

**GUY'S AND ST. THOMAS', KING'S COLLEGE AND
UNIVERSITY LEWISHAM HOSPITALS**

Paediatric Formulary

9th Edition

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WARNING

We have endeavoured to ensure that the information and drug dosages in this paediatric formulary are correct at the time of publication, but errors may have occurred and the therapeutic guidelines may have been altered. Where there is any doubt, information should be checked against manufacturers' Summary of Product Characteristics, (data sheets), published literature or other specialist sources.

The paediatric formulary is intended for rapid reference and cannot always contain all the information necessary for prescribing, dispensing, or administration. It should be supplemented as necessary from specialist publications and also manufacturers' Summary of Product Characteristics (SPC).

We have endeavoured to highlight in this formulary unlicensed products or uses or methods of administration of licensed products which fall outside the Summary of Product Characteristics (off-label use); this includes uses in indications, age ranges or administration outside the manufacturers' recommendations.

Prescribers' must take full responsibility for prescribing unlicensed medicinal products and unlicensed uses or administration of licensed products, when such use falls outside the recommendations.

The formulary is intended for the guidance of medical practitioners, pharmacists, dentists, nurses and others who have the necessary training and experience to interpret the information it provides.

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These guidelines should be tailored where necessary to individual patient needs and do not replace the need for consultation with senior staff and/or referral for expert advice.

FOREWORD

FOREWORD

INTRODUCTORY NOTES

The 8th edition of the paediatric formulary has been fully revised. It has been produced with the assistance of expert opinions from the paediatric departments of the 4 hospitals. Although not all views relating to drug treatment concur, the formulary committee has sought to incorporate the majority of opinions received in order to present a consensus view. Therefore this book should be used as guidance only.

The **drug monographs** included are presented in alphabetical order and are indexed and cross referenced.

Treatment guidelines are included for some aspects of drug therapy. These should be tailored where necessary to individual patient needs. They do not replace the need for consultation with senior staff and/or referral for expert advice.

Prescribing a drug not included in the formulary

Occasionally it will be considered necessary to prescribe a drug not included in the formulary. These are not stocked routinely but can usually be obtained within 48 hours.

A non-formulary form is available from your clinical pharmacist or charge nurse in paediatric outpatients for this purpose.

In the event of a non-formulary drug being prescribed:

- a) **Treatment initiated by hospital staff**
Pharmacy staff will suggest and encourage the use of a similar drug that is included in the formulary.
- b) **Patient admitted on regular therapy with a non-formulary drug**
If it is inappropriate to change therapy (e.g. admitted for a surgical procedure), where possible, patients' own medications should be used. These will be checked by the ward pharmacist/pharmacy technician
When patients have an inadequate supply of their own drugs, a supply will be bought by the pharmacy specifically for that patient.
If the patient is admitted for a review of current treatment, prescribers will be encouraged to change to a formulary preparation where appropriate.

Primary Care Trusts do not encourage General Practitioners (GPs) to prescribe outside their own practice formulary and as a result may refuse to prescribe certain therapies based on clinical grounds but not cost grounds.

Shifting the prescribing of hospital non-formulary items to the GP is discouraged.

Shared Care

Under certain circumstances some drug therapies are part of a shared care arrangement with the General Practitioner (GP). Where this is the case it is good practice to encourage prescribing using an agreed guideline or protocol with agreement on the total number of days supply. Clinical responsibility will be shared between the hospital clinician and the GP. Shared care and the associated prescribing responsibility cannot occur if the GP is unable to take on the clinical responsibility for the management of the patient receiving a named therapy. In such instances the clinical and prescribing responsibility remains with the hospital clinician. Shared Care agreements are official policies which must be agreed in template form for a particular medicine with the PCT before agreement with the GP can be sought.

FOREWORD

THE USE OF MEDICATION IN CHILDREN

Many drugs used in children are used outside the recommendations of the Summaries of Product Characteristics (Data Sheets). We have therefore endeavoured to highlight some of the unlicensed products and indications.

Unlicensed medicinal products are indicated in the text where appropriate. Those included within the formulary have been approved for use in the specific clinical setting by the Drug and Therapeutics Committees of the 4 hospitals.

Prescribers take full responsibility for prescribing products outside the license which is stated in the Summary of Product Characteristics (Data Sheets) i.e. use in indications or age range outside the manufacturers' recommendations. However all prescribing should be carried out in the best interest of the child irrespective of license status.

Specials Manufacturer preparations are made as batch products by a manufacturing unit holding a manufacturer's licence. **Extemporaneously Prepared** preparations are made on an individual basis in pharmacy and are not subjected to full quality assurance.

FOREWORD

ACKNOWLEDGEMENTS

The Formulary Committee would like to thank all paediatricians, nurses, dietitians and pharmacists who have given their time and expertise during the production of this edition. We would like to extend special thanks to Claire Eldridge for her enthusiasm and dedication in formatting the formulary which has enabled the production of this edition.

Many Thanks

Steve Tomlin - Paediatric Formulary Committee Professional Secretary
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We hope you will find the paediatric formulary useful. If you have any comments please direct these to:

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ADMINISTRATION OF MEDICINES TO CHILDREN

ADMINISTRATION OF MEDICINES TO CHILDREN

PRESCRIBING IN CHILDREN

DOSES

The doses in the monographs are either stated on a specific dose per weight/surface area basis or by an age/weight range.

In some circumstances other methods may be required for calculating the appropriate dose in children.

The following method of calculating doses should only be used if a specific dose can not be found since it assumes the child is 'average'.

PERCENTAGE METHOD OF CALCULATING DOSES

Age	Mean weight for age		Mean surface area for age (m ²)	% of adult dose
	kg	lb.		
New-born (full term)	3.5	7.7	0.23	12.5
2 months	4.5	10	0.27	15
4 months	6.5	14	0.34	20
1 year	10	22	0.47	25
3 years	15	33	0.62	33.3
7 years	23	50	0.88	50
10 years	30	66	1.05	60
12 years	39	86	1.25	75
14 years	50	110	1.50	80
16 years	58	128	1.65	90
Adult	68	150	1.73	100

Wherever possible, to avoid confusion and errors, doses have been expressed in whole numbers of units. This means that less familiar units, such as nanograms have been used. This table may help with conversion between units.

1kg	=	1000g
1g	=	1000mg
1mg	=	1000micrograms
1microgram	=	1000nanograms

DEFINITIONS OF AGE

As a guideline only:

Premature baby	Born before 37 weeks gestation
Term baby	Born at 37 - 42 weeks gestation
Neonate	First 4 weeks of life
Infant	Up to 2 year of age
Child	From 2 - 12 years of age
Adolescent	12 - 18 years of age

ADMINISTRATION OF MEDICINES TO CHILDREN

DOSAGE ADJUSTMENT IN RENAL IMPAIRMENT

Where applicable the monographs contain dosage adjustments for renal function based on normalised clearance of creatinine. Adjustments should be made using the glomerular filtration rate (GFR), if determined, or by calculating the estimated creatinine clearance, see below.

Use the equation, adapted from Haycock et al. (1982) by Booth et al (2010), for children aged <18 years. This equation may be used for infants although it is not validated under 3 years.

$$\text{"Estimated" CrCl (ml/minute/1.73m}^2\text{)} = \frac{31 \times ht}{Scr}$$

Where CrCl = Creatinine clearance in ml/minute/1.73m²
SCr = Serum creatinine in micromol/litre
ht = Height in cm

ADMINISTRATION IN CHILDREN

Due to every child requiring a different dose, the fact that most medicines are produced in quantities and strengths suitable for adults, and therefore that most doses are very small and require decimal points in terms of volume; it is easy to see why there is a lot of potential for error when prescribing and administering to children. It is therefore important that prescribing is clear and considers the practicalities of administration when being performed.

The parenteral route for children is the most reliable with regards to obtaining predictable blood levels. However intravenous access is not always easy to achieve and repeated attempts to gain access may be distressing for the child. In neonates due to the fragility of the veins extravasation is reasonably common and careful consideration must determine which drugs are likely to cause problems if they leak into the tissue.

The intramuscular route is best avoided in children due to the pain it causes, the lack of muscle and the poor muscle perfusion.

Care should be taken when preparing parenteral doses. It may be necessary to dilute the injection so that measurable doses can be drawn up. When reconstituting freeze-dried injections, the displacement value is important. Displacement values are not always given in the text as they vary with brand and must be sought for the individual product being used. We try to highlight those products likely to have a displacement value. The displacement value must be taken into account where part vials are used otherwise significant errors in the dose drawn up may result.

Where clinically acceptable doses should be written up to the nearest vial, to ease administration, decrease wastage and reduce the likely-hood of errors.

The use of the iv route should be continuously reviewed and swapped to oral as soon as clinically appropriate.

ADMINISTRATION OF MEDICINES TO CHILDREN

The oral route is usually the easiest and most convenient, especially for long term treatment. Problems can occur due to lack of suitable dosage forms. Therefore the use of 'named patient' or 'specials' preparations may need to be considered. It is important when planning discharges to allow for this and to notify pharmacy as soon as possible so arrangement can be made for continuity of supply. Children should be continued on the same "special" where ever possible as bioavailability and excipients may vary between products.

If it is known that a patient is being sent out into the community on a named patient medication or a medication being used outside its license it is important that they are counselled appropriately and given an "Unlicensed Medications Information Sheet" – these may be Trust specific or use the one produced by the Medicines Committee (Joint Committee of the Royal College of Paediatrics and Child Health and the Neonatal and Paediatric Pharmacists Group).

Pharmacy may have to adjust doses so that they are practical to administer. This decision will be confirmed on the prescription by a pharmacist. If this means a large change to the dose or the pharmacist is clinically unsure as to the impact of the change of dose the prescriber will be contacted.

When out-patient or TTA prescriptions are being dispensed, common items such as paracetamol will automatically be dispensed (if it is thought clinically appropriate) with the dose of the SPC (product licence). This is to make administration for the parent easier and to cause less confusion.

ACCIDENTAL POISONING

Accidental poisoning in the under five age group accounts for 45,500 attendances to Accident and Emergency Departments in the United Kingdom. In an effort to reduce this number, the following measures can be taken: the use of child resistant packaging, warning messages on product labels, educational campaigns and returning unused medicines to pharmacies for safe disposal.

The effectiveness of packaging has been assessed with encouraging results and the problems of accidental poisoning with drugs in children has been shown to be reduced by the use of child resistant closures (CRCs). Unit dose packaging such as aluminium strips, opaque blister and sachets are considered to be child resistant but transparent blister packs are not. Click-locks are used for all dispensed loose tablets and liquid containers.

It is important to remember that child-**resistant** closures are not child-**proof**, and so safe storage is still of paramount importance. Often keeping medicines out of the reach of children is not enough as toddlers and young children can be very proficient at climbing. Perhaps "**keep out of sight of children**" would be a more useful directive. This is particularly true of medicines stored in the fridge e.g. antibiotic mixtures, as a fridge cannot be locked. Such medicines are often involved in accidental poisoning, and so care should be taken to keep them well hidden within the fridge.

ADMINISTRATION OF MEDICINES TO CHILDREN

It is still best to keep medicines in locked cupboards or drawers. If this is not possible, research shows that bathroom cabinets or kitchen cupboards are the safest places; open shelves, fridges and handbags being the most dangerous places. Overall, the kitchen is the safest room, probably because the child is more likely to be supervised there.

The group of medicines most commonly associated with accidental poisoning is analgesics, particularly paracetamol and ibuprofen. The most toxic group are tricyclic antidepressants. Oral contraceptives have a high incidence of accidental ingestion by children, probably due to storage (e.g. bed-side cabinet, handbag) and because they are packaged in transparent blister packs. Fortunately the consequences of such ingestion are minimal.

Educational and DUMP (Disposal of Unwanted Medicines and Poisons) campaigns can raise awareness amongst adults and children about the risk of accidental poisoning and encourage the removal of potential poisons from the home however whether these reduce the incidence of poisoning is debatable. Thus the use of CRCs and safe storage are of utmost importance.

The information provided is based on a personal communication with the London Medical Toxicology Unit.

CHILDREN'S DOSES

ACETAZOLAMIDE

Preparations: TABLETS 250mg. SUSTAINED RELEASE CAPSULES 250mg.
INJECTION 500mg. LIQUID (**Extemporaneously Prepared**).

Dosage: **RAISED INTRACRANIAL PRESSURE**
This is an unlicensed indication.
Orally or IV injection, all ages (except neonates), initially 8mg/kg 8 hourly, increasing by 8mg/kg dose up to a maximum dose of 32mg/kg 8 hourly. Sodium bicarbonate may be required to maintain bicarbonate levels above 18mmol/L, see metabolic acidosis (sodium bicarbonate).

GLAUCOMA, EPILEPSY, METABOLIC ALKALOSIS

The use in glaucoma and metabolic alkalosis are unlicensed indications in children.

Orally or IV injection,

Under 12 years, 5-10mg/kg 2-4 times a day. Maximum 750mg/day.
Over 12 years, 5-10mg/kg 4 times a day or, if appropriate, initially one or two sustained release capsules (250mg). Maximum 1000mg/day.

Administration: Reconstitute each vial with 5ml water for injection, and administer as a slow IV injection.

Notes:

- a) Immediate release tablets can be crushed and dispersed in water prior to administration. Alternatively injection can be given orally but must be diluted first.
- b) IM injection should be avoided due to the alkaline pH of the solution.
- c) SR capsules are not licensed for children under 12 years old and are only licensed for use in the treatment of glaucoma.

ACETYLCYSTEINE

Preparations: INJECTION (20%) 2g in 10ml ampoules.
LIQUID (**Extemporaneously Prepared**).
BLADDER WASHOUT 4% 100ml (**Extemporaneously Prepared**).

Dosage: **PARACETAMOL OVERDOSE**

IF IN ANY DOUBT CONTACT THE MEDICAL TOXICOLOGY UNIT
☎ 020 7188 0600 ☎

If the child presents within 12 hours and can be given an oral preparation, **methionine** tablets are effective. If they present after 12 hours or cannot be given an oral preparation, give **acetylcysteine** using the following regimen:

Initially, by slow IV injection,
150mg/kg over 15 minutes, as loading dose
followed by *IV infusion*
50mg/kg over 4 hours,
finally by *IV infusion*,
100mg/kg over 16 hours.
Total of 300mg/kg over 20 hours to be given.

ANTIOXIDANT, ACUTE LIVER FAILURE

This is an unlicensed indication.

IV infusion, 4-8mg/kg/hour, up to 20mg/kg/hour.

MECONIUM ILEUS

This is an unlicensed indication.

Neonates, *orally*, 1-2ml (of the 20% solution) 2-3 times a day.

MECONIUM ILEUS EQUIVALENT

This is an unlicensed indication.

Orally, doses of 2-20ml (of the 20% solution) 2-3 times a day have been used depending on the age of the child (note a).

BLADDER WASHOUT

This is an unlicensed indication.

Dilute 10ml of the 20% injection solution with 40ml sodium chloride 0.9%. *Instil* into the bladder using a bladder syringe, retain for up to 1 hour. Injection may be used undiluted.

Administration: Dilute loading dose to 30-50mg in 1ml with glucose 5%. Continuous infusion should be diluted to 5mg in 1ml with glucose 5%. In fluid restricted patients dilute to 50mg in 1ml.

Notes:

- Acetylcysteine injection solution diluted to 50mg in 1ml can be given orally but is very bitter. Orange or blackcurrant syrup, or coca cola can be used to dilute the injection solution.
- If anaphylactoid reactions occur with IV acetylcysteine, stop infusion and give an antihistamine e.g. chlorphenamine. Restart the infusion at the lowest dose rate once the reaction has subsided, or give methionine if it is less than 12 hours since the overdose.
- Acetylcysteine (Parvolex[®]) contains 12.8mmol of sodium per 2g in 10ml.
- pH of Acetylcysteine (Parvolex[®]) = 6.5 – 7.5
- Monitoring of plasma potassium concentration is recommended as hypokalaemia may occur.

ACICLOVIR

Preparations: TABLETS/DISPERSIBLE 200mg, 400mg and 800mg.
LIQUID 200mg/5ml. INJECTION 250mg and 500mg.
OPHTHALMIC OINTMENT 3%. CREAM 5%. IV INFUSION (**CIVAS**).

Dosage:

CHECK INDICATION, IMMUNE STATUS, RENAL FUNCTION, AGE & WEIGHT OR SURFACE AREA VERY CAREFULLY BEFORE PRESCRIBING.

INTRAVENOUS INFUSION

Patients with severe neonatal herpes or herpes encephalitis should receive treatment for a minimum of 21 days. The benefits of an extended period of suppressive therapy after the 21 day regimen are not yet established. Discuss with Virology.

Treatment for shingles and chickenpox is for 7 days or longer.

A) NEONATAL HERPES (PRESENT BEFORE ONE MONTH)

Treatment of encephalitis, disseminated infection or localised disease due to proven or suspected herpes simplex infection 20mg/kg 3 times a day.

B) TREATMENT OF HERPES SIMPLEX IN THE IMMUNOCOMPROMISED, HERPES SIMPLEX ENCEPHALITIS, SHINGLES AND CHICKENPOX

Under 3 months	20mg/kg	3 times a day
3 months - 12 years	500mg/m ²	3 times a day
Over 12 years	10mg/kg	3 times a day

C) TREATMENT OF HERPES SIMPLEX IN THE NORMAL HOST AND HERPES SIMPLEX PROPHYLAXIS IN THE IMMUNOCOMPROMISED

Under 3 months	10mg/kg	3 times a day
3 months - 12 years	250mg/m ²	3 times a day
Over 12 years	5mg/kg	3 times a day

ORAL THERAPY

Oral aciclovir is not licensed for treatment of infants under three months of age. Intravenous therapy is required in this age.

Treatment course usually 5-7 days in normal host. Duration of therapy in immunocompromised host usually 10 days or longer as clinically indicated.

A) TREATMENT OF SHINGLES OR CHICKENPOX IN THE NORMAL HOST, AND HERPES SIMPLEX IN THE IMMUNOCOMPROMISED HOST

All ages, 20mg/kg 4 times a day. Maximum single dose is 800mg.

OR

3 months - 2 years	200mg	4 times a day
2 - 6 years	400mg	4 times a day
6 - 12 years	800mg	4 times a day
Adult	800mg	5 times a day

B) TREATMENT OF HERPES SIMPLEX IN THE NORMAL HOST, PROPHYLAXIS OF HERPES SIMPLEX IN THE IMMUNOCOMPROMISED HOST

3 months - 2 years	100mg	4-5 times a day
Over 2 years	200mg	4-5 times a day

HERPES SIMPLEX KERATITIS

Ophthalmic ointment: Apply 5 times a day until corneal re-epithelialisation has occurred; continue for a further 3 days after healing is complete.

HERPES SIMPLEX INFECTION OF THE SKIN

Cream: Apply 5 times a day for 5 days – benefit only if commenced before blister appears.

IN RENAL FAILURE

IV infusion,

Creatinine clearance (ml/minute/1.73m ²)	Dose	Dosage interval (hours)
25-50	Normal	12
10-25	Normal	24
CAPD	Half	24
Haemodialysis	Half	24 (and after dialysis)

Orally,

Creatinine clearance (ml/minute/1.73m ²)	Dosage interval (hours)
10-25	8
Less than 10	12

Administration:

Reconstitute (if necessary) each 250mg vial with 10ml or each 500mg vial with 20ml of water for injection or sodium chloride 0.9% to give 25mg in 1ml solution (displacement volume negligible). The injection can be given undiluted, via a central line using a syringe pump, over a minimum of **1 hour**, **OR** dilute to 5mg in 1ml with sodium chloride 0.9% or glucose 5% and infuse over 1 hour, for peripheral administration.

Infusion solution can be ordered from CIVAS.

Notes:

- a) Polyuric renal failure may occur with high dose IV therapy. If renal impairment develops during treatment, a rapid response normally occurs following hydration of the patient and/or dosage reduction or withdrawal. Avoid dehydration; specific care should be taken in all patients receiving aciclovir to ensure they are well hydrated.
- b) Aciclovir is given as an IV infusion to avoid a rapid increase in blood urea and creatinine levels.
- c) Concomitant administration with mycophenolate increases plasma levels of both drugs.
- d) Oral administration is contraindicated in neonates as the pharmacokinetics are uncertain.
- e) Each 250mg of powder for injection contains 1.1mmol of sodium.
- f) Aciclovir liquid (Zovirax[®]) is sugar free and banana flavour.
- g) To calculate doses for overweight children use IBW (ideal body weight).

ACTIVATED CHARCOAL

Preparations: ORAL SUSPENSION 50g in 240ml.

Dosage: **TREATMENT OF POISONING**

**IF IN ANY DOUBT CONTACT THE MEDICAL TOXICOLOGY UNIT
☎ 020 7188 0600 ☎**

Administration: *Orally*, 1g/kg. (max 50g) In some cases (e.g. following ingestion of sustained release products) this dose should be repeated every 4 hours until charcoal is seen in stools or until clinical improvement. Give suspension as soon as possible after ingestion of the poison or stomach wash-out.

