrated in
milk

Potassium iodide Stop breastfeeding; danger of neonatal hypothyroidism or goitre;
appears to be concentrated in milk

Praziquantel Avoid breastfeeding during and for 72 hours after treatment;
considered safe to continue breastfeeding 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

Proguanil Amount in milk probably too small to be harmful at doses used for
malaria prophylaxis but 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

Quinine Present in milk — continue breastfeeding 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

Salbutamol Safe in usual dosage; monitor infant

Senna Continue breastfeeding; monitor infant for diarrhoea

Silver sulfadiazine Continue breastfeeding; monitor infant for jaundice—small risk of
kernicterus in jaundiced infants particularly with long-acting
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<th>Notes</th>
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<td>Simvastatin</td>
<td>No information available — manufacturer advises avoid</td>
</tr>
<tr>
<td>Sodium nitroprusside</td>
<td>No information available</td>
</tr>
<tr>
<td>Spironolactone</td>
<td>Amount probably too small to be harmful</td>
</tr>
<tr>
<td>Sulfadiazine</td>
<td>Monitor infant for jaundice—small risk of kernicterus in jaundiced infants and of haemolysis in G6PD-deficient infants; caution in ill or premature infants</td>
</tr>
<tr>
<td>Sulfadoxine + Pyrimethamine</td>
<td>Monitor infant for jaundice—small risk of kernicterus in jaundiced infants and of haemolysis in G6PD-deficient infants (due to sulfadoxine); caution in ill or premature infants</td>
</tr>
<tr>
<td>Sulfamethoxazole + Trimethoprim</td>
<td>Monitor infant for jaundice—small risk of kernicterus in jaundiced infants and of haemolysis in G6PD-deficient infants (due to sulfamethoxazole); caution in ill or premature infants</td>
</tr>
<tr>
<td>Suxamethonium</td>
<td>No information available</td>
</tr>
<tr>
<td>Tetracaine</td>
<td>No information available</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>Continue breastfeeding; use alternative drug if possible (absorption and therefore discoloration of teeth in infant probably usually prevented by chelation with calcium in milk)</td>
</tr>
<tr>
<td>Thiamine</td>
<td>Severely thiamine-deficient mothers should avoid breastfeeding as toxic methyl-glyoxal excreted in milk</td>
</tr>
<tr>
<td>Thiopental</td>
<td>Present in milk—not known to be harmful</td>
</tr>
<tr>
<td>Trimethoprim</td>
<td>Present in milk; safe in usual dosage; monitor infant</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>Present in milk—significant absorption after oral admin unlikely</td>
</tr>
<tr>
<td>Vecuronium</td>
<td>No information available</td>
</tr>
<tr>
<td>Verapamil</td>
<td>Amount too small to be harmful</td>
</tr>
<tr>
<td>Warfarin</td>
<td>Risk of haemorrhage; increased by vit-K deficiency; warfarin appears safe</td>
</tr>
<tr>
<td>Zidovudine</td>
<td>Breastfeeding recommended during first 6 months if no safe alternative to breast milk</td>
</tr>
</tbody>
</table>
APPENDIX III

GENERAL INFORMATION ON PRESCRIBING IN THE ELDERLY

The following notes are generally applicable to prescribing for the patient aged over 75 years:

- Nearly all drugs are finally excreted by the kidney. Renal function falls by 50% average by the age of 75 years.
- 20% of subjects over the age of 80 years have clinically detectable dementia and many others will have a decline in cerebral function.
- The elderly have increased sensitivity to drugs acting on the central nervous system. The reasons are not fully understood and do not clearly relate to changes stated in 2 above.
- Nearly all drugs were originally evaluated and dosage schedules established in young patients with normal renal and other metabolic functions.
- Most sick, elderly people are significantly dehydrated. Extracellular fluid volume depletion may result in higher tissue concentrations of drugs administered.
- Adverse reactions are increased in the elderly. The incidence is at least 10% at 65 years rising to 20% at 75 years and over.
- The likelihood of adverse reaction increases with the number of drugs prescribed. The main drug groups responsible for causing problems are cardiac drugs (e.g. digoxin, diuretics and antihypertensives) and cerebrally acting drugs (e.g. anti-Parkinsonism drugs, antidepressants, hypnotics, tranquillisers and psychotropic drugs).
- Presentation of illness is often atypical in the elderly subject.