Notes: Concurrent drugs (e.g. to treat shock) should be given parenterally since absorption may be reduced.

ADALIMUMAB

Preparations: INJECTION 40mg PREFILLED PEN or PREFILLED SYRINGE.

Dosage: **CROHN'S DISEASE (SEEK PHARMACY APPROVAL)**
Subcutaneous Injection

Child 13 - 17 years: Initial dose of 80mg followed 2 weeks later by 40 mg on alternate weeks; review treatment if no response within 12 weeks.

Notes:

Children should be evaluated for tuberculosis before treatment. Active tuberculosis should be treated with standard treatment for at least 2 months before starting adalimumab. Children and their carers should be advised to seek medical attention if symptoms suggestive of tuberculosis (e.g. persistent cough, weight loss, and fever) develop.

ADENOSINE

Preparations: INJECTION 6mg in 2ml.

Dosage: **ANTIARRHYTHMIC**
This indication is unlicensed for use in children.

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Newborn – 12 years	Fast IV bolus, initially 100mcg/kg, increasing if necessary after 2 minutes by 50mcg/kg to a maximum dose of 300mcg (if < 1 month) or 500mcg/kg (if > 1 month).
12 – 18 years	Fast IV bolus of 3mg increase after 2 minutes to 6mg and after a further 2 minutes to 12 mg if necessary (max dose 18mg)

Administration: Fast IV bolus injection over less than 2 seconds, followed by a 5-10ml rapid sodium chloride 0.9% flush, given centrally if possible as adenosine is both painful and rapidly metabolised in the peripheral circulation.

Notes:

- Initial dose should be quartered (i.e. 25microgram/kg) if patient is on concurrent dipyridamole.
- Aminophylline, theophylline, caffeine and other xanthines are strong inhibitors of adenosine's antiarrhythmic action.
- Dosage adjustment of adenosine is not required in renal or hepatic impairment.
- Adenosine is not recommended in asthmatics because it can cause bronchoconstriction.
- Very rarely, adenosine may accelerate some tachycardias and therefore resuscitation facilities must be available before administration.

ADRENALINE (EPINEPHRINE)

Preparations: INJECTIONS 1mg in 1ml (1 in 1000) (1ml, 5ml, 10ml) and 1mg in 10ml (1 in 10,000) (**Specials Manufacturer**).
 PREFILLED SYRINGE (MINIJET) 1mg in 10ml (1 in 10,000) and 1mg in 1ml (1 in 1000).
 EPIPEN 150microgram/0.3ml and 300microgram/0.3ml.
 JEXT PREFILLED PEN 150microgram and 300microgram

Dosage: These indications are unlicensed for children under 1 year. The use of 1 in 1,000 as IV infusion is also unlicensed.

CARDIAC ARREST

SEE CPR GUIDELINES

IO/IV injection, all ages, 10microgram/kg (0.1ml/kg of 1 in 10,000). Repeat as required.

OR

IO/IV injection,

AGE	NEWBORN	6 MTH	1 YR	4 YR	8 YR
WEIGHT	3kg	6kg	10kg	15kg	25kg
1 in 10,000	0.3ml	0.6ml	1ml	1.5ml	2.5ml

If vascular access not available, administer via an endotracheal tube, *endotracheally*, 100microgram/kg.

ACUTE ANAPHYLAXIS AND STATUS ASTHMATICUS

IM or SC, all ages, 10microgram/kg (0.01ml/kg of 1 in 1000). Doses may be repeated every 5 minutes if necessary according to response. (IM is recommended because SC routes absorption might be delayed). Epipen-junior should be suitable for children down to 6 months, but care should be taken when looking at needle length and muscle mass.

OR

Age (Average weight or greater)	Volume of adrenaline (1 in 1000/1mg in 1ml)
< 6 months	0.05ml
6 months – 6 years	0.12ml
6 - 12 years	0.25ml
Adult & Adolescent	0.5ml – 1ml

OR

Weight	Dose	
7.5-30kg	Epipen Jr [®] 150microgram in 0.3ml	May be used from 25kg.
Over 30kg	Epipen [®] 300microgram in 0.3ml	

IV injection, 10microgram/kg (0.1ml/kg of 1 in 10,000).

ACUTE HYPOTENSION

IV infusion, all ages, 0.1-1.5microgram/kg/minute increasing until a response obtained. Higher doses have been used.

STRIDOR

This is an unlicensed indication.

All ages, *nebulised*, 1ml of 1 in 1,000 adrenaline diluted with 3ml sodium chloride 0.9% (effect rapidly wears off).

CROUP

This is an unlicensed indication.

All ages, *nebulised*, 5ml of 1 in 1,000 (undiluted).

Administration: IV Infusion, dilute with sodium chloride 0.9% or glucose 5% (preferred).
Via endotracheal tube, dilute with an equal volume of sodium chloride 0.9% (up to 5ml) and bag in over at least 5 minutes.

ALENDRONIC ACID

Preparations: TABLETS 70mg.

Dosage: **INHIBITION OF BONE TURNOVER, OSTEOPOROSIS**
This indication is unlicensed for use in children.
Orally,
Children >12 years 70mg weekly

Notes:

- a) **Avoid if eGFR is less than 35 mL/minute.**
- b) Counselling: Swallow the tablets whole with a full glass of water on an empty stomach at least 30 minutes before breakfast (and any other oral medication); stand or sit upright for at least 30 minutes and do not lie down until after eating breakfast. Do not take the tablets at bedtime or before rising.
- c) Severe oesophageal reactions (oesophagitis, oesophageal ulcers, oesophageal stricture and oesophageal erosions) have been reported; patients should be advised to stop taking the tablets and to seek medical attention if they develop symptoms of oesophageal irritation such as dysphagia, new or worsening heartburn, pain on swallowing or retrosternal pain.
- d) Tablets can be crushed.

ALFACALCIDOL **(1-ALPHAHYDROXYCHOLECALCIFEROL)**

Preparations: CAPSULES 0.25microgram and 1microgram.
ORAL DROPS 2microgram in 1ml. (1 drop = 0.1microgram, 1ml = 20 drops).
INJECTION 2microgram in 1ml.

Dosage: **PROPHYLAXIS AGAINST EARLY NEONATAL HYPOCALCAEMIA IN PREMATURE BABIES**
Orally, 100nanogram (0.1microgram)/kg/day.

NEONATAL HYPOCALCAEMIA

Neonates, orally, initially 50-100 nanogram (0.05-0.1microgram)/kg once a day then modify according to response. In severe cases, doses of up to 2microgram/kg/day may be needed.

HYPOPHOSPHATAEMIC RICKETS

Neonates and premature infants 0.05 - 0.1 micrograms/kg/day
Children less than 20kg; 0.05 micrograms/kg/day
Children over 20kg; 1 microgram/day

VITAMIN D DEFICIENCY IN LIVER PATIENTS, (AS PER KING'S COLLEGE HOSPITAL LOCAL GUIDELINE)

Orally, 50 to 100 nanogram (0.05-0.1microgram)/kg/dose once a day (max starting dose 1 microgram). Then adjust dose according to levels (Use in combination with Calciferol).

TREATMENT AND PROPHYLAXIS OF RENAL OSTEODYSTROPHY & CHOLESTATIC LIVER DISEASE

Under 20kg, orally, 15-30nanogram/kg once a day, (max. 500nanograms).

Over 20kg, orally, 250-500nanogram (0.25-0.5microgram) once a day.

Adjust dose according to response.

Administration: Oral and IV dose are the same – administer IV dose as a bolus over 30 seconds

Notes:

- a) For comparison of vitamin D preparations see Adult Formulary.
- b) Nutritional deficiency of Vitamin D is best treated with colecalciferol or ergocalciferol. Vitamin D requires hydroxylation by the kidney and liver to its active form. Therefore, the hydroxylated derivative (alfacalcidol) should be prescribed for patients with severe liver or renal impairment who require Vitamin D therapy.
- c) Alfacalcidol drops (One-alpha[®]) contains alcohol, but is colour and sugar free. One-alpha[®] capsules contain sesame oil.
- d) A significant risk of hypercalcaemia exists if treatment is long term.
- e) To avoid confusion it is advised to prescribe the oral drops in terms of micrograms. Volumes should be drawn up using an oral syringe instead of using drops.
- f) Injection contains propylene glycol.
- g) Plasma calcium-concentration should be checked regularly whilst on Alfacalcidol.
- h) Indices of response include plasma levels of calcium (ideally corrected for protein binding), alkaline phosphatase, parathyroid hormone, as well as radiological and histological investigations.
- i) In the management of renal osteodystrophy, the aim is to maintain parathyroid hormone level at or slightly above the normal range.

- Oversuppression can result in adynamic bone disease.
- j) For liver patients who have Vitamin D deficiency, they should remain on drug treatment until levels remain in the range of 30 to 60ng/l. This may take up to 6 months in some post liver transplant children.

ALIMEMAZINE (TRIMEPRAZINE)

Preparations: TABLETS 10mg. LIQUID 7.5mg in 5ml and 30mg in 5ml.

Dosage:

ANTIHISTAMINE

This indication is unlicensed for use in children under 2 years.

Orally, over 6 months, 1mg/kg/day in 3-4 divided doses.

OR

6 months - 2 years	250microgram/kg	3 - 4 times a day
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2 - 5 years	2.5mg	3 - 4 times a day
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5 - 12 years	5mg	3 - 4 times a day
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Over 12 years	10mg	2 - 3 times a day
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Up to maximum 100mg/**day**.

SEDATION, PREMEDICATION

This indication is unlicensed for children under 2 years and over 7 years.

Orally, over 1 month, 2mg/kg/dose 30-60 minutes before bedtime or before procedure (e.g. MRI scan) often used with chloral hydrate as a premed. Maximum dose is 60mg.

Notes:

- a) Caution: in infants under 6 months because of the possible association with 'cot deaths'.
- b) In chronic eczema doses are often just given at night and higher doses may also be needed.
- c) Alimemazine liquid (Vallergan®) contains sugar and 4.8% w/v of alcohol (7.5mg/5ml).
- d) Alimemazine can cause ECG changes including prolonged QT interval. Pre-existing cardiac disease, hypokalaemia and concurrent tricyclic antidepressant use may predispose.
- e) See sedation guidelines and premedication guidelines.

ALLERGEN IMMUNOTHERAPY (See as listed below)

a) GRASS POLLEN EXTRACT – (GRAZAX®)

Preparations: Oral lyophilisates TABLET: grass pollen extract 75000 units.

Dosage: **TREATMENT OF SEASONAL ALLERGIC HAY FEVER DUE TO GRASS POLLEN**

Pharmacy Approval Required Before Use

Sublingual: 5–18 years: 1 tablet daily; start treatment at least 4 months before start of pollen season, continue for up to 3 years.

Notes:

- a) The oral lyophilisate should be taken from the blister unit with dry fingers, and immediately placed under the tongue, where it will disperse.
- b) Swallowing should be avoided for about 1 minute. Food and beverage should not be taken for the following 5 minutes.
- c) If no relevant improvement of symptoms is observed during the first pollen season, there is no indication for continuing the treatment.

b) GRASS & RYE EXTRACT – (POLLINEX QUATTRO®)

Preparations: INJECTION 1ml. 300SU/ml (Green), 800SU/ml (Yellow) and 2000SU/ml (Red).

Dosage: **TREATMENT OF SEASONAL ALLERGIC HAY FEVER DUE TO GRASS POLLEN**

6 years and over: Four 1ml doses to be injected subcutaneously in increasing strength prior to pollen season at 1 to 4 weeks intervals.

1st dose – 300SU followed in 1 – 2 weeks by,

2nd dose – 800SU followed in 1 – 2 weeks by,

3rd dose – 2000SU followed in 1 – 4 weeks by,

4th dose – 2000SU (final dose)

If the patient is highly sensitised, the dosing and progression from dose to dose should be adapted to the patient's reactivity according to the clinician's discretion.

Administration: The suspension should be warmed to room temperature and shaken well until all the sediment is evenly re-suspended immediately before injecting.

Rotate site of injection.

Notes:

- a) The CSM has advised that facilities for cardiopulmonary resuscitation must be immediately available and children must be monitored closely for 1 hour after each injection due to potential occurrence of anaphylactic reactions/shock
- b) If one or more dose is missed and the recommended interval between injections is exceeded by 7 days, treatment must be re-started.
- c) For highly sensitive patients 0.5ml of each vial can be used per dose.
- d) Intramuscular and intravascular injection should be strictly avoided.
- e) Vaccinations should be administered at least 7 days after the last dose of POLLINEX QUATTRO. The next dose of POLLINEX QUATTRO should be given at least 14 days after the vaccination date.
- f) Contraindicated in asthma, acute or chronic infection or inflammation, autoimmune disease and treatment with beta blockers (refer to product literature for full list).
- g) Store in fridge.
- h) Once opened, the product may be stored for a maximum of 70 days at 2°C – 8°C.

c) Sublingual ImmunoTherapy (SLIT) - (STALORAL®)

Preparations: SUBLINGUAL SOLUTION at 10IR/ml (Blue Cap) and 300IR/ml (Violet Cap) as 10ml vials.
 Dust Mite (*D. Pteronyssinus*).
 Dust Mite (*D. Pteronyssinus* + *D. Farinae*).
 5 Grasses Mixtures.
 Betulacea Tree Mixture.
 SUBLINGUAL SOLUTION at 10IR/ml (Blue Cap) and 100IR/ml (Red Cap) as 10ml vials.
 Cat, Dog, Horse

Dosage:

Strength	Day	Doses
Low Strength (10IR/ml) Initiation Phase	7 doses/day, then	7 days (1 st dose given in hospital)
High Strength (300IR/ml) Maintenance Phase	7 doses/day, then 4 doses/day	1 day (given in hospital), for at least 3-5 years

IN CASE OF TREATMENT INTERRUPTION

Phase	Length of interruption	What to do
Initiation Phase	1 - 2 weeks	Continue escalation without any change.
	2 weeks - 1 month	Repeat the previous dose and then continue the initiation phase normally.
	> 1 month	Restart the dose escalation with the same vial and continue normally.
Maintenance Phase	< 4 weeks	No change.
	> 4 weeks	Reduce the dose by 50% then continue with previous well tolerated dose.

Administration:

1 press of the pump dispenser = 1 dose.
 The dose is to be deposited directly under the tongue and left there for about 2 minutes before swallowing.
 Administer in the morning on an empty stomach.

Notes:

- The course of treatment should be discontinued if there is no improvement within 9 – 12 months, for perennial allergy or after 2 pollen seasons, for seasonal allergy.
- Traditional pharmacotherapy (corticosteroids, antihistamines) must be continued during a course of SLIT.
- Side effects are rare and mainly consist of buccal pruritis or gastrointestinal reactions. In case of repeated episodes, return to previous well tolerated dose and then increase day after day until the full maintenance dose is reached.
- Contraindications include: serious immunodeficiency, malignant disease, unstable asthma, auto-immune disease and on-going treatment with beta-blockers.
- Store in the fridge. Discard 4 months after opening.

d) VENOMS (BEE & WASP ALLERGEN EXTRACT)

Preparations: SUBCUTANEOUS INJECTION (Initial and Maintenance sets for reconstitution).
PHARMALGEN[®] (ALK-ABELLÓ).
BEE VENOM EXTRACT (APIS MELLIFERA).
WASP VENOM EXTRACT (VESPULA SPP).

Dosage: **HYPERSENSITIVITY TO WASP OR BEE VENOM**
'to be undertaken in specialist allergy setting only'
Initial treatment is by one of three schedules:
"Modified Rush or Cluster Technique"
"Conventional Schedule"
"Rush Schedule"

Maintenance Treatment

100 micrograms of venom in 1ml each month for at least 3 years.

If the injection volume is too large for a small child to tolerate comfortably, then the injection volume may be split into multiple injections.

For patients who experience allergic reactions after the recommended maintenance dose has been attained, the maintenance dose can be increased to 200 micrograms.

Notes:

- a) CSM advice: facilities for cardiopulmonary resuscitation must be immediately available and children monitored closely for 1 hour after each injection.
- b) If symptoms or signs of hypersensitivity develop (e.g. rash, urticaria, bronchospasm, faintness), even when mild, the child should be observed until these have resolved completely.

ALLOPURINOL

Preparations: TABLETS 100mg and 300mg.
LIQUID (**Extemporaneously Prepared**).

Dosage: **PREVENTION OF URIC ACID NEPHROPATHY, NEOPLASTIC DISEASE, METABOLIC DISORDERS e.g. LESCH-NYHAN SYNDROME**
Orally,
1 month - 15 years 10-20mg/kg once a day, (max 400mg daily).
Over 15 years Initially 100mg once a day, increasing according to condition to a maximum of 900mg/day.
Divide doses over 300mg.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dosage
10-50	7-14mg/kg/day
Less than 10	3-7mg/kg/day or give at longer intervals

Allopurinol and its metabolites are removed by haemodialysis. Dose should be given after dialysis with none in the interim.
Peritoneal dialysis: Dose as for creatinine clearance less than 10ml/minute/1.73m² and monitor oxypurinol levels. Levels are measured by the Purine Research Laboratory ☎ Guy's ext 81265.

Notes:

- a) If concurrent use of mercaptopurine or azathioprine is necessary, reduce the dose of these drugs to 25% as allopurinol competes for excretion within the renal tubule.
- b) Allopurinol toxicity may be increased by thiazide diuretics.
- c) If rash occurs withdraw therapy. If rash is mild reintroduce allopurinol on resolution of rash however discontinue if rash recurs.
- d) Lesch Nyhan Syndrome – Allopurinol dose should be adjusted to uric acid and xanthine levels in blood & urine.

ALTEPLASE (t-PA)

Preparations: INJECTION 20mg and 50mg.
INJECTION 4mg in 4ml (**GSTT special**) (Freezer).

Dosage: **FIBRINOLYTIC AGENT TO DISSOLVE INTRAVASCULAR THROMBI**
This is unlicensed for use in children.
IV infusion, Standard dose 0.1-0.6mg/kg/hr for 4 hours
Usual start dose 0.3mg/kg/hr

Low dose (neonates)	0.06mg/kg/hr for 24-48 hours
Low dose (non-neonates)	0.03mg/kg/hr for 24-48 hours

OCCLUDED ARTERIOVENOUS SHUNTS, PERITONEAL DIALYSIS CATHETERS AND INDWELLING CENTRAL LINES

Using the 1mg in 1ml solution, *instil* the appropriate volume into the catheter. Refer to catheter manufacturer if lumen volume is unknown. Dose into catheter should not exceed 1.5mg/kg.

HAEMODIALYSIS CATHETER THROMBI DISSOLUTION

0.01mg/kg/hr infused through each lumen of the haemodialysis catheter for 4-6 hours. Make up 2 syringes (one for each lumen).

Patient weighing 10-19kg: Use (0.4 x Wt)mg in 20ml Sodium Chloride 0.9% and run at 0.5ml/hr.

Patient weighing 20-100kg: Use (0.1 x Wt)mg in 10ml Sodium Chloride 0.9% and run at 1ml/hr.

Administration: **IV infusion:** Dissolve with water for injection to a concentration of 1mg/ml. May be diluted further to a minimum concentration of 0.2mg/ml with saline prior to administration. Once reconstituted, the solution for infusion and Haemodialysis Dissolution is stable for 8 hours at room temperature (25°C).

Instillation: 1mg in 1ml injection is stored in the freezer. Defrost thoroughly and allow solution to come to room temperature before using. Instil into the affected catheter, clamp off and retain for at least 4 hours. The lysate is then **aspirated**, DO NOT FLUSH until alteplase has been aspirated from the catheter. [After defrosting use as soon as possible – within 4 hours – **do not refreeze**].

Notes:

- Antibody formation has not been observed with alteplase and hence repeated doses may be given.
- Extreme caution** should be used in patients with an increased risk of bleeding and with recent traumas e.g. biopsies, venepuncture.
- Monitor prothrombin time, partial thromboplastin time and fibrinogen levels 4 hours after commencing infusion and every 6-8 hours thereafter.
- For arterial thrombosis a heparin infusion may run concurrently starting at 10units/kg/hr at the consultant's discretion depending on individual clinical case. Aim for therapeutic APTT. Refer to paediatric thrombolysis guideline.

ALUMINIUM HYDROXIDE

Preparations: CAPSULES 475mg.

Dosage: **PHOSPHATE BINDING IN RENAL PATIENTS**
Orally, initially,
5 - 12 years 1 - 2 capsules 3 - 4 times a day
Dose is adjusted according to phosphate levels.

Notes:

- a) Calcium carbonate is the preferred phosphate binding agent because of the risk of aluminium toxicity.
- b) For phosphate binding in patients who cannot take capsules sucralfate may be used.
- c) Converting between aluminium hydroxide and calcium carbonate as phosphate binders the following can be used as a starting guide:
One aluminium hydroxide 475mg capsule (Alucap[®]) is equivalent to:- one calcium carbonate 1500mg tablet (Adcal[®]).
- d) Aluminium hydroxide is very constipating, laxatives may be required.
- e) Ascorbic acid and citrate may increase aluminium absorption.

AMILORIDE

Preparations: TABLETS 5mg. LIQUID 5mg in 5ml.

Dosage: **POTASSIUM-SPARING DIURESIS**
This indication is unlicensed for use in children.
All ages, *orally*, 100-200microgram/kg twice a day. (Max. 20mg).
12 years - 18 years : 5-10mg twice a day

IN RENAL FAILURE

Diuresis is poor in patients with renal failure, therefore amiloride is best avoided if creatinine clearance is less than 50ml/minute/1.73m² (can result in severe hyperkalaemia). If needed and CrCl 10-50ml/minute/1.73m² use 50% of dose.

Notes:

- a) Avoid concurrent use of spironolactone, ACE-inhibitors or other potassium-sparing diuretics due to the risk of hyperkalaemia.
- b) Amiloride appears particularly to cause hyperkalaemia in diabetics.
- c) Liquid is sugar-free.
- d) Increased risk of nephrotoxicity with NSAID's.

AMINOPHYLLINE

Preparations: MODIFIED RELEASE TABLETS 225mg and 100mg (**Purchased on request**). INJECTION 250mg in 10ml.

Dosage: **ASTHMA THERAPY**

DO NOT GIVE A LOADING DOSE IF THE CHILD WAS PREVIOUSLY ON ORAL AMINOPHYLLINE OR THEOPHYLLINE.

IV infusion, loading dose of 5mg/kg (max. 500mg) given over 20 minutes, followed by:

1month - 9 years: 1mg/kg/hr

9 - 16 years: 800micrograms/kg/hr

16 - 18 years: 500micrograms/kg/hr

Orally, (slow release tablets - **cannot be chewed**).

Initially

Under 3 years see theophylline

3 - 12 years 6mg/kg twice a day

12 - 18 years 100 – 225mg twice a day

Dose is doubled after 1 week. Adjust maintenance dose according to levels. Some children require 13-20mg/kg/day if they suffer chronic asthma. Maximum dose 40mg/kg/day.

PREVENTION OF APNOEA DURING PROSTAGLANDIN E INFUSION IN NEONATES

(Unlicensed)

Bolus of 6mg/kg (before or during initiation of PGE infusion).

Then, 2.5mg/kg (up to 3.5mg/kg) every 12 hours for 72 hours (check levels at 18 and 36 hours – optimum levels = 8-12mg/L).

Administration: Dilute infusion to 1mg in 1ml in sodium chloride 0.9% or glucose 5%. If patient is fluid restricted, injection solution can be given undiluted (preferably centrally). The infusion can usually be stopped and not tapered down.

Notes:

- a) 100mg aminophylline is equivalent to 80mg theophylline.
- b) Blood levels:
 - Approx. time to steady state: 1-2 days
 - Therapeutic range of theophylline: 10-20mg/L
 - Take levels 30 mins after end of loading dose, then 12-24 hours after initiation of infusion.
 - Take trough sample, immediately prior to next dose for slow release preparations or at least 8 hours after starting IV dose.
- c) Frequency of serious toxic side effects increases at plasma concentrations >25mg/L.
- d) The bioavailability of brands of slow release aminophylline may differ and therefore brands should be stated on each prescription. Pharmacy currently stocks Phyllocontin®.
- e) Refer to theophylline for potential drug interactions.
- f) Doses in obese children should be calculated on ideal body weight.

AMIODARONE

Preparations: TABLETS 100mg and 200mg. INJECTION 150mg in 3ml.
LIQUID (**Extemporaneously Prepared**).

Dosage: **ANTIARRHYTHMIC**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Unlicensed for use in children.

0-12 years, *orally*, 5-10mg/kg twice a day for 7-10 days, then 5-10mg/kg once a day.

12-18 years, *orally* 200mg three times a day for 7 days, then 200mg twice a day for 7 days then 200mg daily,

Adjust the maintenance dose after 2 weeks, according to plasma levels.

Larger doses may be required in some patients.

Slow IV injection, 5mg/kg/dose, repeated up to total of 15mg/kg (1.2g) over 24 hours.

IV infusion, 25microgram/kg/minute for 4 hours, then 5-15microgram/kg/minute (maximum 1.2g/24hrs).

Cardiopulmonary resuscitation – see guidelines – 5mg/kg.

ANTENATAL ARRHYTHMIAS (MATERNALLY ADMINISTERED DRUGS)

Orally, 800mg three times a day for 2-7 days (loading dose), followed by 800mg once a day for 7 days.

Maintenance 200-400mg once a day.

Initial loading done in hospital with ECG monitoring.

Administration: IV injection, over 30 minutes or continuous IV infusion; preferably via a central line. Diluted in 5% glucose (**not** sodium chloride 0.9%). Do not dilute below 600microgram in 1ml.

Notes:

- a) Blood levels:
 - Steady state is achieved when ratio of desethyl-amiodarone to amiodarone is approx. 0.8 to 1.
 - Therapeutic range of amiodarone and metabolite: 0.6-2.5mg/L.
 - Take trough sample, immediately prior to next dose.
- b) Severe hypotension may occur if infusion is too rapid.
- c) The maintenance doses of digoxin and flecainide should be halved if amiodarone therapy is introduced.
- d) Amiodarone potentiates oral anticoagulants and may potentiate the effects of highly protein bound drugs such as phenytoin.
- e) Corneal microdeposits usually occur during long term administration. These rarely interfere in the vision and are reversible on withdrawal.
- f) Photosensitivity (sunburn) of exposed areas occur frequently. Sunblock creams are required.
- g) Bluish-grey pigmentation of exposed areas may also occur after prolonged exposure and may become permanent.
- h) Thyroid function tests should be checked at 6 monthly intervals.
- i) Pulmonary alveolitis and pulmonary fibrosis have been reported. A baseline chest X-ray should be performed. Repeat 6 monthly.
- j) Irreversible liver damage has been reported therefore liver function tests should be performed at 6 monthly intervals. A sample for a base line LFT should be taken before starting maintenance therapy.
- k) Amiodarone Hydrochloride IV injection contains Benzylalcohol. This has been associated with gasping syndrome in neonates and infants. Keep an eye if child on other drugs containing the same preservative.
- l) IV formulation should not be given orally.

AMITRIPTYLINE

Preparations: TABLETS 10mg, 25mg and 50mg.
LIQUID 50mg in 5ml (**Manufactured Specials**).

Dosage: These indications are unlicensed for use in children.

NOCTURNAL ENURESIS

> 6 years 10-25mg at night
> 12 years 25-50mg at night

DEPRESSION

> 12 years 25mg 2 - 3 times a day, or 50mg at night
Usual maintenance 50-150mg daily.

NEURALGIC PAIN

> 12 years 30mg at night (maximum 150mg daily).

Notes:

- a) Amitriptyline is generally avoided in children due to the dangers in overdose (seizures, hypotension, arrhythmias, prolonged QRS interval, flushing, dilated pupils and coma).
- b) Tricyclic antidepressants lower the seizure threshold and should be used with caution in patients with a history of convulsions. They may also increase the risk of arrhythmias and should be avoided in patients with heart block or a history of arrhythmias.
- c) Treatment should not exceed 3 months without further review. Treatment should be withdrawn gradually.
- d) ECG advisable before prescribing.

AMLODIPINE

Preparations: TABLETS 5mg and 10mg.
LIQUID 5mg in 5ml (**Manufactured Special**) (Fridge).

Dosage: **HYPERTENSION**
This indication is unlicensed for use in children.
Orally, initially, 100-200microgram/kg once a day, increased according to response (usually at 1-2 weekly intervals). Maximum 10mg/**day**. Total daily dose may be split twice daily in younger children
OR
initially,
6 - 15kg 1.25mg once a day
15 - 25kg 2.5mg once a day
over 25kg 5mg once a day

Notes:

- a) Amlodipine 5-10mg/day has been shown to be comparable to nifedipine retard 40mg/day.
- b) Amlodipine tablets can be crushed and dispersed in water.
- c) Dose may need to be reduced in liver impairment.
- d) Tablets may contain different salts (besilate, maleate, mesilate), but the strength is always expressed in terms of the base).

AMOXICILLIN

Preparations: CAPSULES 250mg and 500mg. LIQUIDS 125mg in 5ml and 250mg in 5ml. SACHETS 3g. INJECTIONS 250mg and 500mg.

Dosage: **TREATMENT OF INFECTION**
Premature neonates, neonates up to 7 days old,
Orally/IV/IM, 50mg/kg bd.

DOSE SHOULD BE DOUBLED IN SEVERE INFECTION/MENINGITIS

Neonates over 7 days old, infants and children.

Orally,

Up to 1 year	62.5mg	}
1 - 5 years	125mg	} 3 times
5 - 12 years	250mg	} a day
Over 12 years	250-500mg	}

DOSE SHOULD BE DOUBLED IN SEVERE INFECTION AND CYSTIC FIBROSIS

IV injection,

30mg/kg 3 times a day up to a maximum 4g/day.

DOSE SHOULD BE DOUBLED IN MENINGITIS

IN RENAL FAILURE

Creatinine clearance (ml/min/1.73m ²)	Dosage interval (hours)
10-50	8-12
<10	12-18

Amoxicillin is significantly cleared by haemodialysis and peritoneal dialysis, give dose as per creatinine clearance of 10-50ml/minute/1.73m² above - dose is given after dialysis session.

Administration: Reconstitute vials to give 50mg in 1ml concentration (use displacement value). Inject over 3-4 minutes.

May be further diluted with sodium chloride 0.9%.

During reconstitution a transient pink colour may occur, reconstituted solutions are usually a pale straw colour. Do **NOT** administer if reconstituted solution is pink.

Notes:

In confirmed **penicillin allergy**, cephalosporins and other beta-lactams should be avoided.

AMPHOTERICIN

Preparations: LIPOSOMAL INJECTION 50mg (AmBisome®).
BLADDER WASHOUT 100microgram in 1ml in Water for Irrigation (100ml) (**Extemporaneously Prepared**) (Fridge).

Dosage: **SYSTEMIC ANTIFUNGAL**
Prescribe as “Amphotericin liposomal (AmBisome®)”
All ages, give a test dose (see note a) of 100microgram/kg, to a maximum of 1mg, over 10 minutes, followed 1 hour later by 1mg/kg/day, increased if necessary, to 3mg/kg/day – 5mg/kg/day. Dose is 3mg/kg/day in febrile neutropenia.

Administration: **LIPOSOMAL IV INFUSION**
Add 12ml water for injection to liposomal amphotericin to produce a 4mg in 1ml solution. SHAKE vial vigorously to disperse liposomes. Add the liposomal amphotericin to glucose 5% (no other solutions suitable) using the 5 micron filter provided. Liposomal amphotericin should be diluted to an appropriate concentration between 0.2mg in 1ml and 2mg in 1ml. Infuse over 30-60 minutes.

BLADDER WASHOUT AND VIA NEPHROSTOMY TUBES
Bladder washout, pre-made in pharmacy.
Administration: Use a solution of 100microgram in 1ml twice a day. Volumes up to 100ml have been used depending on the size of the bladder. Clamp catheter for 60-120 minutes then drain.

Nephrostomy tubes, – pre-made in pharmacy.
Administration: Use a solution of 50microgram in 1ml (in sterile water) instil up to 10mls, to a maximum of 6 times a day through nephrostomy tube. Clamp catheter for 30 minutes then drain.

IN RENAL FAILURE
No dosage reduction is required in pre-existing renal failure.

Notes:

- a) Adverse effects during the infusion may include fever, chills and rigors. Hydrocortisone and chlorphenamine may be given to patients who have previously had these effects prior to starting the infusion to prevent them.
- b) Amphotericin is nephrotoxic; blood counts and serum potassium levels should be closely monitored. May decrease serum magnesium levels.
- c) There is some evidence suggesting synergism between amphotericin and flucytosine. Concurrent administration of intravenous imidazole drugs and amphotericin may be antagonistic.

ANTITHYMOCYTE GLOBULIN (ATG -RABBIT)

Preparations: INJECTION 25mg in 5ml (Fridge).

Dosage: **PREVENTION OF RENAL GRAFT REJECTION FOR HIGHLY SENSITISED PATIENTS AND TREATMENT OF RENAL GRAFT REJECTION**

SEEK EXPERT ADVICE.

All ages, *IV injection*, **test dose** 0.1mg (see note c); then **full dose** 2mg/kg/day for 4 days in case of prophylaxis and until resolution of the clinical and biological signs in case of treatment, up to 10 days.

TREATMENT OF APLASTIC ANAEMIA

All ages, *IV injection*, **test dose** 0.1mg (see note c); then **full dose** 10-20mg/kg/day for 8-14 days. Usual course is 10 days.

Administration: **Test dose**, dilute to 5-10ml in sodium chloride 0.9% or glucose/saline, administered over 30 minutes. If no severe reactions are observed after 30 minutes the full dose may be commenced immediately.

Full dose, dilute to a final concentration of not more than 2mg ATG in 1ml of sodium chloride 0.9% or glucose/saline.

Administered via a central line, if possible, over a min. of 4 hours.

Notes:

- a) Currently ATG is mainly used for prevention of renal graft rejection for highly sensitised patients with positive cross match. For non-sensitised or sensitised with negative cross match basiliximab is considered.
- b) Chlorphenamine and hydrocortisone injection should be given 1 hour before commencing infusion of ATG. Do not give prior to test dose.
- c) Test dose is 0.1mg total dose regardless of weight.

APROTININ

Preparations: INJECTION 70mg in 50ml (500,000 Kallikrein Inactivator Units).

Dosage:

PRESCRIBING USE MUST BE AGREED BY PICU CONSULTANTS

- a) Treatment of major blood loss due to **hyperplasmaemia**.
10,000kiu/kg loading dose followed by 3,000kiu/kg/hr
- b) Prophylaxis and treatment of patients at high risk of major blood loss during or following **cardiac surgery on cardiopulmonary bypass**.
30,000kiu/kg loading dose on induction of anaesthesia, plus 30,000kiu/kg in pump prime, followed by 10,000kiu/kg/hr until 1 hour post bypass.

Administration: 2.5% of the loading dose should be administered over 5-10minutes. Wait 10 minutes, if no sign of anaphylactic reaction then give the remaining of the dose over 20 minutes.

Notes:

- a) The vials should be kept at room temperature, however if the contents are cloudy the product must not be used.
- b) Drugs for resuscitation and anaphylaxis should always be available.
- c) There is a significant risk of anaphylactic reactions. For patients previously exposed to aprotinin delay administration until surgeon is ready to immediately institute bypass. Re-exposure patient should get a prophylactic antihistamine dose.
- d) Do not administer a 2nd dose within 6 months of 1st exposure.
- e) Aprotinin is incompatible with antibiotic solutions (i.e. Tetracyclines, beta lactams), corticosteroids, heparin and TPN.

ARGININE (L-Arginine)

Preparations: INJECTION 5g in 10ml (50%) (**Specials Manufacturer**).
LIQUID 500mg in 5ml (**Specials Manufacturer**).
TABLETS 500mg (**Specials Manufacturer**).

Dosage: **TREATMENT OF UREA CYCLE DEFECTS**

SEEK EXPERT ADVICE FROM METABOLIC TEAM BEFORE PRESCRIBING

Orally, all ages, 100-150mg/kg/day, usually in 3 to 4 divided doses. In citrullinaemia and arginosuccinic aciduria (ASA) doses up to 700mg/kg/day may be required.

Intravenously, all ages, total daily dose administered as a continuous infusion over 24 hours.

For Acute Hyperammonaemia: load with 200mg/kg given over 90 minutes. Then give continuous dose as above.

GROWTH HORMONE STIMULATION TEST

Intravenously, all ages, 500mg/kg (max. 30g), over 30 minutes.

Administration: Dilute to 20mg in 1ml with glucose 10% or 5%, maximum concentration is 50mg in 1ml.

Notes:

- a) Injection can be given orally.
- b) Blood levels should be maintained between 50-200micromol/L.

ARGIPRESSIN (8-ARGININE VASOPRESSIN)

Preparations: INJECTION 20 international pressor units in 1ml (8-arginine vasopressin - Pitressin[®]) (Fridge).

Dosage: **VASOCONSTRICTOR IN VASODILATORY SHOCK**

IV infusion, 0.0001 – 0.002 units/kg/min

Prepare a continuous infusion as:

1.5units (argipressin) x patients weight (kg) in 50ml

follow the dosing schedule below:

low dose	0.2ml/hr	=	0.0001units/kg/min
standard dose	0.5 ml/hr	=	0.00025units/kg/min
high dose	1ml/hr	=	0.0005 units/kg/min
max dose	4ml/hr	=	0.002 units/kg/min

Administration: As IV infusion, infuse in glucose 5% or sodium chloride 0.9% at a concentration of 0.2 – 1unit/ml.

Notes:

- Vasoconstrictor effect is independent of adrenergic receptors, and is via the Vasopressin 1 receptor (V_1).
- Extreme caution** in cardiogenic shock.
- Do not use for more than 48 hours as tachyphylaxis may occur.
- High dose may cause gut and skin ischaemia.

ARIPIPRAZOLE

Preparations: TABLETS 5mg, 10mg and 15mg.
ORAL SOLUTION 1mg in 1ml.

Dosage: **SCHIZOPHRENIA AND MANIA (SPECIALIST CARE ONLY)**
Not licensed under 15 years.
Orally,
>13 years: initially 2mg once daily for 2 days, then 5mg once daily for 2 days, then 10mg once daily for 2 days.
Increase further if required in increments of 5mg every 2 days to a maximum of 30mg daily.

Notes:

- a) **Caution:** Use with caution in cardiovascular disease.
- b) Avoid abrupt withdrawal.

ASCORBIC ACID

Preparations: TABLETS 200mg and 500mg.

Dosage: **TREATMENT SCURVY**

Orally,

1 month - 4 years 125-250mg/day

4 - 12 years 250-500mg/day

12 - 14 years 375-750mg/day

Over 14 years 500mg-1g/day

Dosage may be given in divided doses.

METABOLIC DISORDERS

Orally,

Neonates 50-200mg daily adjusted as necessary

1 month – 18 years 200-400mg daily adjusted as necessary up to
1g daily

ASPIRIN

Preparations: DISPERSIBLE TABLETS 75mg and 300mg.

Dosage:

WARNING: ASPIRIN SHOULD NOT BE GIVEN UNDER 16 YEARS FOR ANALGESIA OR AS AN ANTIPYRETIC BECAUSE OF THE RISK OF REYE'S SYNDROME.

ANTI-PLATELET

All ages, *orally*, 2 - 5mg/kg a day. Over 12 years – 75mg/day

HAEMODIALYSIS PATIENTS

For anti-platelet effect

Orally,

Under 15kg	18.75mg	} On three days of the week
15kg – 50kg	37.5mg	
Over 50kg	75mg	

TRANSPLANT PATIENTS

For anti-platelet effect

Orally,

Under 15kg	18.75mg	Once a day for one month
Over 15Kg	37.5mg	Once a day for one month

KAWASAKI SYNDROME

Orally,

20-25mg/kg 4 times a day for about 14 days (until afebrile) then 5mg/kg once a day for 6 to 8 weeks (until echocardiogram normal).

Notes:

- To give doses less than 75mg, dissolve one tablet in 5ml of water and use a proportion to obtain correct dose.
- Aspirin should temporarily be discontinued if patient develops viral infection (e.g. chickenpox, influenza). If infection is not resolved after a couple of days then an alternative antiplatelet should be considered (i.e. clopidogrel or dipyridamole).
- Aspirin irreversibly inhibits cyclo-oxygenase. Stop 7-10 days prior to surgery. However the decision to stop will depend on the cardiovascular risk for each patient versus risk of bleeding.
- Concomitant use of ibuprofen can interfere with the anti-platelet effect of low-dose aspirin rendering aspirin less effective when used for cardioprotection and stroke prevention. Avoid if possible.

ATENOLOL

Preparations: TABLETS 25mg, 50mg and 100mg. LIQUID 25mg in 5ml.

Dosage:

HYPERTENSION

This indication is unlicensed for use in children.

Orally, all ages, 1-2mg/kg once a day. Dose may be divided into two doses if necessary. Maximum 100mg daily.

IN RENAL FAILURE

CrCl (ml/min/1.73m ²)	Dose
> 35	No dose adjustment
10 - 35	50% of dose
< 10 or CAPD	30 - 50% (adjust according to response)

Notes:

- a) Caution, may induce bronchospasm; do not use in asthmatics.
- b) May precipitate heart failure, use with caution.
- c) Atenolol syrup (Tenormin[®]) is sugar free but contains 40% w/v of sorbitol.

ATOMOXETINE

Preparations: CAPSULES 10mg, 18mg, 25mg and 40mg (60mg not stocked).

Dosage: **ATTENTION-DEFICIT HYPERACTIVITY DISORDER (ADHD)**
> 6 years, Initially 0.5mg/kg for a minimum of 7 days then titrate according to response to a maintenance dose of 1.2mg/kg/day (maximum 1.8mg/kg/day) given as a single dose or in two divided doses.
> 70kg, Initially 40mg/day for a minimum period of 7 days then titrate to a maintenance dose of 80mg/day. Maximum dose 120mg/day.