It follows from the above that:

- Small doses at longer intervals should be used. It is common to start with about 50% of the adult dose for the elderly.
- Drugs with prolonged half-lives should be avoided e.g. nitrazepam.
Appendix III – Prescribing in Elderly

- Simple regimens where possible no more than 4 drugs prescribed at any one time should be used. A drug with a less frequent dosing interval (e.g. twice daily dosing) is preferred.

- Drugs with cerebral and cardiac effects should be used with extreme care. Sedatives and hypnotics should be the last resort in management of noisy, confused and agitated patients.

- CLEAR EXPLANATIONS should be given, with full instructions on every prescription including repeat prescriptions so that proper labels with full directions can be given (avoid vague terms like “as directed”). Check that patient is able to swallow tablets comfortably and operate medical devices given (e.g. inhalers or child resistant containers). Large print labels may be necessary for those with poor eyesight. Advise on over-the-counter drugs and alcohol to avoid drug interactions.

- REPEATS AND DISPOSALS. Instruct patients what to do when drugs run out, and also how to dispose of any that are no longer necessary. Try to prescribe matching quantities.

SPECIFIC CLINICAL SITUATIONS

- ACUTE CONFUSION. FIRST SEEK THE CAUSE. Look for infection present in 80% of such cases, cardiac problems, uraemia, drug side effects, stroke etc. IF ALL ELSE FAILS, for the very confused, aggressive or agitated patient try Thoridazine in syrup or tablet form, starting at 5-10mg [not on Mercy Ships list]. It is better to adjust the dose of this drug upward to achieve the desired effect than to chop and change to other drugs. This is the phenothiazine best tolerated by the elderly with the least hypotensive effect.

- INSOMNIA. Hypnotics are indicated in a few cases for relief of insomnia due to grief or other severe emotional stress. More commonly prescribed for the peace of mind of relatives, night nurses or doctors.

- OEDEMA. There are multiple causes in the elderly and drugs are not always indicated. Many cases are associated with immobility and venous insufficiency, lymphatic obstruction etc. in which cases diuretics are potentially harmful and do not reduce the swelling. But remember that approximately 50% of elderly people admitted to hospital have cardiac failure and significant number of others has hypoalbuminaemia due to sundry causes.

- HYPERTENSION. Current opinion is that treatment for hypertension is indicated for elderly patients, certainly up to the age of 80 years and probably
beyond, without which target organ damage may occur. Drugs of choice: a) Thiazide diuretics; b) Calcium channel blockers; and c) ACE inhibitors. Beta-blockers may cause confusion and precipitate heart failure in the elderly (cardiac reserve is markedly reduced by age alone).

- HYPOTHYROIDISM. The correct starting dose is thyroxine 25 micrograms, increased at monthly intervals. A higher starting dose is like to precipitate symptoms of ischaemic heart disease.

- DIZZINESS, GIDDINESS AND VERTIGO. These symptoms demand full investigation and correction of the cause. Prochlorperazine and related drugs are not appropriate for the elderly and may be positively harmful (may cause postural hypotension and falls).

- DIABETES IN THE ELDERLY. Often type II (non-insulin dependent), potentially serious and requires careful treatment (risk of death in a five-year period 4-5 times normal). Treatment:
  1) Diet – which may achieve reasonable control in 30% of cases;
  2) In combination with: - i) Insulin – prescribe long acting preparations with caution, as the elderly are known to be less likely to develop symptoms of hypoglycaemia until the situation is serious. ii) Oral agents – again long acting preparations should be used with great caution and some should be avoided altogether.

- USE OF NON-STEROIDAL ANTI-INFLAMMATORY DRUGS (NSAIDs) IN THE ELDERLY. It should be remembered as stated above that the sick elderly are often dehydrated and many are on diuretic therapy. Both may aggravate nephrotoxic effects of NSAIDs. Gastrointestinal side effects are common and may be dose related, use smallest effective doses and monitor closely.