WARNING: ATOMOXETINE SHOULD BE DISCONTINUED IN PATIENTS WITH JAUNDICE OR LABORATORY EVIDENCE OF LIVER INJURY, AND SHOULD NOT BE RESTARTED.

CSM WARNING – SUICIDAL IDEATION: CHILDREN AND CARERS SHOULD BE INFORMED ABOUT THE RISK AND TOLD TO REPORT CLINICAL WORSENING, SUICIDAL THOUGHTS AND BEHAVIOUR, IRRITABILITY, AGITATION OR DEPRESSION

CHRONIC RENAL FAILURE

No need to adjust dose.

Notes:

- a) Atomoxetine should not be used in combination with MAOIs. After stopping therapy with MAOIs, a period of 2 weeks should be allowed prior to starting Atomoxetine.
- b) Atomoxetine can produce postural hypotension.
- c) The most prominent side effect is drowsiness which does abate. The maximum effect however may take up to 6 weeks

ATRACURIUM BESILATE (ATRACURIUM BESYLATE)

Preparations: INJECTION 25mg in 2.5ml, 50mg in 5ml and 250mg in 25ml (Fridge).

Dosage: **NEUROMUSCULAR BLOCKADE FOR VENTILATION AND SURGERY**
This indication is unlicensed for use in neonates.

NEUROMUSCULAR CONDUCTION, USING A NERVE STIMULATOR, SHOULD BE MONITORED IF REPEATED DOSES OR INFUSIONS ARE ADMINISTERED.

All ages, *IV injection*, initially 300-500microgram/kg with supplementary doses of 100-200microgram/kg. (Up to 1mg/kg for rapid sequence induction).

IV infusion, 300-400microgram/kg/hour. Larger doses have been used in intensive care.

Administration: Infuse in sodium chloride 0.9%. Do not dilute to concentrations less than 500microgram/ml (maximum concentration 5mg/ml). Glucose solutions may be used however these infusions are only stable for 8 hours.

Notes:

- a) Neonates may show increased sensitivity to atracurium.
- b) Aminoglycosides increase or prolong paralysis caused by atracurium.
- c) Elimination of atracurium is by Hofmann degradation, a non enzymatic process, which occurs at physiological pH and temperature. Decreased efficacy may be seen in pyrexia patients.
- d) Drug of choice for patients with renal and/or hepatic failure.
- e) Cardiovascular effects are caused by significant histamine release.

ATROPINE SULPHATE

- Preparations:* INJECTION 600microgram in 1ml. TABLETS 600microgram.
PREFILLED SYRINGE (Minijet) 1mg in 10ml and 3mg in 10ml.
EYE OINTMENT 1%. EYE DROPS 0.5% and 1%.
ORAL SOLUTION 500microgram in 5ml
- Dosage:*
- PREMEDICATION**
This indication is unlicensed for the oral route.
SC or IM, 10-20microgram/kg up to max. of 30microgram/kg.
Administer dose 45 minutes prior to procedure.
Orally, all ages, 20-40microgram/kg (maximum 900 microgram).
Administer 1-2 hours prior to procedure.
- SINUS BRADYCARDIA**
This indication is unlicensed for use in children.
Over 1 year, IV injection, 15- 30microgram/kg.
- REFLEX ANOXYC SEIZURES, HYPERSALIVATION**
These are unlicensed indications.
Orally, initially, 10microgram/kg three times a day.
- TO PARALYSE ACCOMMODATION IN YOUNG CHILDREN**
Eye ointment applied twice a day for 3 days prior to the examination. If eye ointment unavailable drops can be used.
Neonates use 0.5% strength, twice a day for 5-7 days.
- NEONATAL INTUBATION**
20mcg/kg (together with fentanyl and suxamethonium).
- Notes:*
- Injection can be given orally.
 - Neonates may require higher doses on a microgram/kg basis as they are more resistant to atropine.
 - Can cause constipation if given regularly.
 - If frequent doses of Atropine required to control anoxic seizures transdermal patches of Hyoscine have anecdotally been used.

AZATHIOPRINE

Preparations: CAPSULES 10mg (**Specials Manufacturer**).
TABLETS 25mg and 50mg. INJECTION 50mg.
LIQUID 50mg in 5ml (**Specials Manufacturer**).

Dosage: **PREVENTION OF RENAL GRAFT REJECTION, SYSTEMIC LUPUS ERYTHEMATOSUS**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Orally or IV injection, 60mg/m² (approx. 2mg/kg) once a day.

PREVENTION OF LIVER GRAFT REJECTION, CARDIOMYOPATHY

Orally or IV injection, all ages, 1.5mg/kg once a day.

ECZEMA, ULCERATIVE COLITIS AND CROHN'S DISEASE

Orally or IV injection, all ages, 2mg/kg daily (max 3mg/kg daily).

Administration: Reconstitute vial with 5ml of water for injection.
IV injection, see note c), give over at least 1 minute and flush thoroughly with at least 50mls of sodium chloride 0.9% or glucose/saline **or** further dilute to at least 0.5mg in 1ml with glucose/saline and infuse over 30-60 minutes.

Notes:

- a) If allopurinol is administered concurrently, reduce dose of azathioprine to 25% as it is potentiated by allopurinol.
- b) Monitor FBC and LFTs weekly for first month then at least 3 monthly.
- c) Use the intravenous route **only** when the oral route is not feasible as the injection solution is alkaline (pH 10-12) and very irritant.
- d) Thiopurine Methyltransferase (TPMT) levels should ideally be measured before commencing therapy. Consult with local laboratories for details.
- e) Due to immunosuppressive nature of Azathioprine the tablets should not be crushed.

AZITHROMYCIN

Preparations: TABLETS 250mg and 500mg. LIQUID 200mg in 5ml.

MICROBIOLOGY APPROVAL ONLY

Dosage:

TREATMENT OF STAPH AUREUS, H INFLUENZA, ATYPICAL INFECTION

> 6 months - 2 years	10mg/kg once daily for 3 days	One hour before or two hours after food/antacids
3 - 7 years (15-25kg)	200mg once daily for 3 days	
8 - 11 years (26-35kg)	300mg once daily for 3 days	
12 - 14 years (36-45kg)	400mg once daily for 3 days	
>14 years (>45kg)	500mg once daily for 3 days	

SEXUALLY TRANSMITTED DISEASES - CHLAMYDIA

> 12 years 1 g stat

PROPHYLAXIS IN CYSTIC FIBROSIS

This indication is unlicensed for use in children.

< 40kg 250mg daily

> 40kg 500mg daily

INFECTION IN CYSTIC FIBROSIS

10mg/kg (max. 500mg) daily for 3 days. Repeat after 7 days, then repeat as necessary.

Notes:

- Use with caution with impaired liver function or concomitant hepatotoxic agents. Use with caution in severe renal failure.
- Azithromycin can increase ciclosporin levels, concomitant administration not advised without monitoring ciclosporin levels.
- May increase digoxin, theophylline and carbamazepine plasma concentrations.
- May enhance warfarin effect – monitor INR.
- Liquid is cherry/banana flavoured; contains sucrose.

AZTREONAM

Preparations: INJECTION 500mg, 1g and 2g.

Dosage: **TREATMENT OF INFECTION (MICROBIOLOGY APPROVAL ONLY)**
This indication is unlicensed for premature neonates and neonates less than 7 days old.

IV injection,

Premature neonates	30mg/kg	twice a day
Full term neonates < 7 days	30mg/kg	twice a day
Neonates > 7 days to 2 years	30mg/kg	3-4 times a day
2 years – 12 years	30-50mg/kg	3-4 times a day
12 – 18 years	1g	3 times a day

Severe infection: >12years – 2g 3-4 times daily

IN RENAL FAILURE

The initial dose should be the normal dose and the following doses adjusted according to creatinine clearance. Dosage intervals should remain the same.

Creatinine clearance (ml/min/1.73m ²)	Dosage interval (hours)
10-30	50% of dose
< 10	25% of dose

Haemodialysis:

The initial dose should be the normal dose and the following doses 25% of the initial dose. A supplementary 12.5% of the initial dose should also be given after each dialysis session.

Administration: On reconstitution each 500mg displaces 0.6ml. Addition of 1.9ml of water for injection to each 500mg of Aztreonam gives 500mg in 2.5ml.

IV injection, further dilute with sodium chloride 0.9% or glucose 5% to 20mg/ml or less, (100mg/ml has been used) and give as an injection, over 3-5 minutes or an infusion, over 20-60 minutes.

Notes:

- a) There is evidence suggesting synergism between aztreonam and aminoglycosides for treatment of serious pseudomonal infections.
- b) Reconstituted aztreonam injection solution may vary from colourless to light straw yellow which may develop a slight pink tint on standing; however this does not affect potency.
- c) Aztreonam injection vials are sodium free.

BACLOFEN

Preparations: TABLETS 10mg. LIQUID 5mg in 5ml.
INTRATHECAL INJECTION (PRESERVATIVE FREE) 50micrograms in 1ml, 3mg in 1ml (**Import**) and 10mg in 5ml

Dosage: **SPASTICITY AND FLEXOR/EXTENSION SPASM**
Under 1 year, probably of little use in this age group as neuronal transmissions are underdeveloped.
Over 1 year, *orally*, 0.25mg/kg three times a day increasing at three day intervals to 2mg/kg/day. Over 10 years, maximum dose is 2.5mg/kg/day or 100mg/day.

Recommended daily maintenance doses (may be given in 2-3 divided doses).

12 months - 2 years 10-20mg/day

2 - 6 years 20-30mg/day

6 - 10 years 30-60mg/day

Intrathecal, all ages, test dose 25 micrograms over 1 minute.

Start maintenance dose 24 hours after test dose at 50micrograms. Increase dose every 24 hours by 25 microgram until desired clinical effect is achieved to a maximum of 100microgram.

Maintenance doses are to be given by implantable pumps:

In children <12 years maintenance doses of 24microgram to 1200micrograms/day have been given.

In children >12 years doses may increase to 1400microgram/day.

Doses to be given via a lumbar puncture or intrathecal catheter.

POST-OPERATIVE SKELETAL MUSCLE SPASM CONTROL

Orally, over 1 year, initially 0.25mg/kg twice a day increasing according to spasm score.

Epidurally, all ages 1microgram/kg (max 50micrograms) diluted in 10ml sodium chloride 0.9% and infused via epidural catheter over 1-2 hours (see note d).

IN RENAL FAILURE

Reduce oral doses by at least 50% (max dose 5mg) in patients with impaired renal function and use a frequency of three times a day (mild), twice a day (moderate), once daily (severe). In CAPD/H give as for severe impairment. In CAV/VVHD give as for moderate impairment.

Notes:

- a) **CSM warning:** Drug withdrawal should be gradual (over at least 1-2 weeks) to avoid serious side effects.
- b) Baclofen should be used with caution in epilepsy.
- c) Baclofen liquid (Lioresal[®]) is sugar free and raspberry flavoured.
- d) To start day 2 post op (once opioid epidural has stopped) by consultant anaesthetist only. Use preservative free 50microgram/ml intrathecal product

BASILIXIMAB

Preparations: INJECTION 20mg (Fridge).

Dosage: **PREVENTION OF RENAL GRAFT REJECTION**

**SEEK EXPERT ADVICE BEFORE PRESCRIBING.
DOSE IS DEPENDENT ON THE CURRENT TRANSPLANT REGIMEN.**

Intravenous infusion,

10mg IV if body weight <35kg

20mg IV if body weight >35kg

Doses to be given pre-operatively within 2 hours before transplant and on day 4 post transplant.

There is no need to give a test dose

Administration: Intermittent infusion in glucose 5% or sodium chloride 0.9%.

Reconstitute with water for injection, then dilute 20mg to at least 50ml with infusion fluid and give over 20-30 minutes.

Notes:

- a) Prescribe hydrocortisone and chlorphenamine when required in case of reaction.

BECLOMETASONE DIPROPIONATE

Preparations: AEROSOL INHALER 50microgram, 100microgram, 200microgram and 250microgram per metered inhalation (Clenil Modulite®).
AQUEOUS NASAL SPRAY 50microgram per metered spray.

Dosage: **ASTHMA THERAPY** (see note a).
Prescribe by brand "Clenil" as brands are not interchangeable.
Inhaled doses,

Under 1 year	50microgram	twice a day
1 - 4 years	50 - 100microgram	twice a day
4 - 12 years	100 - 400microgram	twice a day
Over 12 years	200 - 400microgram	twice a day (maximum 1mg twice a day)

In severe cases inhaled doses may be given in 2-4 divided doses up to 1600microgram/day; Cushingoid effects may occur at these doses. Adrenal suppression is possible above 600microgram per day. The effect of inhaled corticosteroids as an independent risk factor on growth or final height is unknown.

ALLERGIC OR VASOMOTOR RHINITIS

Nasally, 6 years and over, 2 sprays (100microgram) into both nostril(s) twice a day to a maximum of 4 times a day. Reduce to 1 spray into each nostril twice a day when symptoms are controlled.

Notes:

- a) Beclomethasone CFC-Free MDIs are not interchangeable and should be prescribed by brand "Clenil Modulite®".
- b) Children under 10 years are usually incapable of using inhalers without spacers.
- c) An Aerochamber or Volumatic® spacer can be used with beclomethasone inhalers.
- d) Rinse mouth and wash face (if using mask) after use.
- e) See guidelines for management of chronic asthma.

BENDROFLUMETHIAZIDE (BENDROFLUAZIDE)

Preparations: TABLETS 2.5mg and 5mg.

Dosage:

DIURESIS

Orally,

Up to 12 months	1.25mg	once a day
1 - 4 years	1.25 - 2.5mg	once a day
5 - 12 years	2.5mg	once a day
Over 12 years	2.5 - 5mg	once a day

Doses as high as 400microgram/kg once a day have been used.

Notes:

- a) Monitor serum potassium levels as required.
- b) Tablets may be crushed and dissolved/dispersed in water.

BENZATHINE PENICILLIN

Preparations: INJECTION 2.4 mega unit (**Import**).

Dosage: **INFANTS BORN TO MOTHERS WITH POSITIVE TESTS FOR SYPHILIS
(DISCUSS WITH CONSULTANT)**

For asymptomatic infants

IM injection

50,000 units/kg stat dose. (50mg/kg)

Notes:

- a) In confirmed penicillin allergy consider doxycycline or erythromycin.
- b) 2.4 mega unit is equivalent to 2,400,000 units = 2,400mg.

BENZYL PENICILLIN

Preparations: INJECTION 600mg.

Dosage: **TREATMENT OF INFECTION**
Premature and term neonates.

IV injection,

Gestational age (weeks)	Postnatal age (days)	Dose	Interval (hours)
≤ 29	0 - 28	50mg/kg	12
	> 28		8
30 - 36	0 - 14	50mg/kg	12
	> 14		8
37 - Term	0 - 28	50mg/kg	8
	> 28		6

For Congenital Syphilis give 30mg/kg twice a day (IM/IV) for 7 days then three times a day for 3 days.

1 month-12 years,

IV or IM injection, 25mg/kg 4 times a day for 10 days.

In severe infection, 50mg/kg every 4-6 hours (Max. 14.4g/day).

IN RENAL FAILURE

Creatinine clearance (ml/min/1.73m ²)	Dosage Interval (hours)
10-50	8-12
Less than 10	12

Benzylpenicillin is moderately dialysed. For intermittent haemodialysis, CVVHD and CAVH/CVVH, dose as for creatinine clearance of 10-50ml/minute/1.73m². In CAPD, calculate dose as for a creatinine clearance of <10ml/min/1.73m².

Administration: Reconstitute, taking the displacement value into account.

For IM injection dilute with water for injection to give 600mg in 2ml.

For IV injection dilute with water for injection to give 600mg in 5ml.

Normal doses are usually administered as a slow bolus over 5 minutes. Infusions administered over 30 minutes may be used and are recommended for doses over 100mg/kg as too rapid administration has been associated with CNS toxicity and convulsions.

Notes:

- a) In confirmed penicillin allergy, avoid cephalosporins and other beta-lactams.
- b) 1 mega unit is equivalent to 1,000,000 units or 600mg.
- c) **Caution:** benzylpenicillin **is not to** be given via the intrathecal route.
- d) Each 600mg vial contains 1.68mmol of sodium.
- e) See antibiotic treatment guidelines.

BETAINE

Preparations: TABLET 500mg (**Specials Manufacturer**).
LIQUID 500mg in 1ml (**Specials Manufacturer**).
POWDER (CYSTADANE® 1g – licensed – scoops measure 100mg, 150mg and 1g).

Dosage: **TREATMENT OF HOMOCYSTINURIA**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Orally, all ages 100mg/kg/day in 2-3 divided doses, adjusted according to plasma homocysteine and amino acid concentrations. May need to increase to 150mg/kg daily
Maximum dose 20g/day. Usual effective dose is 6-9g/day in adults.

Notes:

- a) Monitor methionine concentrations to avoid potentially toxic levels in classical homocystinuria.
- b) Liquid is strawberry flavour. Discard 28 days after reconstitution. Prepared dose should be diluted 10 times it's volume with water before administration (to be given immediately)
- c) Powder is licensed and thus should be considered first line. Powder should be measured in scoops levelled to the top. Contents should be dissolved with water, juice or milk and used immediately or mixed with a spoonful of food.

BIOTIN (Vitamin H)

Preparations: TABLETS 5mg (**Import**). INJECTION 5mg in 1ml (**Import**).

Dosage: **METABOLIC DISORDERS**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Orally or IV injection, all ages, 5-10mg 1-3 times a day. Doses up to 50mg/day may be required.

Administration: Slow bolus over 3-5 minutes.

Notes:

- a) Biotin (Vitamin H) is an essential coenzyme in fat metabolism and in other carboxylation reactions.
- b) Tablets may be crushed and dissolved/dispersed in water.
- c) The Roche injection is licensed in France for IM injection but was previously licensed for IV and IM use and the formulation has not changed.

BISACODYL

Preparations: TABLETS 5mg. SUPPOSITORIES 5mg and 10mg.
ENEMA SOLUTION 2.74mg in 1ml (**Specials Manufacturer**).

Dosage: **CONSTIPATION**
Under 10 years 5mg *orally* at night or 5mg *rectally* in the morning.
Over 10 years 5-10mg *orally* at night increasing to 20mg in severe cases, or 10mg *rectally* in the morning.
Administration via ACE (Antigrade Continence Enema) stoma: 2-5ml of bisacodyl made up to 50ml with water or sodium chloride 0.9%. (Initiate with 1ml of enema solution per 10kgs per body weight).

PREPARATION FOR RADIOLOGICAL INVESTIGATION

Under 10 years 5mg *orally* on each of the 2 nights before the investigation and 5mg *rectally* (if necessary) 1 hour before the investigation.
Over 10 years 10mg *orally* on each of the 2 nights before the investigation and 10mg *rectally* (if necessary) 1 hour before the investigation.

Notes:

- a) Bisacodyl is a stimulant laxative which increases intestinal motility and may be associated with abdominal cramp/colic or, in the presence of faecal impaction in the rectum, an increase of faecal overflow.
- b) Many small children who experience pain or fear during defecation find rectally administered treatments very distressing and alternatives should be considered.
- c) Response from rectal administration usually occurs within 30 minutes.
- d) Avoid concomitant use of tablets with milk products/antacids as it may reduce coating leading to dyspepsia/gastric ulceration
- e) Tablets should not be crushed or chewed.

BOTULINUM A TOXIN

Preparations: INJECTION 500units (Dysport®). INJECTION 100units (Botox®) (Fridge).

Dosage: **A) PAEDIATRIC SPASTICITY**
IM injection, over 2 years,
Dysport®: maximum total of 25units/kg divided equally between the muscle groups to be injected, not exceeding 1000units per patient.
Botox®: maximum total of 14units/kg divided equally between the muscle groups to be injected, not exceeding 400units per patient.
Do not repeat injection more frequently than every 4 months.
Licensed use for dynamic equinus. See note c) for unlicensed use
Maximum doses apply in total and also per muscle body injected.
Please see international consensus guidelines for further details.

B) BLADDER VOIDING DYSFUNCTION

(Under specialist supervision)

Intravesical injection, **Dysport®** 40units/kg. Maximum dose 1200units. Repeat injections based on response.

C) HYPER SALIVATION

(Under specialist supervision)

Intraglandular injection of 15units **Botox®** into submandibular glands

Administration: Gloves must be worn when handling botulinum A toxin including during reconstitution and injecting. Reconstitute with 1.1ml of sodium chloride 0.9% to give 500 units in 1ml.

For Dynamic Equinus insert into muscle to be treated a 23G needle (blue) detached from syringe. Correct location is checked by manipulating the limb. Attach syringe to needle and draw back plunger to ensure it is not sitting in a vein followed by injection of the desired dose.

Notes:

- a) Midazolam or Entenox are appropriate sedatives for Dynamic Equinus.
- b) International clinical governance recommends guidance for administration either by nerve stimulation, EMG or ultrasound.
- c) There are a number of unlicensed applications for Botulinum A Toxin which may be used under the guidance of a specialist clinic. These are used to improve children's function as part of a movement therapy programme. Further information on these is available in the European Consensus Statement on the use of Botulinum A Toxin in children with cerebral palsy.
- d) Discard unused botulinum A toxin vials by inactivating the residue with a 1% (10,000 parts per million (ppm)) chlorine solution. This is prepared by adding 1 Haz-tab® to 250ml of water. Botulinum A toxin spills must be wiped up with the above solution and disposable towels.
- e) Counsel patient/carer to report any unusual/new muscle weakness not in the treated area e.g. droopy eyelids, difficulty swallowing or altered voice **or** pain or swelling at site of injection. Patients/carers should be informed about the risk of spread of toxins and be advised to seek immediate medical care if swallowing, speech or respiratory disorders arise
- f) Pre-injection assessment and post injection follow-up at 4 weeks and 12-16 weeks are essential to monitor side effects and benefits.
- g) BEWARE – Botulinum Toxin Type A formulations are not comparable in terms of iu dosage.

BUDESONIDE

<i>Preparations:</i>	TURBOHALER	100microgram per dose 200microgram per dose 400microgram per dose
	RESPIRATOR SOLUTION	0.5mg in 2ml and 1mg in 2ml.

Dosage:

ASTHMA THERAPY

Inhaled doses,

All ages 100-400micrograms twice a day.

In severe cases inhaled doses up to 2mg/day may be required.

Turbohalers have been shown to be effective in once daily dosing. (Total daily dose given once daily).

Nebulised,

This route is unlicensed for use in children under 3 months.

< 3 months 0.25-0.5mg twice a day, reducing to 0.125-0.25mg twice a day

3 months - 12 years 0.5-1mg twice a day, reducing to 0.25-0.5mg twice a day.

Over 12 years 1-2mg twice a day, reducing to 0.5-1mg twice a day.

Initial doses may be doubled in severe cases.

CROUP

Nebulised, all ages, 2mg administered as a single dose **OR** two 1mg doses administered 30 minutes apart. Dose may be repeated after 12 hours if necessary.

BRONCHOPULMONARY DYSPLASIA

Nebulised,

Neonates – 4 months 500micrograms twice daily.

If >2.5kg and severe symptoms dose may be doubled to 1mg twice daily.

Notes:

- Children under 4 years are usually incapable of using turbohalers. Consider beclomethasone MDI with spacer device as alternative.
- Turbohalers are breath activated and are effective at low inspiratory flow rates i.e. 30L/minute. Lung deposition is also good and therefore changing to the turbohaler may allow a dose step down/better control.
- Rinse mouth and wash face (if using mask) after use.
- Cover eyes of neonates when using nebulised budesonide in an enclosed environment i.e. head box, incubator.
- Use nebule within 12 hours of opening.
- See guidelines for management of chronic asthma.

BUMETANIDE

Preparations: TABLETS 1mg and 5mg. LIQUID 1mg in 5ml.
INJECTION 2mg in 4ml.

Dosage: **DIURESIS**
This indication is unlicensed for use in children <12 years.
Orally, initially, 15microgram/kg once to four times a day to a maximum of 300microgram/kg/day.
IV infusion: 25-50mcg/kg. Over 12 years: 1-2mg.

Administration: Infuse in sodium chloride 0.9% or glucose 5% over 30 minutes.
Dilute to 24micrograms/ml.

Notes:

- a) Monitor serum potassium levels regularly.
- b) Bumetanide is well absorbed from the gut.
- c) At low doses, Frusemide 40mg \equiv bumetanide 1mg however at higher doses this ratio falls.
- d) Encephalopathy may be precipitated in patients with pre-existing hepatic impairment.
- e) Bumetanide may enhance the nephrotoxicity or ototoxicity of other drugs, particularly if patients are in renal failure.
- f) Bumetanide liquid (Burinex[®]) is sugar-free.

BUPIVACAINE

Preparations: INJECTION 0.25%, 0.5% and 0.75% (**Specials Manufacturer**).
INFUSION 0.125% 500ml bags.
INJECTION 0.25% with adrenaline 1 in 200,000; 10ml (**Specials Manufacturer**).
INJECTION 0.5% with adrenaline 1 in 200,000; 10ml (**Specials Manufacturer**).
INJECTION 0.5% with glucose 8% in 4ml (bupivacaine heavy).
EPIDURAL Bupivacaine 0.1% and Fentanyl 2micrograms in ml; 500ml.
PARAVERTEBRAL INFUSION (bupivacaine 0.25%) (**Specials Manufacturer**).

Dosage: **CAUDAL ANALGESIA**
Maximum dose: 1ml/kg 4hourly (2.5mg/kg 4hourly) of 0.25% bupivacaine plain.
Up to lower thoracic (T10) (e.g. orchidopexy), 1ml/kg (maximum) of 0.25% bupivacaine plain. Maximum volume of 0.25% is 20ml. Dilute with sodium chloride 0.9% if greater volumes are required.
Sacral roots (e.g. circumcision, hypospadias), 0.5ml/kg of 0.25% bupivacaine plain.
Lumbar roots (e.g. inguinal hernia), up to 0.75ml/kg of 0.25% bupivacaine plain.
Ilio-inguinal block 0.5ml/kg of 0.5% bupivacaine plain single bolus.

SUBCUTANEOUS BUPIVACAINE

Via indwelling subcutaneous catheter – bolus dosing at 1ml/minute usually using 0.125%, but may be increased to 0.25%.
Maximum dose of 2mg/kg in 4 hours (max 4ml) - up to 4 times in 24 hours.

EPIDURAL

0.1–0.4ml/kg/hr using 0.1% bupivacaine (max 0.3ml/kg/hr in neonates).

Top up bolus of 0.2ml/kg of 0.1% may be given.

Maximum total dose of bupivacaine in 4 hours is 2mg/kg.

Notes:

- a) In children, particularly neonates and infants, the 0.25% strength provides very good pain relief and avoids dilution or difficult-to-administer infusion volumes.
- b) 1ml of bupivacaine 0.125% = 1.25mg.
- c) Stop use immediately if symptoms of ringing in the ears, metallic taste, numbness of lips and tongue.

BUPRENORPHINE - (CD)

Preparations: SUBLINGUAL TABLETS 200microgram and 400microgram.

Dosage: **ANALGESIA FOR MODERATE TO SEVERE PAIN**

Sublingually,

16 - 25kg	100microgram	every 6-8 hours
25 - 37.5kg	100-200microgram	every 6-8 hours
37.5 - 50kg	200-300microgram	every 6-8 hours
over 50kg	200-400microgram	every 6-8 hours

Notes:

- a) Buprenorphine is a strong opioid mu receptor partial agonist that is not completely reversed by naloxone.
- b) It is a long acting drug and may take up to 1 hour to work (peak levels after 90 min). The side effects are also long lasting.
- c) Sublingual administration is not usually suitable for children under the age of six years.
- d) Tablets may be halved.

CAFFEINE (BASE)

Preparations: LIQUID 5mg in 1ml (**Specials manufacturer**).
INJECTION 5mg in 1ml.

Dosage: **NEONATAL APNOEA (UNLICENSED IN CHILDREN)**
Premature neonates, *orally, IV injection*;
Loading dose 10mg/kg followed 24 hours later by maintenance dose 5mg/kg/day; may increase to a maximum of 5mg/kg twice a day (see note b).

Administration: Loading dose: IV infusion, dilute with sodium chloride 0.9% or glucose 5%. Give over 20 minutes.
Slow IV injection, give over 3-5 minutes diluted further if needed.

Notes:

- a) Caffeine base 1mg = caffeine citrate 2mg. All **doses should be prescribed as the base**.
- b) Neonates over 28 days of age who are still apnoeic should benefit from maintenance caffeine doses administered twice a day. Preterm neonates on phenobarbitone should receive maintenance caffeine doses administered twice a day.
- c) Therapeutic drug monitoring:
 - i) Blood levels are not routinely monitored as caffeine has a wide therapeutic margin, however if required, a trough sample (just before the next dose) should be taken once the patient has been stabilised on a maintenance dose.
 - ii) Therapeutic range: 5-40mg/L. Toxicity: ≥ 80 mg/L.
 - iii) Pre-term newborns have a half-life >100 hours.
- d) Caffeine has a weaker diuretic action than theophylline.
- e) Caffeine is a weak bronchodilator. Where this effect is desired, theophylline may be the drug of choice.

CALCITRIOL (1,25-DIHYDROXYCHOLECALCIFEROL)

Preparations: CAPSULES 250nanograms and 500nanograms.
INJECTION 1microgram in 1ml and 2microgram in 1ml.
ORAL DROPS 1microgram in 1ml (**Import**).

Dosage: **PROPHYLAXIS AGAINST RENAL OSTEODYSTROPHY**
This indication is unlicensed for use in children.
Initially, *orally*, 15nanogram/kg once a day, (see note d) then titrate to response.

Notes:

- a) For a comparison of vitamin D preparations see Adult Formulary.
- b) There is a significant risk of hypercalcaemia if treatment is continued long term.
- c) Calcitriol injection is available and may be indicated for hypocalcaemia in chronic dialysis, although this indication is unlicensed for use in children.
- d) Injection solution can be given orally, preferably use oral drops if available.
- e) If there is no evidence of liver impairment, alfacalcidol is preferred.

CALCIUM (ORAL SUPPLEMENTS)

Preparations: LIQUID (Calcium Sandoz[®]) containing calcium glubionate 3.27g and calcium lactobionate 2.18g in 15ml (1ml contains 0.54mmol calcium).

EFFERVESCENT TABLETS (Sandocal-1000[®]) each containing calcium lactate gluconate 2263mg, calcium carbonate 1750mg, providing calcium 1000mg (25mmol calcium).

Dosage:

HYPOCALCAEMIA

<i>Orally</i> , up to 4 years	0.25mmol/kg	4 times a day
<i>Orally</i> , 5 - 12 years	0.2mmol/kg	4 times a day
12 - 18 years	10mmol	4 times a day

Notes:

- a) Sandocal tablets are citrus flavoured and sucrose free but contain aspartame. Calcium-Sandoz[®] syrup is fruit flavoured and contains 1.5g sucrose in 5ml. They are both lactose free, and contain no added sodium, potassium or azo dyes.
- b) Tablets should be dissolved in 1/3 to 1/2 tumblerful of water.
- c) High oral doses of calcium may cause constipation.

CALCIUM ACETATE

Preparations: TABLET 1g.

Dosage: **PHOSPHATE BINDING IN RENAL PATIENTS**

Orally, initially

Under 1 year	50mg	with feeds
1 - 6 years	150mg	3 – 4 times a day
6 - 12 years	250mg	3 – 4 times a day
Over 12 years	500mg	3 – 4 times a day

Dose is adjusted according to phosphate levels.

Notes:

- a) Calcium carbonate is the preferred phosphate binding agent, calcium acetate may be used in cases of hypercalcaemia or high calcium load.
- b) Calcium acetate has approximately double the binding capacity of calcium carbonate. For simplicity of conversion 1g of Calcium Acetate is equivalent to 2,500mg of calcium carbonate
- c) For patients who cannot take tablets or for doses less than 1,000mg. Crush and dissolve one 1g tablet in 10mls of water to give a 100mg in 1ml suspension, use the required amount and dispose of any remaining solution.
- d) To convert from Calcium Carbonate 600mg in 5ml suspension. For each 1ml of Calcium Carbonate 600mg in 5ml use 0.5ml of Calcium Acetate 100mg in 1ml.
- e) Calcium Acetate 1g tablets contain 250mg of calcium.

CALCIUM CARBONATE

Preparations: TABLETS 300mg (120mg Calcium) (**GSTT Special**) and 1500mg (Adcal[®]) (600mg Calcium).
LIQUID 600mg in 5ml (240mg Calcium in 5ml) (**GSTT Special**).

Dosage: **PHOSPHATE BINDING IN RENAL PATIENTS**

See notes below.

Orally, initially

Under 1 year	120mg	with feeds
1 - 6 years	300mg	3-4 times a day
6 - 12 years	600mg	3-4 times a day
Over 12 years	1500mg	3-4 times a day

Dose is adjusted according to phosphate levels.

Notes:

- a) Calcium carbonate is the preferred phosphate binding agent and should be taken immediately prior to or with food to bind dietary phosphate.
- b) Calcium carbonate is not suitable as a calcium supplement as only very small amounts of calcium are absorbed.
- c) Converting between aluminium hydroxide, sucralfate or calcium carbonate as phosphate binders the following can be used:
One aluminium hydroxide 475mg capsule (Alucap[®]) is equivalent to one calcium carbonate 1500mg Adcal[®].
2.5ml of Sucralfate is equivalent to two calcium carbonate 300mg tablets
or 5ml of calcium carbonate 600mg in 5ml mixture.
- d) 300mg tablets can be dispersed in water. 1500mg tablets can be chewed. The liquid can be added to feeds but must be mixed thoroughly to avoid precipitation.
- e) Adcal[®] is fruit flavoured.
- f) The colour of Calcium Carbonate Liquid may vary between batches from white to pale pink. This does not affect quality in any way.

CALCIUM CHLORIDE

Preparations: PREFILLED SYRINGES 10% (6.8mmol of calcium in 10ml).
INJECTION 14.7% (10mmol of calcium in 10ml).

Dosage: **ACUTE HYPOCALCAEMIA ASSOCIATED WITH CPR**
All ages, *slow IV injection* (3-5 minutes) 0.2ml/kg with ECG monitoring. Emergency Use - may give neat - centrally if possible.

Notes:

- a) Calcium chloride produces severe tissue necrosis on extravasation-unless used centrally.
- b) Routine administration of calcium in resuscitation of asystolic patients is not recommended. Only use in documented hypocalcaemia.
- c) Do NOT add to sodium bicarbonate as it precipitates.
- d) Given too rapidly IV calcium may cause cardiac arrhythmias or arrest, hypotension and vasomotor collapse, sweating, hot flushes, nausea and vomiting.

CALCIUM FOLINATE (FOLINIC ACID)

Preparations: TABLETS 15mg.
INJECTION 15mg in 2ml.

Dosage: **TREATMENT OF MEGALOBlastic ANAEMIA**
Orally, 0.25mg/kg, up to 15mg, once a day.

DHPR DEFICIENCY (BIOPTERIN RECYCLING DEFECT)
Orally, initially 15mg once a day. Dose is determined by clinical response and C.S.F folate concentrations.

FOLATE RESCUE AFTER METHOTREXATE THERAPY

DOSAGE REGIMENS VARY DEPENDING ON THE PROTOCOL USED, DOSE ADMINISTERED AND THE RESULTING BLOOD LEVELS OF METHOTREXATE.

<10kg Orally, IV/IM injection, IV infusion; 0.5mg/kg every 4-6 hours for 36-48 hours.

>10kg Orally, IV/IM injection, IV infusion, 10-15mg/m² every 4-6 hours for 36-48 hours.

Administration: IV injection over 2 minutes.
Slow IV infusion, dilute with sodium chloride 0.9% or glucose 5% and give over 30 minutes.

Notes:

- a) Calcium folinate is not indicated for pernicious anaemia or other megaloblastic anaemias where vitamin B₁₂ is deficient as it may improve haematological parameters but neurological symptoms may still occur.
- b) Injection solution can be given orally.

CALCIUM GLUCONATE

Preparations: INJECTION 10% (2.25mmol of calcium in 10ml).

Dosage: **CALCIUM MAINTENANCE**
IV infusion, 1mmol/kg/day added to the maintenance infusion

ACUTE HYPOCALCAEMIA

Intermittent IV Infusion, 0.5ml (0.11mmol)/kg.

ACUTE HYPOCALCAEMIA ASSOCIATED WITH CPR

Slow IV injection (3-5 minutes), 0.5ml (0.11mmol)/kg with ECG monitoring. (Calcium Chloride is 1st line treatment).

HYPERKALAEMIA (URGENT PREVENTION OF ARRHYTHMIAS)

For potassium levels of >6mmol/L, 0.5ml (0.11mmol)/kg by slow IV injection (3-5 minutes) with ECG monitoring.

Administration: IV infusion.

Dilute to at least 0.045mmol in 1ml (i.e. 1 in 5) with glucose 5% or sodium chloride 0.9% (may give neat via central-line).

Administer as slowly as possible, preferably at a rate of not greater than 0.045mmol/kg/hour (neonates 0.022mmol/kg/hr). Maximum rate (non emergency) = 0.0225mmol/min.

Notes:

- a) Routine administration of calcium in resuscitation of asystolic patients is not recommended. Only use in documented hypocalcaemia.
- b) **Caution:** Avoid extravasation as calcium salts cause tissue necrosis, use central line if available. Never administer SC or IM.

CALCIUM POLYSTYRENE SULFONATE

(CALCIUM RESONIUM)

Preparations: POWDER for oral and rectal use (15g (**GSTT Special**) and 300g).
ENEMA 30g (**GSTT special**).

Dosage: **USE IN MODERATE HYPERKALAEMIA WITHOUT ECG CHANGES.**

HYPERKALAEMIA

Neonates: *rectally*, 0.125-0.25g/kg 4 times a day.

Children: *orally or rectally*, 0.25g/kg (Max. 15g/dose) 4 times a day.

Administration: Rectally: use pre-prepared enema or prepare enema solution by mixing each 1g of powder with 5-10ml of methylcellulose mucilage (see methylcellulose) as inadequate dilution may result in faecal impaction. Administer immediately, once mixed. The enema should be retained for 9 hours and the colon should be irrigated prior to administration of next dose to ensure removal.

Notes:

- a) Administration of calcium polystyrene sulphonate should be stopped before serum potassium falls below 5mmol/L.
- b) Serum calcium levels should be monitored at weekly intervals.
- c) Give orally with a drink - NOT SQUASH OR FRUIT JUICE.
- d) Bowel obstruction may occur and prophylactic laxatives be prescribed (avoid Magnesium laxatives).
- e) Calcium content is about 1.6 to 2.4mmol in 1g.
- f) Treatment of overdose: Give a laxative or enema to remove resin.
- g) Exchanges 1-2mmol of potassium per 1g of resin.

CAPTOPRIL

Preparations: TABLETS 12.5mg and 25mg.
LIQUID 5mg in 1ml (**Specials Manufacturer**).

Dosage: **HYPERTENSION, CONGESTIVE CARDIAC FAILURE, PROTEINURIA**
Use in proteinuria and mild to moderate hypertension is unlicensed for use in children.
Orally, children, initially (see note c), 100microgram/kg 3 times a day. Increasing to 1mg/kg 3 times a day. (Maximum 2mg/kg 3 times a day).
Orally,
Premature and full-term neonates (see note a) initially (see note c) 50-100microgram/kg 3 times a day. Increasing to a maximum of **2mg/kg/day**.

KEEP THE DOSE AS LOW AS POSSIBLE IN RENAL FAILURE AND IF A DIURETIC IS INDICATED, USE A LOOP DIURETIC RATHER THAN A THIAZIDE.

Notes:

- a) Captopril should be used with caution in neonates, particularly preterm neonates due to the risk of renal failure, anuria and hypotension.
- b) ACE inhibitors reduce glomerular filtration rate leading to severe and progressive renal failure in patients with severe bilateral renal artery stenosis (or severe stenosis in a single kidney).
- c) Observe patient every 15 minutes for the first 2 hours after the initial dose for effects of severe hypotension. Test dose in supine position. Monitor after each dose change.
- d) Concomitant diuretic dosages may need to be reduced or not administered concurrently to avoid severe hypotension.
- e) Neutropenia is rarely reported but incidence is increased in renal failure, therefore monitor WBC every 2 weeks for first 3 months. Parent/patients should be encouraged to report any persistent sore throats or raised temperatures. Urine should be tested for protein every month for first nine months.
- f) Hyperkalaemia may occur particularly in renal failure. Other potassium retaining drugs may need to be stopped e.g. spironolactone.
- g) Rashes may occur but usually disappear if dose is reduced. Rash caused by captopril does not necessarily indicate cross-reactivity with other ACE inhibitors.
- h) Persistent dry cough, although rare, is sometimes alleviated by reducing dose however it is rapidly reversible upon withdrawal of drug. Another ACEI may be tried.
- i) Initiation of captopril has been associated with unexplained hypoglycaemia in severe diabetics.
- j) The 12.5mg tablets can be dissolved in water and a proportion taken for the dose. Use a fresh solution for each dose.
- k) Conversion of ACE inhibitors on a total daily dose basis
Lisinopril : Captopril → 1 : 5
Enalapril : Captopril → 1 : 7.5

CARBAMAZEPINE

Preparations: TABLETS 100mg, 200mg and 400mg.
MODIFIED RELEASE TABLETS 200mg and 400mg.
LIQUID 100mg in 5ml.
CHEWABLE TABLETS 100mg (**Purchased on request**).
SUPPOSITORIES 125mg and 250mg.