- OSTEOPOROSIS. The occurrence of a fracture implies further fractures are almost certain. Consider hormone replacement therapy, biphosphonates and calcium supplements.

Finally, it is vital in the elderly to review treatment regularly and frequently. Long-term follow up must be maintained.
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## M/V AFRICA MERCY MEDICAL LABORATORY TEST LIST
(REVISED 10/2008)

Please note: test list may vary due to availability of supplies, specializations of technologists, and instrumentation.

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<th>Liver Function</th>
<th>Lipid Function</th>
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<td>ALT</td>
<td>Cholesterol</td>
<td>Ferritin</td>
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<td>Urea</td>
<td>ALKP</td>
<td>HDL</td>
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<td>Cl</td>
<td>Nitrogen (BUN)</td>
<td>GGT</td>
<td>Triglycerides</td>
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<td>AST</td>
<td>VLDL (calculated)</td>
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<th>Cardiac Tests</th>
<th>Urine Tests</th>
<th>Microbiology Tests</th>
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<tr>
<td>CK</td>
<td>Urinalysis</td>
<td>Culture ID and Sensitivity</td>
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<td>CKMB</td>
<td>Dipstick</td>
<td>OCP/Concentrations (O &amp; P)</td>
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<tr>
<td>Myoglobin</td>
<td>Urine</td>
<td>Salmonella Grouping</td>
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<tr>
<td>Troponin (Qualitative and Quantitative)</td>
<td>Microscopic Pregnancy (urine)</td>
<td>Shigella Grouping</td>
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<td>d-Dimer</td>
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<td>Group A Strep</td>
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<tr>
<th>Hematology Tests</th>
<th>General Chemistry</th>
<th>Antigen/Antibody Tests</th>
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<tr>
<td>CBC (full blood count)</td>
<td>ALB</td>
<td>Hepatitis Bs Ag</td>
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<tr>
<td>WBC Differential</td>
<td>Calcium</td>
<td>Hepatitis C Ag</td>
</tr>
<tr>
<td>ESR (Erythrocyte Sedimentation Rate)</td>
<td>Amylase</td>
<td>HIV 1/2 Ab (Immunochromatographic)</td>
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<tr>
<td>HBA1C (Glucohemoglobin)</td>
<td>Bilirubin Total</td>
<td>HIV 1/2 Ab  (passive particle agglutination)</td>
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<tr>
<td>Malaria Quick Test (P. falcip and Combo)</td>
<td>Glucose</td>
<td>RPR (Syphilis)</td>
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<tr>
<td>Malaria Smear PT</td>
<td>Protein Total</td>
<td>CRP (C-Reactive Protein)</td>
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<tr>
<td>APTT</td>
<td>Uric Acid</td>
<td>TB Ab (serum)</td>
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<td>Bleeding Time</td>
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<td>H. Pylori (serum)</td>
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<td>Sickle Quick Screening</td>
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<td>Chlamydia Ag (swab)</td>
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<td>Hemoglobin</td>
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<tr>
<td>Electrophoresis</td>
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<td>Legionella Ag (urine)</td>
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<tr>
<th>Blood Banking</th>
<th>Antigen/Antibody Tests</th>
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<tbody>
<tr>
<td>ABO Typing</td>
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<tr>
<td>Rh Typing</td>
<td>Hepatitis C Ag</td>
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<tr>
<td>Antibody Screen and Identification Crossmatch/ Compatibility testing</td>
<td>HIV 1/2 Ab (passive particle agglutination)</td>
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<tr>
<td>Phenotyping (known antigens)</td>
<td>RPR (Syphilis)</td>
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<th>Thyroid Tests</th>
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<td>TSH</td>
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<tr>
<td>Free T4</td>
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<tr>
<td>T3</td>
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</tbody>
</table>
# Table of Values, Conversions & Units

## TABLE OF VALUES, CONVERSIONS & UNITS

### Mass:
- 1 kg = 1000 g (gram)
- 1 g = 1000 mg (milligrams)
- 1 mg = 1000 micrograms
- 1 microgram = 1000 nanograms
- 1 stone = 14 lb (pounds)

<table>
<thead>
<tr>
<th>lb (pound)</th>
<th>Kg (kilogram)</th>
<th>stones</th>
<th>kg</th>
<th>ml</th>
<th>fl oz</th>
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</table>