Dosage: **EPILEPSY, CO-ANALGESIA FOR NERVE PAIN**
Co-analgesia for nerve pain indication is unlicensed for use in children.
Initially, *orally*, 2.5mg/kg twice a day. Increase by 2.5-5mg/kg/day every 3-4 days until maintenance dose achieved. See note b).
Typical maintenance dose: 5-10mg/kg twice a day
OR
Up to 1 year 50-100mg twice a day
1 - 5 years 100-200mg twice a day
5 - 10 years 200-300mg twice a day
10 - 15 years 300-500mg twice a day
Controlled release tablets; use doses above
Rectally, use only when the oral route is not available. Increase the required/established oral dose by 25% and give as rectal dose. Adjust according to response. Oral suspension can be administered diluted rectally. However suppositories should be first line rectally.

Notes:

- a) Other agents such as gabapentin or tricyclics are considered first line for nerve pain. If carbamazepine is needed for nerve pain doses are the same as those for epilepsy.
- b) Blood levels: Therapeutic range 4-14mg/L. Ideally levels to assess efficacy should be taken immediately prior to the next dose.
- c) As carbamazepine induces its own metabolism, the half life falls with repeated dosing therefore the dose may have to be increased after initial treatment. Maximal induction of metabolism occurs after 4 weeks.
- d) A full blood count and liver function test may be performed before and 4-6 weeks after starting treatment. Counsel patients or their carers to report any fever, sore throat, mouth ulcers, bruising or any other symptoms of blood, hepatic or skin disorders.
- e) Carbamazepine can affect the metabolism of many hepatically metabolised drugs due to enzyme induction. Also carbamazepine blood levels may be increased or decreased by drugs which alter its metabolism.
- f) Anti-convulsants should be prescribed by generic AND trade name to ensure continuity of the same preparation for the patient as NOT ALL PRODUCTS ARE BIOEQUIVALENT. Tegretol[®] is the brand stocked by the Trust.
- g) Controlled release tablets may be halved BUT must not be chewed.
- h) Carbamazepine liquid and 100mg chewable tablets (Tegretol[®]) are sucrose free.

CARBIMAZOLE

Preparations: TABLETS 5mg and 20mg. LIQUID (**Extemporaneously Prepared**).

Dosage: **HYPERTHYROIDISM**

Initially, *orally*,

Up to 1 year 250microgram/kg 3 times a day

1 - 4 years 2.5mg 3 times a day

4 - 12 years 5mg 3 times a day

Over 12 years 10mg 3 times a day

Notes:

- a) Give as above until the patient is euthyroid, then progressively reduce (usually to once daily).
- b) Monitor total and differential white blood cell count every 3 to 6 months.
- c) Counsel carer/patient to report the onset of sore throats, mouth ulcers, bruising and other indicators of bone marrow suppression and agranulocytosis.
- d) Carbimazole is unstable in solution – if required, crush tablets and mix with water – use immediately.

CARGLUMIC ACID

Preparations: DISPERSIBLE TABLETS 200mg (CARBAGLU®) (Fridge).

Dosage: **TREATMENT OF HYPERAMMONAEMIA DUE TO N-ACETYL GLUTAMATE SYNTHASE(NAGS) DEFICIENCY**

SEEK SPECIALIST ADVICE FROM METABOLIC TEAM BEFORE PRESCRIBING

Orally,

All Ages

50-125mg/kg twice a day, immediately before feeds, adjusted according to response, usual maximum 250mg/kg per day.

Maintenance: 5-50mg/kg twice a day.

Measure ammonia levels prior to administration. Ammonia levels should normalise within a few hours after starting carglumic acid.

Administration Disperse in 5 – 10ml of water. Administer before meals or feeding.

Notes:

- a) Tablets must be stored in the fridge until opened.
- b) After first opening the container, do not refrigerate.
- c) Shelf life of 1 month after opening.
- d) Can cause raised transaminases and increased sweating.
- e) Systemic surveillance of liver, renal, cardiac functions and haematological parameters is recommended.

CARNITINE

Preparations: LIQUID 30% (300mg in 1ml). INJECTION 1g in 5ml (Both products are L-Carnitine).

Dosage: **TREATMENT OF PRIMARY OR SECONDARY CARNITINE DEFICIENCY.**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

All ages, *orally or IV injection*, 50mg/kg twice a day. May be increased up to 200mg/kg/day or 3g/day (see note b).

Continuous IV infusion: Give 100mg/kg loading dose over 30 minutes and continue with 100mg/kg/day.

Administration: Slow IV injection over 2-3minutes.

IV infusion: Can be diluted with glucose 5%, 10%, sodium chloride 0.9%. Y site compatible with arginine, sodium benzoate & sodium phenylbutrate.

Notes:

- a) L-Carnitine is an amino acid derivative which is an essential co-factor of fatty acid metabolism.
- b) Dose over 100mg/kg/day may cause diarrhoea.
- c) Can be diluted in fruit juice or water if required.
- d) L-Carnitine liquid (Carnitor[®]) contains 140mg of sucrose in 5ml.

CARVEDILOL

Preparations: TABLETS 3.125mg, 6.25mg and 12.5mg.

Dosage: **HEART FAILURE**

This indication is unlicensed for use in children.

Orally, initially 0.05mg/kg (max 3.125mg) twice a day. Dose can be doubled every two weeks to a maximum of 0.35mg/kg twice a day. Maximum dose 25mg twice daily.

Notes:

- a) Caution, may induce bronchospasm; do not use in asthmatics.
- b) Monitor blood pressure, heart rate, saturations and respiratory rate at initiation of treatment and following dose adjustments.
- c) Renal and cardiac function should be checked before each dose increase.
- d) Tablets can be crushed and dispersed in water. Use immediately.
- e) Digoxin levels may be increased with concomitant use, adjust dose as necessary.

CEFALEXIN

Preparations: CAPSULES 250mg and 500mg.
LIQUIDS 125mg in 5ml and 250mg in 5ml.

Dosage: **TREATMENT OF INFECTION**
Orally,
All ages 10-15mg/kg three times daily.
Severe infection 25mg/kg four times daily. Max. single dose 1g.
Or
1 - 5 yrs 125mg three times a day
Over 5 yrs 250mg three times a day
Doses may be doubled in severe infection.

UTI PROPHYLAXIS

All ages 125mg at night (< 5kgs – 25mg/kg at night).

RENAL IMPAIRMENT

CrCl/1.73m² <10ml/min Reduce dose frequency to 12 hourly.

Notes:

In confirmed cephalosporin allergy an alternative antibiotic should be prescribed. Contact Microbiology department for further advice.

CEFOTAXIME

Preparations: INJECTIONS 500mg, 1g and 2g. 100mg/0.5ml pre-filled syringe (GSTFT CIVAS only).

Dosage: **TREATMENT OF INFECTION**
Neonates: *IV injection*, 100mg Pre-filled syringe: For treatment of infection for babies between 2.3 and 4.5 kg (8-12 hourly).
Less than 7 days old 50mg/kg every 12 hours
Over 7 days old 50mg/kg every 8 hours
Increase dose to 150-200mg/kg/day in 2-4 divided doses in severe infections, including neonatal meningitis.
Infants and children: *IM or IV injection*, 50mg/kg twice a day. Up to 50mg/kg 4 times a day in severe infections, max. 4g 3 times daily).

IN RENAL FAILURE

No dose reduction is required until the creatinine clearance is less than 5ml/minute/1.73m² when, following a single normal dose, the dose should be halved, keeping same frequency.

It is significantly removed by peritoneal dialysis and haemodialysis, dose as for normal renal function.

Administration: IV injection:
Reconstitute (allowing for displacement) with water for injection and give over 3-5 minutes.
IV infusion: Dilute appropriate dose with glucose 5% or sodium chloride 0.9% to 20mg in 1ml and administer over 20-60 minutes.

Notes:

- a) In confirmed cephalosporin allergy an alternative antibiotic should be prescribed. Contact Microbiology department for further advice.
- b) Cefotaxime may be associated with reversible, late-onset neutropenia and eosinophilia.

CEFTAZIDIME

Preparations: INJECTION 500mg, 1g and 2g.

Dosage: **TREATMENT OF INFECTION**
IV or IM injection,
Under 2 months 30mg/kg twice a day (50mg/kg twice a day for meningitis).
Over 2 months 30-50mg/kg 2-3 times a day.
Doses up to 50mg/kg 3 times a day, maximum of 2g 3 times a day, may be given in severe infection, the immunocompromised, or children with cystic fibrosis. Single dose over 1g not via IM route.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dose	Dosage Interval (hours)
30-50	50-100% of dose	12
15-30	50-100% of dose	24
5-15	25-50% of dose	24
Less than 5	25-50% of dose	48

Haemodialysis: the normal dose should be given after dialysis.

Peritoneal dialysis: 50% of the normal dose should be given initially, then 25-50% of the normal dose once a day. 125-250mg may be added to 2L of dialysis fluid.

CVVHD or high flux haemofiltration, dose is 25-50% of normal dose twice a day.

Administration: Reconstitution taking the displacement value into account.

IV infusion: Dilute reconstituted vial with sodium chloride 0.9% or glucose 5% and give over a maximum of 30 minutes.

Notes:

- a) In confirmed cephalosporin allergy, an alternative antibiotic should be prescribed. Contact the Microbiology department for further advice.
- b) Neurological sequelae have been seen in renal failure where the dose has not been adjusted.
- c) Each 1g of powder contains 2.3mmol of sodium.
- d) See Antibiotic treatment guidelines.

CEFTRIAXONE

Preparations: INJECTIONS 250mg, 1g and 2g.

Dosage: **TREATMENT OF INFECTION**
IV,
Neonates IV 20-50mg/kg (see note c).
> 1 month IV/IM 20-50mg/kg once a day (increase to 80mg/kg
IV infusion for severe infection or meningitis)
(See note d). Maximum dose 4g/day.

PROPHYLAXIS OF MENINGOCOCCAL MENINGITIS

This is an unlicensed indication.

IM injection,

1 - 12 years	125mg single dose
over 12 years	250mg single dose

IN RENAL FAILURE

No dosage reduction is required until creatinine clearance is less than 10ml/minute/1.73m² and then dose should not exceed 40mg/kg (2g)/day. Ceftriaxone is generally not removed during haemodialysis or peritoneal dialysis, dose as for creatinine clearance less than 10ml/minute/1.73m².

Administration: Deep IM injection: Dissolve 250mg in 0.8ml 1% lignocaine to give 250mg in 1ml. Dosages greater than 500mg should be divided and injected in more than one site.

IV injection: Reconstitution taking the displacement value into account. Doses in neonates or over 50mg/kg should be given by IV infusion.

IV infusion: Dilute reconstituted dose with sodium chloride 0.9% or glucose 5% and give over 60 minutes in neonates (see note b) and 30 minutes for doses over 50mg/kg in infants and children.

Notes:

- a) In confirmed cephalosporin allergy an alternative antibiotic should be prescribed. Contact Microbiology department for further advice.
- b) The administration time of ceftriaxone in neonates is over 60 minutes to reduce the displacement of bilirubin from albumin thus reducing the risk of bilirubin encephalopathy.
- c) Ceftriaxone should not be administered to premature, acidotic, jaundiced neonates or those with impaired or reduced bilirubin binding (e.g. prematurity, acute or chronic liver failure).
- d) **Caution:** Doses over 80mg/kg may increase the risk of biliary precipitates.
- e) Incompatible with calcium containing solutions i.e. Hartmann's solution.
- f) Each 1g of (Rocephin[®]) powder contains 3.6mmol sodium.
- g) Ceftriaxone is contraindicated in newborns up to age 28 days who need treating with calcium containing solutions.
Ceftriaxone should not be mixed with calcium containing intravenous solutions and must not be given simultaneously with calcium containing solutions – even via different infusion lines.
Sequential infusions of calcium and ceftriaxone may be infused (in patients greater than 28 days old, provided they are via different site lines or well flushed between solutions.

CEFUROXIME

Preparations: INJECTION 250mg, 750mg and 1.5g. 80mg in 0.8ml pre-filled SYRINGE (GSTFT CIVAS only).

Dosage: **TREATMENT OF INFECTION**
Neonates: *IV injection*, 30mg/kg twice a day.
Infants and children: *IM or IV injection*, 10-30mg/kg 3 times a day. 20mg/kg 3 times a day is the usual dose for most infections. (Max dose 1.5g)

SEVERE INFECTION / CYSTIC FIBROSIS

Neonates: *IV injection*, initially, 50mg/kg twice a day. Reduce dose to 25mg/kg twice a day, on clinical improvement.
Infants and children: *IV injection*, 50-60mg/kg 3-4 times a day. (Max dose 1.5g)

PROPHYLAXIS FOR CARDIOTHORACIC SURGERY FOR 24 HOURS

All ages: 30mg/kg on induction followed by a second dose after 12 hours.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dose interval (hours)
Over 20	Not less than 8
10-20	12
Less than 10	24

Haemodialysis, normal dose once a day on non dialysis days and twice a day on dialysis days ensuring a dose is given after dialysis session.

CAVHD, high flux haemofiltration, normal dose every 12 hours.

Peritoneal dialysis, normal dose every 12 hours ensuring one dose given prior to and one dose post dialysis session.

Administration: On reconstitution 250mg displaces 0.2ml and 750mg displaces 0.5ml.

IM injection: Add 0.8ml water for injection to 250mg vial to give 250mg in 1ml and 2.5ml to 750mg vial to give 750mg in 3ml. Shake gently to produce a suspension.

IV injection: Add 2.3ml of water for injection to 250mg vial or 7ml of water for injection to 750mg vial to give 100mg in 1ml. Inject over 3-5 minutes.

IV infusion: Dilute reconstituted dose with sodium chloride 0.9% or glucose 5% and give over 30 minutes.

Notes:

- In confirmed cephalosporin allergy an alternative antibiotic should be prescribed. Contact Microbiology department for further advice.
- Cefuroxime can be added to metronidazole infusion.
- Cefuroxime is a 2nd generation cephalosporin and has good activity against Gram positive organisms except Enterococcus (Streptococcus). It may cause *C. difficile* associated diarrhoea.
- See also antibiotic treatment guidelines.

CETIRIZINE

Preparations: LIQUID 5mg in 5ml. TABLETS 10mg.

Dosage: **ANTI-HISTAMINE FOR HAYFEVER AND SEASONAL RHINITIS**

Unlicensed in children under 2 years.

<i>Orally,</i>	under 2 years	0.25mg/kg	twice a day
	2 - 6 years	2.5mg	twice a day
		or 5mg	once a day
	over 6 years	5mg	twice a day
		or 10mg	once a day

IN RENAL FAILURE

If creatinine clearance below 30ml/minute/1.73m² or in haemodialysis or peritoneal dialysis reduce dose by 50%.

CHLORAL HYDRATE

Preparations: SUPPOSITORIES 100mg and 500mg (**Specials Manufacturer**) (Fridge).
SOLUTION 500mg/5ml (**Specials Manufacturer**)

Dosage: **SEDATION**
Orally/Rectal, all ages, single dose of 30-100mg/kg, 30-60 minutes before procedure. Maximum dose is 2g however up to 4g has been given.
For continued sedation doses may be given up to 3 times a day. It may be given more frequently in intensive care areas.
For night sedation give above dose 30 minutes before going to bed.

Notes:

- a) **Caution:** children with obstructive sleep apnoea could be at risk from life threatening respiratory obstruction during sedation.
- b) Use chloral hydrate with extreme caution in patients with severe hepatic or renal impairment.
- c) Try to avoid any repeat doses in preterm infants and neonates < 7 days old. Only prescribe "as required" and review after 48 hours.

CHLORAMPHENICOL

Preparations: INJECTION containing 1g of chloramphenicol (as sodium succinate). CAPSULES 250mg. EYE DROPS 0.5% (Fridge). EYE OINTMENT 1%. SINGLE USE EYE DROPS 0.5% (Minims) (Fridge).

Dosage: **EYE PREPARATIONS**
Use drops or ointment hourly initially in acute infections and then 4 times a day. Continue for 2 days after infection clears (see note b).

TREATMENT OF INFECTION

**CHLORAMPHENICOL IS NOT A FIRST LINE ANTIBIOTIC
ONLY USE AFTER POSITIVE SENSITIVITIES AND ON MICROBIOLOGY ADVICE**

Neonates: In severe infection e.g. meningitis,
IV injection,

Up to 14 days 12.5mg/kg every 12 hours

14 - 28 days 12.5mg/kg every 6 hours

Orally or IV injection,

1 month - 1 year 12.5mg/kg every 6-8 hours

Over 1 year, *orally or IV injection* 25mg/kg 6 hourly (max. 1g).

In severe infections (e.g. meningitis), give a loading dose of 50mg/kg by *IV injection* followed by maintenance dose *IV injection* or *orally*, 25mg/kg every 6 hours.

IN LIVER OR RENAL FAILURE

Dosage reduction is not required in liver impairment and only required in severe renal impairment (<10ml/minute/1.73m²). Avoid unless no alternative available. Monitor levels.

Chloramphenicol is not removed by peritoneal dialysis or haemodialysis. Monitor levels.

Administration: On reconstitution 1g displaces 0.8ml. Add 9.2ml water for injection to 1g vial to give 100mg in 1ml. *IV injection:* Give over 3-5 minutes. *IV infusion:* Dilute with sodium chloride 0.9% or glucose 5% and give over 30-60 minutes.

Notes:

- a) Chloramphenicol use in paediatrics is generally restricted to treatment of severe infection and where a less toxic antibiotic is not available.
- b) Fusidic acid 1% viscous eye drops (see sodium fusidate) are recommended for initial treatment except in neonates where chloramphenicol is more effective. Chloramphenicol eye preparations are only indicated when sensitivities show that fusidic acid is not appropriate.
- c) Blood levels:
Sample should be taken immediately prior to 5th dose.
Trough less than 10mg/L.
- d) Neonates are unable to metabolise the drug rapidly and accumulation can occur causing **grey baby syndrome** i.e. pallor, abdominal distension, vomiting and collapse. **Lower doses** are therefore required at this age, and should be controlled by blood levels. Also, chloramphenicol should only be given parenterally (as the succinate) to neonates as they cannot adequately metabolise the palmitate.
- e) High blood levels are associated with reversible bone marrow suppression. Irreversible suppression is very rare and idiosyncratic.
- f) Chloramphenicol inhibits the metabolism of many drugs including oral anticoagulants and phenytoin. Phenobarbitone and rifampicin reduce the blood concentration of chloramphenicol.

CHLORHEXIDINE

Preparations: MOUTHWASH 0.2%. BLADDER WASHOUT 0.02%.

Dosage: **ORAL HYGIENE**

Mouthwash:

Rinse mouth with 5-10ml for about 1 minute twice a day. Swab around the mouth in neonates and infants.

Chlorhexidine mouthwash should not be swallowed. It may also cause reversible brown staining of the teeth; however this may be prevented by brushing the teeth **before** use.

ANTISEPTIC BLADDER WASHOUT

The volume is dependent on the bladder size and should be retained for 10-15 minutes. Washout is not complete until returning fluid is clear.

Under 7 years,

Instil via catheter, 15-30ml at a time.

Over 7 years,

Instil via catheter, 30-50ml at a time.

Ensure solution is at body temperature before instilling to avoid discomfort and bladder spasms.

Notes:

- a) Mouthwash (Corsodyl®) contains ethanol 7% v/v.

CHLOROQUINE

Preparations: TABLETS chloroquine phosphate 200mg (equivalent to 155mg chloroquine base).
LIQUID chloroquine sulphate 68mg in 5ml (5ml is equivalent to 50mg chloroquine base).

Dosage: **RHEUMATOID ARTHRITIS, SYSTEMIC LUPUS ERYTHEMATOSUS**
All ages, *orally*, 2.5mg/kg up to 3mg/kg (as chloroquine base) once a day (see note f). To avoid excessive dosages in obese or grossly oedematous patients use ideal body weight. Treatment should be discontinued if no improvement is seen in 6 months.

PROPHYLAXIS OF MALARIA

All ages, *orally*, 5mg/kg (as chloroquine base) (maximum dose 300mg) at weekly intervals.

Start treatment 1 week before entering an endemic area and continue for 4 weeks after returning (see note e).

OR

Age	Dose (base)	
Up to 12 weeks	37.5mg	once a week
12 weeks - 11 months	75mg	once a week
1 - 3 years	112.5mg	once a week
4 - 7 years	150mg	once a week
8 - 12 years	225mg	once a week
13 years and over	300mg	once a week

TREATMENT OF BENIGN MALARIA

Orally,

Age		Dose (as chloroquine base)
Up to 12 years	Day 1	10mg/kg up to 600mg, then 5mg/kg up to 300mg, 6-8 hours later.
	Day 2-3	5mg/kg up to 300mg once a day (see note d).
Over 12 years	Day 1	600mg once then 300mg 6-8 hours later.
	Day 2-3	300mg once a day (see note d).

Course may need to be extended to 4-7 days (see note d).

IN RENAL FAILURE

Dosage reduction of treatment doses may be required in renal failure due to increased unbound chloroquine in the circulation.

Creatinine clearance (ml/minute/1.73m ²)	Dosage
10-50	Half of the dose
< 10	One quarter of the dose

Chloroquine is not dialysed.