### Length:
- 1 m (metre) = 1000 mm (millimetres)
- 1 cm (centimetres) = 10 mm
- 1 in (inch) = 25.4 mm
- 1 ft (foot) = 304.8 mm = 12 inches

### Volume:
- 1 L (litre) = 1000 ml (millilitres)
- 1 pint = 568 ml
**Calories:** 1 kcal (kilocalorie) = 4186.8 J (joules)
1000 kcal = 4.1868 MJ (megajoules)
1 MJ = 238.8 kcal

**Dry measures:** 3 teaspoons = 1 tablespoon = 0.5 ounce = 14.3g

**Liquid measures:** 1 cup (US) = 8 fluid ounces = 237 mls
= 16 tablespoons = 0.5 pint

**Pressure:** 1 mmHg (millimetre of mercury) = 133.3 Pa (Pascal)
1 kPa (kilopascal) = 7.5 mmHg

**Units:** 1MU = 1 million (mega) units = 1,000,000 units
1% = 1g/100ml (w/v) = 10mg/ml (w/v)
= 1g/100g (w/w)
= 1ml/100ml (v/v)

**Dilutions:**

Dilution 1 in 10,000 = 1mg/10ml or 100ug/ml (1g in 10,000ml)
Dilution 1 in 1000 = 1mg/ml (1g in 1000ml)

1ml = 20/15/10/60 drops per minute (depending on IV drip set)

**Temperature:**

°C (Celsius) & °F (Fahrenheit)  
°F = (°C x 1.8) + 32,  °C = (°F - 32)/1.8
ABBREVIATIONS

The following are a list of abbreviations and markings used in the book, or commonly encountered by our volunteers:

**F**  **Formulary items**, critical medicines to be consistently available.

**D**  **Donation items**, medicines dependent on donations and may not be consistently available.

**EML**  World Health Organisation (WHO) Essential Medicines List 2005 listed item (Core or Complementary List).

**MSL**  medicines on the Mandatory Sailing List, required in determined quantities by international maritime law during sailing.

**N/CD**  narcotics/controlled drugs (record/storage requirements)

**PS**  psychotropic substances (record/storage requirements)

**WMF**  WHO Model Formulary

**BNF**  British National Formulary

**Q**  every or each

**od/QD**  once a day

**om/q am**  once every morning

**bd/BID**  twice a day

**tds/TID**  three times a day

**qds/QID**  four times a day

**q6h/qxh**  given every 6 hours or every x hours (usually for parenteral products or antibiotics)

**o.n./q hs**  at bedtime

**stat/STAT**  immediately/life threatening emergency

**Max**  Maximum

**Min**  minutes

**hr, hrs**  hour, hours

**wk, wks**  week, weeks

**mth, mths**  month, months

**yo**  years old (age)

**esp.**  especially

**prn**  when needed, when required/necessary

**Abx**  Antibiotics

**ASAP**  as soon as possible
Abbreviations

SC  subcutaneous route  S/E  side effects
IM  intramuscular route  C/I  Contraindications
IV  intravenous route  OD  right eye
(injection unless stated otherwise as infusion)  OS  left eye
KVO  keep the vein open, slow IV drip  OU  both eyes
PR  rectal route  R/Rt  right
PO  per OS/oral route  L/Lt  Left
NG  per NG/nasogastric tube  w/, w/o  with, without
SL  sublingual  c/o  complaints of
NEB  by nebuliser  d/c  Discontinued
NPO  nothing/nil by mouth  D/C  Discharged
NKA  no known allergies  OR  Operating Room
NKDA  no known drug allergies  ICU  Intensive Care Unit

D5  Dextrose/Glucose 5% infusion solution
NS  Normal Saline or 0.9% NaCl infusion solution
RL/LR/SL  Ringer’s lactate/sodium lactate compound solution (Hartmann’s)
WFI  Water for Injection, sterile solution for reconstitution or infusion

Conc  concentration of solution (e.g. mg/ml)

WHO  World Health Organisation  www.who.int/medicines/
IDA  International Dispensary Association  www.idafoundation.org