Notes:

- a) Tablets may be crushed if used immediately afterwards. Bioavailability increased if given with food.
- b) IV infusion should **only** be used if oral route is impossible. **Slow** infusion is necessary to avoid arrhythmias, peripheral circulatory failure or acute encephalopathy.
- c) SC/IM route should only be used in exceptional circumstances where IV or oral route is not possible.
- d) Chloroquine alone is suitable for *P.malariae*; however a **radical cure** is required for *P.vivax* and *P.ovale*. Primaquine should be given for a radical

cure.

Advice on **PROPHYLAXIS** and **TREATMENT** can be obtained from:

Medicines Information Centre

OR

The London Malaria Reference Laboratory

☎ 020-7636 3924 ☎

The Hospital for Tropical Disease

☎ 020-7387 4411 (all hours) ☎

- e) Retinopathy becomes more common with prolonged malaria prophylaxis for more than 1 year or after a total dose of 1.6g/kg. Specialist advice should be sought for long term prophylaxis.
- f) Before starting long term therapy a base line eye examination should be performed. Ocular toxicity is not normally seen with doses not exceeding 2.5mg/kg/day although monthly monitoring maybe considered necessary.

CHLOROTHIAZIDE

Preparations: LIQUID 250mg in 5ml (**Import**).

Dosage:

DIURESIS

Orally,

Under 6 months 12.5-17.5mg/kg twice a day.

Over 6 months 12.5mg/kg twice a day, increasing to a maximum of 500mg twice daily.

HYPERINSULINAEMIC HYPOGLYCAEMIA

7-10mg/kg/day in 2 divided doses (see note c).

Notes:

- a) Hypokalaemia and hyperuricaemia may occur.
- b) Chlorothiazide liquid (Diuril[®]) contains 2g of sugar in 5ml and alcohol 0.5%.
- c) To be used in conjunction with diazoxide, synergistic action.

CHLORPHENAMINE MALEATE

(CHLORPHENIRAMINE MALEATE)

Preparations: TABLETS 4mg. LIQUID 2mg in 5ml. INJECTION 10mg in 1ml.

Dosage:

SEDATIVE ANTIHISTAMINE

Chlorphenamine is unlicensed for use in children under 1 year.

Orally,

1 month - 2 years	1mg	twice a day
2 - 6 years	1-2mg	3 times a day
6 - 12 years	2-4mg	3-4 times a day (max. 12mg/day)
Over 12 years	4mg	3-6 times a day

IV, SC or IM injection,

These routes are unlicensed for use in children.

< 6 months	250microgram/kg
6 months - 6 years	2.5mg
6 - 12 years	5mg
Over 12 years	10mg

Repeat up to 4 times in 24 hours if necessary.

For **anaphylaxis** the injection should be given IV.

SC or IM injections rarely act more quickly than oral doses.

Administration:

IV injection, dilute in the syringe with 5-10ml of sodium chloride 0.9%, or water for injection and inject slowly over 1 minute.

Notes:

- IV injection may be associated with transient drowsiness, giddiness and hypotension particularly if administration is too rapid.
- Paradoxical excitation can be seen in children.
- Injection can be given orally.
- Chlorphenamine liquid (Piriton[®]) contains 1.8g of sucrose in 5ml and 6.5% v/v of alcohol but is tartrazine free.

CHLORPROMAZINE

Preparations: TABLETS 25mg, 50mg and 100mg.
LIQUID 25mg in 5ml and 100mg in 5ml.
INJECTION 50mg in 2ml.

Dosage:

THE IV ROUTE IS UNLICENSED AND CAN RESULT IN SEVERE HYPOTENSION, USE THIS ROUTE WITH EXTREME CAUTION.

PREMEDICATION

This is an unlicensed indication.
All ages, *IM injection* 1mg/kg.

INTRACTABLE HICCUP

6 – 12 years	10mg	3 times a day
> 12 years	25-50mg	3 times a day

CHILDHOOD SCHIZOPHRENIA, AUTISM

Orally, 500microgram/kg every 4-6 hours.
IM injection, 500microgram/kg every 6-8 hours.
1 - 5 years Maximum total daily dose 40mg/day.
6 - 12 years Maximum total daily dose 75mg/day.
Over 12 years Maximum total daily dose 300mg/day.

NARCOTIC WITHDRAWAL IN THE NEONATE

This is an unlicensed indication.
Orally or IV injection, 550-750microgram/kg 4 times a day. Dose can be doubled if withdrawal is severe, maximum dose 6mg/kg/day. Once stable reduce dose by not more than 2mg/kg/day on every third day.

Administration: Dilute to at least 2.5mg in 1ml in sodium chloride 0.9% and give over 20-60 minutes. Keep patient supine and monitor BP regularly, as **severe hypotension** may occur.

Notes:

- a) Chlorpromazine should only be used where alternatives are not available due to the risk of side effects. Side effects include antimuscarinic effects, photosensitivity, occasionally abnormal liver function, agranulocytosis and rarely neuroleptic malignant syndrome and lupus erythematosus like syndrome.
- b) Extrapyramidal side effects may also occur, especially in young children. Chlorpromazine should not generally be used in infants under 1 year except for narcotic withdrawal in neonates.
- c) **Caution:** Do not crush tablets and minimise handling of preparations due to risk of contact sensitisation.
- d) The injection must be protected from light. Any solution which develops a pink or yellow colouration should be discarded.
- e) Both liquids are sugar free.

CICLOSPORIN

Preparations: ORAL LIQUID (Neoral[®]) 100mg in 1ml.
CAPSULES (Neoral[®]) 10mg, 25mg, 50mg and 100mg.
INJECTION (Sandimmun[®]) 50mg in 1ml.

Dosage:

SEEK EXPERT ADVICE BEFORE PRESCRIBING.

MUST BE PRESCRIBED BY BRAND.

PREVENTION OF RENAL GRAFT REJECTION

Initial dose, 150mg/m² orally twice a day (see current paediatric renal transplant protocol). Dosage should then be adjusted according to trough blood levels. If converting from the oral to the intravenous route, give one-third of the previous oral dose.

NEPHROTIC SYNDROME

i) Steroid dependent

Initial dose, 75mg/m² orally twice a day. Dosage should then be adjusted according to trough blood levels.

ii) Steroid resistant

Initial dose, 150mg/m² orally twice a day (see current paediatric renal protocol). Dosage should then be adjusted according to trough blood levels. If converting from the oral to the intravenous route, give one-third of the previous oral dose.

Administration: IV injection, dilute to between 0.5mg in 1ml and 2.5mg in 1ml with sodium chloride 0.9% or glucose 5% and give over 2-6 hours.

Notes:

- a) Limited to use in specialised units.
- b) The therapeutic range is dependant on the assay used. Ideal trough whole blood levels are as follows:-
 - i. Prevention of Renal Graft Rejection and Steroid Resistant Nephrotic Syndrome = 200 microgram/L. One year post-transplant if stable level = 100 microgram/L.
 - ii. Steroid Dependant Nephrotic Syndrome = 100 microgram/L.
- c) Blood levels of ciclosporin may be **increased** by the concurrent administration of grapefruit juice, erythromycin, cimetidine, methylprednisolone, metoclopramide, sex hormones (oral contraceptives), diltiazem, nicardipine, verapamil, tacrolimus, ketoconazole, itraconazole and fluconazole, clarithromycin, amiodarone.
- d) Blood levels of ciclosporin may be **reduced** by concurrent administration of rifampicin, St John's wort, phenobarbitone, phenytoin, carbamazepine, or heparin. Dose may be adjusted according to levels.
- e) Concurrent administration of nephrotoxic drugs such as aminoglycosides, co-trimoxazole, amphotericin, ciprofloxacin, diclofenac, frusemide or metolazone may enhance nephrotoxicity.
- f) Administration with digoxin can cause elevated plasma digoxin levels.
- g) The immunological response to vaccines may be reduced in patients taking ciclosporin. Use of live attenuated vaccines should be avoided.
- h) The oral liquid has an unpleasant taste which can be masked by orange juice. It can be administered via a nasogastric tube.
- i) NG and PO routes have different bioavailabilities. If changing between routes, plasma monitoring is required.
- j) Do not refrigerate oral liquid and discard two months after opening.
- k) Ciclosporin injection contains polyethoxylated castor oil which has been reported to cause anaphylactic reactions.

CIPROFLOXACIN

Preparations: TABLETS 100mg, 250mg and 500mg. LIQUID 250mg in 5ml.
INJECTION 100mg in 50ml, 200mg in 100ml and 400mg in 200ml.

Dosage: **TREATMENT OF SEVERE INFECTIONS**
This indication is unlicensed for use in children under 1 year. In children and growing adolescents ciprofloxacin is only recommended where the benefits outweigh the risk of arthropathy.
Orally, Neonates: 10-15mg/kg twice a day.
1 month - 18 years: 10mg/kg twice a day. Can be increased to 20mg/kg in severe infection (max. single dose 750mg).
IV infusion, Neonates: 6-10mg/kg twice a day.
1 month - 18 years: 6mg/kg 2-3 times a day. Increase to 10mg/kg three times a day in severe infection (max. single dose 400mg).

IN CYSTIC FIBROSIS

Use doses as for severe infection.

PROPHYLAXIS OF MENINGOCOCCAL DISEASE

This is an unlicensed indication but is the preferred treatment at Guy's & St Thomas'. (see note i)

1 month – 4 years 125mg as a single dose
5 - 12 years 250mg as a single dose.
Over 12 years 500mg as a single dose.

IN RENAL FAILURE

In renal failure reduce the total daily dose by 50% if creatinine clearance is less than 20ml/minute/1.73m².

Administration: Infuse directly over 30-60 minutes. Dilute if required with sodium chloride 0.9%.

Notes:

- a) **CSM Warning:** At the first sign of pain or inflammation, patients should discontinue treatment and rest the affected limb until tendon symptoms have resolved.
- b) **Seizure threshold** may be reduced by ciprofloxacin therefore it should be used with caution where there is a history of convulsions. This risk may be increased with concomitant NSAIDs.
- c) Ciprofloxacin may enhance effect of oral anticoagulants, increase theophylline levels and increase risk of nephrotoxicity with ciclosporin.
- d) Ciprofloxacin absorption is very good, use the oral route whenever practicable. Antacids, iron, milk and sucralfate may reduce absorption.
- e) Ciprofloxacin suspension contains lecithin and there is a theoretical possibility of increased gastrointestinal side effects in children of less than two years of age.
- f) The tablets can be dispersed in water immediately before taking, although the taste is very bitter. The liquid has an initial pleasant taste but still has a bitter after taste. Liquid is not suitable for administration down a nasogastric tube as it may block the tube.
- g) The liquid contains 1.3% of sucrose in 5ml and is strawberry flavoured.
- h) As with other quinolones patients should avoid prolonged exposure to strong sunlight or uv radiation during treatment.
- i) Rifampicin is the drug of choice for meningococcal prophylaxis in neonates.

CITRATE SOLUTIONS

Preparations: LIQUID Tricitrate Oral Solution (**Manufactured Special**).
LIQUID Potassium Citrate Mixture BP.

Dosage: **RENAL ACIDOSIS, PRIMARY HYPEROXALURIA, URINARY ALKALISATION**
Orally, all ages, 0.5-1mmol citrate/kg/day (see note a).

Notes:

- a) 1mmol of citrate is approximately equivalent to 3mmol of bicarbonate.
- b) Potassium levels should be monitored.
- c) Tricitrate Oral Solution, each 1ml contains 1mmol of sodium, 1mmol of potassium, 0.7mmol of citrate and an equivalent of 2mmol of bicarbonate.
- d) Potassium Citrate Mixture BP, each 1ml provides 2.8mmol of potassium, 0.9mmols of citrate and an equivalent of 2.8mmol of bicarbonate.

CITRULLINE

Preparations: SACHETS 200mg AND 1000mg

Dosage: **UREA CYCLE DEFECTS (CPS AND OTC DEFICIENCY)**
Orally, 170mg/kg a day in 4 divided doses.

Notes:

- a) Used as an alternative to arginine supplementation.
- b) Sachets dissolve well in 20ml of water.

CLARITHROMYCIN

Preparations: LIQUID 125mg in 5ml and 250mg in 5ml.
TABLETS 250mg and 500mg. INJECTION 500mg.

Dosage: **TREATMENT OF INFECTION**
The intravenous route is unlicensed for use in children.
Orally, IV injection, 7.5mg/kg twice a day. Maximum dose 500mg twice a day for severe infection.

OR, orally,

1 - 2 years	62.5mg	twice a day
3 - 6 years	125mg	twice a day
7 - 9 years	187.5mg	twice a day
over 10 years	250mg	twice a day

HELICOBACTER PYLORI ERADICATION

Orally, – dose as above. Doses should be used for 7 days in conjunction with amoxicillin or metronidazole plus omeprazole.

IN RENAL FAILURE

Reduce dose by 50% if creatinine clearance is less than 30ml/minute/1.73m². No dosage adjustments are necessary in haemodialysis or peritoneal dialysis.

Administration: Reconstitute vial with 10ml of water for injection to give 50mg in 1ml concentration. Dilute reconstituted dose to 2mg in 1ml with sodium chloride 0.9% or dextrose 5% and give over 1 hour via a large vein.

Notes: Clarithromycin as with other macrolide antibiotics, interacts with drugs metabolised by the cytochrome P450 system therefore may increase plasma concentrations of drugs such as theophylline, carbamazepine, ciclosporin, tacrolimus, warfarin and digoxin.

CLINDAMYCIN

Preparations: CAPSULES 150mg.
INJECTION 300mg in 2ml.

Dosage:

CONSULT MICROBIOLOGIST BEFORE PRESCRIBING

TREATMENT OF INFECTION

Neonates:

Less than 2 weeks	3-6mg/kg	three times a day
> 2 weeks	3-6mg/kg	four times a day

Over 1 month of age,

Orally, 3-6mg/kg 4 times a day depending on severity of infection. Children less than 10kg, minimum recommended dose is 37.5mg 3 times a day. (Use 6mg/kg in Cystic Fibrosis – max 600mg 4 times a day).

IM or IV injection, 4-6mg/kg (max. 10mg/kg) 4 times a day.

ENDOCARDITIS PROPHYLAXIS

See guidelines on antibiotic prophylaxis of infective endocarditis

IN HEPATIC FAILURE

Dose should be reduced in hepatic failure and liver function tests should be monitored.

Administration: IM injection: Maximum 600mg (4ml) per dose.

IV injection: Clindamycin must be diluted before IV administration to at least 6mg in 1ml with sodium chloride 0.9% or glucose 5% and infused over 60 minutes.

Notes:

- a) Monitor liver function tests and blood counts in neonates and infants.
- b) Clindamycin should only be used in consultation with the microbiology department.
- c) Capsule contents may be mixed on spoonful of food or dispersed in water or juice.

CLOBAZAM

Preparations: TABLETS 10mg.
LIQUID 1mg in 1ml (**GSTT special**) [25mg/5ml stocked at Lewisham].

Dosage: **EPILEPSY**
This indication is unlicensed for use in children less than 3 years.
Orally,
< 12 years initially 125microgram/kg twice a day (max 500microgram/kg, or 15mg twice daily)
12 - 18 years Initially 10mg twice a day (max 30mg twice daily)
Increase doses at 5 day intervals until satisfactory response or maximum achieved.

Notes:

- a) Not all liquid preparations are bioequivalent. Continuation supplies should be obtained from the same manufacturer.
- b) Clobazam is on the government "black list" for all indications except epilepsy. Prescriptions should be endorsed "SLS".
- c) Tablets can be crushed and dissolved/dispersed in water.

CLOMETHIAZOLE (CHLORMETHIAZOLE)

Preparations: CAPSULES clomethiazole base 192mg.

Dosage: **EPILEPSY**

This is an unlicensed indication.

Orally, all ages, initially 10-20mg/kg/day in divided doses given every 2-4 hours. Tachyphylaxis occurs quickly.

Notes:

- a) Worsening of epilepsy in Lennox Gastaut Syndrome may occur.
- b) One capsule is approximately equivalent to 5ml of the old liquid.

CLONAZEPAM

Preparations: TABLETS 500microgram and 2mg. INJECTION 1mg in 1ml.
LIQUID 2mg in 5ml

Dosage: **STATUS EPILEPTICUS**
Slow IV injection, over 2-3 minutes,
Neonates: 100micrograms/kg
1 month – 12 years 50microgram/kg (max. 1mg)
>12 years 1mg
IV infusion, initially bolus dose as above, followed by a continuous infusion starting at 10 microgram/kg/hour. Adjust according to response, up to 60microgram/kg/hr has been used.

EPILEPSY

Orally, all ages, 50-200microgram/kg/day in 3-4 divided doses. Increase dose every 4-5 days.

OR

Age	Initial dose/day	Maintenance dose/day
Up to 1 year	250microgram	500microgram-1mg
1 - 5 years	250microgram	1-3mg
5 - 12 years	500microgram	3-6mg
Over 12 years	1mg	4-8mg

Administration: IV injection, dilute with 1ml water for injection immediately before use and give slowly over 2-3 minutes. IV infusion, dilute with sodium chloride 0.9% or glucose 5%. Watch infusion for signs of precipitation and change every 12 hours. Clonazepam can be infused undiluted, into large vessels (preferably a central line).

Notes:

- a) Impaired swallowing and respiratory depression are possible with IV administration. Salivary and bronchial hypersecretion may also occur, particularly if there are learning difficulties.
- b) Prolonged infusion may lead to accumulation and delay recovery.
- c) Tolerance to clonazepam may develop in some patients. If this occurs control may be re-established by increasing the dose or interrupting therapy for 2 to 3 weeks.
- d) Injection can be given orally but see excipients.
- e) To prevent withdrawal symptoms withdraw clonazepam by reducing dose by approximately 40microgram/kg/week.
- f) Clonazepam injection contains 20% v/v ethanol and 30mg of benzylalcohol per 1ml ampoule.
- g) Clonazepam can be administered rectally in acute situations. Use oral solution undiluted (0.02 - 0.1 mg/kg) or injection diluted (0.05 - 0.1 mg/kg).

CLONIDINE

- Preparations:** TABLETS 25microgram and 100microgram.
INJECTION 150microgram in 1ml.
LIQUID 10microgram in 1ml (**GSTT Special**).
- Dosage:** **ATTENTION DEFICIT HYPERACTIVITY DISORDER WITH OR WITHOUT OPPOSITIONALITY, OR WITH TIC DISORDER, TOURETTES SYNDROME**
These are unlicensed indications.
Orally, initially, 25microgram at night for 1-2 weeks then increase to 50microgram at night.
If required dose can be further increased by 25microgram every 2 weeks, side effects permitting.
Maximum dose 5microgram/kg/day (or up to a maximum of 300microgram/day).
- SEDATION/PAIN/OPIATE WITHDRAWAL**
Orally, initially, 3micrograms/kg three times daily (increase if necessary to 5microgram/kg/dose).
Weaning:
Clonidine can to stopped immediately if used for <2 weeks.
If used for >2 weeks reduce daily over 5 days (e.g. 5, 4, 3, 2, 1microgram/kg/dose 3 times a day) then stop.
IV Infusion, (PICU only),
Commence infusion at 1micrograms/kg/hour.
If required increase by 0.5microgram/kg/hour until adequate sedation is achieved. Max 2micrograms/kg/hour.
Weaning:
Clonidine can to stopped immediately if used for <2 weeks.
If used for >2 weeks reduce daily over 5 days.
- DIAGNOSIS OF GROWTH HORMONE DEFICIENCY**
This is an unlicensed indication.
Children over 3 years 0.15mg/m² (**SEE SEPARATE PROTOCOL**).
- Administration:** Clonidine may be diluted in sodium chloride 0.9% or glucose 5%.
Clonidine must not be bolused or double pumped.
- Notes:**
- Blood pressure and pulse must be monitored on initiating treatment and after each dosage increase. Patients on concomitant methylphenidate should have a base line and then three monthly ECGs.
 - The 100microgram tablets can be crushed and dispersed in water.

CLOPIDOGREL

Preparations: TABLETS 75mg. LIQUID 75mg in 5ml (**Manufactured Special**).

Dosage: **ANTIPLATELET (NOT FIRST LINE)**
0.2mg/kg once a day (max 1.5mg/kg up to 75mg).

Notes:

- a) Aspirin should be used first line.
- b) Clopidogrel does not inhibit the TxA₂ production but acts on inhibition of ADP (which induces platelet aggregation). Therefore in exceptional cases it has been used in combination with low dose aspirin (Seek expert advice).
- c) Crushed tablets do not dissolve well in water.

CO-AMOXICLAV

Preparations:

	Amoxicillin		Clavulanic acid
TABLETS	250mg	plus	125mg
	500mg	plus	125mg
LIQUIDS	125mg	plus	31mg
	250mg	plus	62mg
INJECTIONS	500mg	plus	100mg
	1g	plus	200mg

Dosage:

TREATMENT OF INFECTION

Orally,

under 1 year	0.25ml/kg (of 125/31 suspension)	3 times a day
1 - 6 years	5ml of 125/31 suspension	3 times a day
6 - 12 years	5ml of 250/62 suspension	3 times a day
Over 12 years	1 tablet (250/125)	3 times a day

In severe infections dosage may be doubled if suspension is prescribed. With tablets, increase to the 500mg/125mg tablet.

Slow IV injection,

Dosage is based on co-amoxiclav content:

Premature and neonates <7 days	30mg/kg every 12 hours
Neonates >7 days - 3 months,	30mg/kg every 8 hours
3 months - 12 years	30mg/kg 8 hourly increase to 6 hourly in severe infections
Over 12 years	1.2g 8 hourly, increase to 6 hourly in severe infections

PROPHYLAXIS

Give one third of the total daily treatment dose at night.

IN RENAL FAILURE

CrCl (ml/min/1.73m ²)	Dosage Interval (hours)
10-30	Orally: normal dose 12 hrly
	IV: normal dose initially, then half dose 12 hrly
<10	Orally: half-normal dose 12 hrly
	IV: normal dose initially, then half dose 24 hrly

Haemodialysis: Co-amoxiclav is cleared by dialysis therefore give as per creatinine clearance <10ml/minute/1.73m². May need to give an additional half dose during and after dialysis.

Peritoneal dialysis: Dose as for CrCl 10-30ml/minute/1.73m².

Administration:

Reconstitution (using the appropriate displacement values) so the resulting concentration is 60mg of co-amoxiclav in 1ml. Give as a slow IV injection over 3-4 minutes or as an IV infusion over 30 minutes, further diluted to 10mg in 1ml with sodium chloride 0.9%.

Notes:

- a) In confirmed penicillin allergy, cephalosporins may be an alternative treatment although approximately 10% of these patients will also be allergic to cephalosporins. Where severe allergy symptoms have occurred previously or the extent of the allergy is unknown an alternative antibiotic should be given.
- b) **CSM warning:** Cholestatic jaundice has been reported as an adverse reaction occurring either during or shortly after use of co-amoxiclav. Treatment should not exceed 14 days except on specialist advice.

CODEINE PHOSPHATE

Preparations: TABLETS 15mg and 30mg. INJECTION 60mg in 1ml (**CD**).
SUPPOSITORIES 5mg, 15mg and 30mg (**Specials Manufacturer**).
LIQUID 25mg in 5ml.

Dosage: **ANALGESIA FOR MILD TO MODERATE PAIN**
This indication is unlicensed for use in children under 1 year.
All ages, *orally, rectally, SC/IM injection*. See Pain management guidelines.
0.5-1mg/kg/dose repeated every 4-6 hours.

Notes:

- a) Codeine phosphate should be avoided in children with renal impairment and used with caution in patients with hepatic impairment.
- b) **Codeine phosphate injection must not be given by IV injection as it causes histamine release, resulting in reduced cardiac output.**
- c) Caution in neonates and infants as they show increased susceptibility to respiratory depression.
- d) Often causes constipation.
- e) It is rarely advantageous to use doses greater than 30mg.
- f) 30mg Codeine = 2.5mg morphine (very roughly).

COLECALCIFEROL (VITAMIN D3)

Preparations: LIQUID 3000 units in 1ml (**Specials Manufacturer**).
CAPSULES 20,000units (**Specials Manufacturer**).

Dosage: **PREVENTION OF RICKETS**
Orally,
Premature babies 400 units (0.13ml) once a day
All other ages 600 units (0.2ml) once a day

TREATMENT OF RICKETS

Orally,

0 - 6 months 3,000 units/day
6 months - 12 years 6,000 units/day
> 12 years 10,000 units/day

Reduce dose within a few weeks, as there is a significant risk of hypercalcaemia if treatment is continued long term. The resolution of induced hypercalcaemia may be delayed. Monitor serum calcium and phosphate levels.

VITAMIN D DEFICIENCY IN INTESTINAL MALABSORPTION OR CHRONIC LIVER DISEASE

Orally or IM,

1 - 12 years: 10,000 – 25,000units/day
> 12 years: 10,000 – 40,000units/day

TREATMENT OF VITAMIN D RESISTANT RICKETS OR HYPOPARATHYROIDISM

Doses of 20,000-100,000 units *orally*, per day may be required. Consider using **calcitriol** or **alfacalcidol** if treatment fails.

Notes:

- a) 300 units is equivalent to 7.5microgram of Vitamin D3.
- b) Abidec multivitamin drops and Ketovite liquid contain 400 units of ergocalciferol in 0.6ml and 5ml respectively.
- c) Alfacalcidol should not normally be used for the treatment of vitamin D deficiency.
- d) Liquid is sucrose free.
- e) 1 unit colecalciferol (Vitamin D3) = 1 unit ergocalciferol (Vitamin D2).
- f) Capsules contain soya and peanuts.

COLESTIPOL

Preparations: SACHETS 5g (**Purchased on request**).

Dosage: **FAMILIAL HYPERCHOLESTEROLAEMIA**
This indication is unlicensed for use in children.
Orally, mixed with water or other fluids, 5-10g daily divided between 1-2 doses. Start with half a sachet a day and slowly build up, increase by 5g/month (max 30g/day) titrated against cholesterol and LDL levels.

Notes:

- a) All other drugs should be administered at least 1 hour before or 6 hours after colestipol to reduce possible interference with absorption, especially digoxin and warfarin.
- b) Fat soluble vitamin malabsorption may occur.
- c) Use only in conjunction with an appropriate diet.
- d) Monitor cholesterol levels and clotting.

COLESTYRAMINE (CHOLESTYRAMINE)

Preparations: SACHETS containing 4g of colestyramine (Questran Light[®]).

Dosage: **PRURITUS ASSOCIATED WITH CHOLESTASIS AND DIARRHOEAL DISORDERS**

Indications are unlicensed for use in children under 6 years.

Orally, initially,

Under 1 year	1g (¼ sachet)/day (max 9g/daily in 2-4 doses)
1 - 6 years	2g (½ sachet)/day (max 18g/daily in 2-4 doses)
6 - 12 years	4g (1 sachet)/day (max 24g/daily in 2-4 doses)
12 - 18 years	4-8g (1-2 sachet)/day (max 36g/daily in 2-4 doses)

Notes:

- a) All other drugs should be administered at least 1 hour before or 6 hours after colestyramine to reduce possible interference with absorption, especially digoxin and warfarin.
- b) Fat soluble vitamin malabsorption may occur.
- c) Use only in conjunction with an appropriate diet.
- d) Each sachet of Questran Light[®] contains 30mg aspartame and is sugar free.
- e) The powder must be mixed with water, juices, skimmed milk or soup.

COLISTIN

Preparations: INJECTION 1 mega unit. NEBULISER SOLUTION 1 mega unit.

Dosage: **CYSTIC FIBROSIS (BY INHALATION/NEBULISATION)**
1 month - 2 years 0.5 - 1 million units TWICE daily
2 - 18 years 1 - 2 million units TWICE daily

Administration: **CYSTIC FIBROSIS (IV INFUSION)**
All ages – 15,000 – 25,000 units/kg three times daily
Nebulised: Reconstitute vial with 2-4ml of WFI or sodium chloride 0.9% and administer after physiotherapy and/or bronchodilators.
IV infusion: Reconstitute with 10ml water for injection or sodium chloride 0.9%. Further dilute with either glucose 5% or sodium chloride 0.9%. Administer over 30-60 minutes.

Notes:

- a) Colistin has excellent antipseudomonal activity and is probably the first line choice for nebulised use.
- b) Adverse affects are mainly limited to bronchoconstriction at time of delivery, cutaneous rashes and sore mouth due to candidiasis.

CO-TRIMOXAZOLE

Preparations:

Co-trimoxazole	Sulfamethoxazole	Trimethoprim
ADULT TABLETS 480mg	400mg	plus 80mg
FORTE TABLETS 960mg	800mg	plus 160mg
LIQUID 240mg in 5ml	200mg	plus 40mg
LIQUID 480mg in 5ml	400mg	plus 80mg
INJECTION 480mg in 5ml	400mg	plus 80mg

Dosage:

CSM Recommendation: Use should be limited to drug of choice for Pneumocystis pneumonia, toxoplasmosis and nocardiasis. Use for acute exacerbations of chronic bronchitis and UTIs where there is evidence of bacterial sensitivity and good reason to prefer to a single antibiotic. There must also be good reason to prefer it to a single antibiotic for use in acute otitis media.

ALL DOSES ARE EXPRESSED AS 'MG/KG' OF CO-TRIMOXAZOLE

SYSTEMIC INFECTION (NOT INCLUDING PNEUMOCYSTIS)

Orally,

18-24mg/kg twice a day **OR**

6 weeks - 6 months	120mg	twice a day
6 months - 6 years	240mg	twice a day
6 - 12 years	480mg	twice a day
> 12 years	960mg	twice a day

IV infusion, over 6 weeks, 18mg/kg twice a day.

In severe infection increase IV dose to 27mg/kg twice a day.

PROPHYLAXIS OF URINARY TRACT OR RESPIRATORY TRACT INFECTION

Orally, 12mg/kg, once a day, at night.

Impaired renal function: (<30ml/minute/1.73m²) 6mg/kg at night.

PNEUMOCYSTIS

Orally or IV injection, 60mg/kg twice a day for 10-14 days. The oral route is preferred unless nausea is severe.

PROPHYLAXIS OF PNEUMOCYSTIS INFECTIONS IN THE IMMUNOCOMPROMISED

Give oral systemic infection dose, i.e. 18-24mg/kg twice a day, on three days of the week.

OR

<0.25m ²	120mg	}
0.25m ² - 0.39m ²	240mg	}
0.4m ² - 0.49m ²	360mg	} Daily on 3 days
0.5 - 0.75m ²	480mg	} of the week
0.76 - 1m ²	720mg	}
>1m ²	960mg	}

PROPHYLAXIS OF PNEUMOCYSTIS INFECTIONS IN RENAL TRANSPLANT PATIENTS

Orally, 12mg/kg, up to 480mg, at night for 6 months.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dosage
15-30	Normal dose for 3 days then half the dose.
Less than 15	Avoid unless haemodialysis available, and then give half the normal dose.

Co-trimoxazole is **NOT** removed by peritoneal dialysis.

Administration:

IV injection: Wherever possible, give centrally. In severe fluid restriction this can be given undiluted via the central route. For peripheral injection, the manufacturers recommend a 25-fold

dilution, in glucose 5% or sodium chloride 0.9%. However in severe fluid restriction dilute 10-fold with glucose 5%. Dilution to less than 1 in 10 is not possible as the propylene glycol precipitates out. Infuse over 60-90 minutes.

Notes:

- a) Sulphonamides displace bilirubin from protein binding sites, and so, because of the risk of kernicterus, **co-trimoxazole is contraindicated in neonates and also the last month of pregnancy.**
- b) **CAUTION:** Treatment should be stopped if blood disorders or rashes develop. Counsel patient/parent to report all rashes, sore throats, fevers and other manifestations of agranulocytosis.
- c) Severe adverse reactions to co-trimoxazole, similar to Stevens-Johnson syndrome, may occur, particularly in HIV patients. Seek expert advice.
- d) Therapeutic drug monitoring:
Monitor blood levels of sulphamethoxazole when large doses of co-trimoxazole are given e.g. pneumocystis or if renal function is poor
Approx. time to steady state: 2-3 days.
Therapeutic level: 100-150mg/L.
If level is above 150mg/L stop treatment until level falls below 120mg/L than restart treatment at a lower dose.
Take a trough sample, immediately prior to next dose.
- e) Co-trimoxazole may raise plasma phenytoin levels and potentiate warfarin effect. Concomitant use with ciclosporin has shown increased risk of nephrotoxicity.
- f) Co-trimoxazole injection contains 45% w/v propylene glycol together with ethyl alcohol. It also contains sulphite which in susceptible patients can cause bronchospasm or anaphylaxis.

CYCLIZINE

Preparations: TABLETS 50mg. INJECTION 50mg in 1ml.
LIQUID 50mg in 5ml (**Extemporaneous**).

Dosage: **NAUSEA & VOMITING. SEE ANTIEMETIC GUIDELINES**
This indication is unlicensed in children under 6 years.

Orally/IV injection,

0.5 mg - 1mg/kg 3 times a day

OR

Orally,

Up to 1 year 1mg/kg 3 times a day

2 - 5 years 12.5mg 3 times a day

6 - 12 years 25mg 3 times a day

Over 12 years 50mg 3 times a day

Administration: IV injection, as a bolus over 3–5 minutes. Dilute if required with water for injection.

Notes:

- a) Tablets may be crushed and dispersed in water.
- b) There is no data on giving the injection orally (pH of injection = 3.3).

CYCLOPHOSPHAMIDE

Preparations: TABLETS 50mg. INJECTION (available from Oncology Aseptics).
LIQUID 50mg in 5ml (**Specials Manufacturer**).

Dosage: **NEPHROTIC SYNDROME**
This is an unlicensed indication.
Orally, 3mg/kg once a day for 8 weeks **OR** 2mg/kg once a day for 12 weeks (see note a).

SYSTEMIC LUPUS ERYTHEMATOSUS

REFER TO RENAL UNIT PROTOCOL OR SEEK EXPERT ADVICE

This is an unlicensed indication.

IV injection, (see notes below).

STANDARD DOSE

If GFR > 1/3 normal, initially, 750mg/m² once a month.

If GFR ≤ 1/3 normal, initially, 500mg/m² once a month.

For standard dosing; doses are given once a month for 6 months, then once every 3 months until patient is in remission for 1 year.

LOW DOSE

All renal functions, initially, 375mg/m² (max 500mg) every 2 weeks for 6 doses

Renal function and white blood cell count must be monitored before prescribing.

Administration: Cyclophosphamide is a cytotoxic drug therefore it must be reconstituted by the oncology pharmacy department.

Administer over 30 – 60 minutes.

Notes:

Premedication: Cold Cap should be in place 15-20 minutes before starting cyclophosphamide. Granisetron IV 40 micrograms/kg (upto a max 3mg) IV Hydration, 0.9% sodium chloride should be started at least 60 minutes before cyclophosphamide infusion and continuing good hydration for the next 24 hours. 125ml/m²/hour (3L/m²/day) is recommended. Part of hydration can be given orally if feasible. (Watch for fluid overload)

- a) Cyclophosphamide should preferably be administered in the morning.
- b) Maintain good urine output following administration. Mesna may be needed to prevent haemorrhagic cystitis (always use with IV). Co-trimoxazole should be prescribed for the duration of the course. If allergic to co-trimoxazole, then discuss with pharmacy.
- c) Check white blood cell count regularly.
- d) Cyclophosphamide may also cause nausea and vomiting (see Antiemetic guidelines), alopecia, amenorrhoea and azoospermia. A second dose of Granisetron 40 microgram/kg (upto a max of 3mg) can be given in a 24 hour period.
- e) Injection can be given orally – dilute well and may be mixed with fruit juice. Injection must be reconstituted in pharmacy first.
- f) Cyclophosphamide is cytotoxic, it must be disposed of in a cytotoxic waste container.

DALTEPARIN

Preparations: INJECTION 10,000units in 4ml ampoule, 10,000units in 1ml ampoule
 PREFILLED SYRINGES 2,500units in 0.2ml, 5,000units in 0.2ml and
 7,500units in 0.3ml 10,000units in 1ml.

Dosage: **TREATMENT OF THROMBOTIC EVENTS**
 These indications are unlicensed for use in children.
Subcutaneous injection,
 < 8 weeks and /or <5kg 150units/kg TWICE a day
 >8 weeks and >5Kg – 12 years 100 units/kg TWICE a day
 Over 12 years 200 units/kg ONCE a day
 Maintain peak (4 hours post dose) Anti-Xa levels of 0.5-1 unit/ml.

Monitoring and adjustment recommendations

Anti Xa level	Dose Change	Next anti Xa level
<0.35	Increase by 25%	24 hours
0.35 – 0.49	Increase by 10%	24 hours
0.50 – 1.0	-	Weekly
1.1 – 1.5	Decrease by 20%	24 hours
1.6 – 2.0	Decrease by 30%	24 hours
>2.0	Decrease by 40%, Redoes only when anti Xa <0.5	24 hours

PROPHYLAXIS OF THROMBOTIC EVENTS

Subcutaneous injection
 Neonates – 12 years 100 units/kg ONCE a day
 Child 12 – 18 years 2500-5000 units ONCE a day

Administration: If volume containing dose is too small, dilute with water for injection or sodium chloride 0.9%.

Notes:

- a) Ampoules are for single use only.
- b) Caution with use in renal impairment, seek specialist advice.
- c) Anti Xa samples need to be taken from fast flowing venous blood and packed in ice immediately. Send samples to haemostatis laboratory.
- d) For treatment doses, to ensure efficacy, it is recommended that anti Xa levels are checked within the first 24 hours
- e) Routine anti Xa levels are not required for patients on prophylaxis.
- f) CIVAS can prepare syringes for doses of 700 units or less for patients on NICU.

DANTROLENE

Preparations: CAPSULES 25mg. INJECTION 20mg.
LIQUID (**Extemporaneously Prepared**).

Dosage: **CHRONIC SEVERE SPASTICITY**
This indication is unlicensed for use in children.
Orally, 0.5mg/kg twice a day for 4 days increasing to 0.5mg/kg three times a day for 4 days then 0.5mg/kg four times a day.
If the desired response is still not achieved then increase dose by 0.5mg/kg every 4 days.
Max. dosage should not exceed 3mg/kg or 100mg 4 times a day.

MALIGNANT HYPERTHERMIA

IV injection, Initially 2-3mg/kg, followed by 1mg/kg doses repeated if necessary to maximum cumulative dose of 10mg/kg.

Administration: Dissolve contents of vial with 60ml of water for injection and give as a bolus injection. Reconstituted solution should be protected from light and used within 6 hours, do not refrigerate or freeze and do not store above 30°C.

Notes:

- a) Dantrolene has been associated with symptomatic hepatitis (fatal and non-fatal). Liver function tests should be performed before starting treatment and at regular intervals during treatment.
- b) Use with caution in patients with cardiac and pulmonary disorders.
- c) Therapeutic effect may take a few weeks to develop, however if effect is not seen within 4-6 weeks discontinue drug.
- d) Dantrolene 20mg injection contains 3g of mannitol and has a pH of 9.5 when reconstituted.

DAPSONE

Preparations: TABLETS 50mg and 100mg.

Dosage:

SEEK MICROBIOLOGY ADVICE BEFORE PRESCRIBING

TREATMENT OF PNEUMOCYSTIS PNEUMONIA (SECOND LINE)

Orally, over 1 month, 1-2mg/kg/day up to 200mg.

PROPHYLAXIS OF PNEUMOCYSTIS PNEUMONIA (SECOND LINE)

Orally, over 1 month, 1mg/kg/day up to 100mg.

Notes:

- a) Dapsone Syndrome may occur after 3 to 6 weeks therapy; symptoms include rash, fever and eosinophilia - discontinue therapy immediately.
- b) Caution with use in pulmonary or cardiac disease, severe glucose-6-phosphate-dehydrogenase deficiency or porphyria. Dapsone may cause haemolysis and rarely agranulocytosis. Monitor blood counts and counsel to report any sore throats, fever, mouth ulcers, bruising or rashes.
- c) Crush and dissolve/disperse tablets. Liquid is **not** available.

DEFERASIROX

- Preparations:** DISPERSIBLE TABLETS 125mg, 250mg and 500mg (Exjade®).
- Dosage:** **TREATMENT OF CHRONIC IRON OVERLOAD DUE TO FREQUENT BLOOD TRANSFUSIONS IN PATIENTS WITH BETA THALASSAEMIA AGED 2 YEARS AND OLDER**
Orally, recommended initial dose 20mg/kg/day.
Patients who receive < 7ml/kg/month of packed **red** blood cells may require 10mg/kg - Aim to maintain ferritin level.
Patients who receive > 14 ml/kg/month of packed red blood cells may require 30mg/kg - Aim to decrease ferritin level.
Maintenance dose
Adjust doses in steps of 5 to 10mg/kg every 3 – 6 months based on trends in serum ferritin levels. Maximum dose 30mg/kg/day.
- RENAL IMPAIRMENT**
GFR <90ml/min/1.73m² – reduce dose by 10mg/kg/day
GFR <60ml/min/1.73m² – stop treatment
- Administration:** Deferasirox must be taken once daily on an empty stomach at least 30 minutes before food, preferably at the same time each day. The tablets are dispersed by stirring in a glass of water or orange or apple juice (100 to 200 ml) until a fine suspension is obtained. After the suspension has been swallowed, any residue must be resuspended in a small volume of water or juice and swallowed. The tablets must not be chewed or swallowed whole.
- Notes:**
- Serum creatinine, and creatinine clearance should be assessed prior to initiation of treatment to establish a baseline level and then monthly thereafter. Patients who are at increased risk of complications, have pre-existing renal conditions, have co-morbid conditions, or are receiving medicinal products that depress renal function should be monitored weekly during the first month after initiation or modification of therapy.
 - Blood counts should be monitored regularly, and treatment interruption considered in patients who develop unexplained cytopenia.
 - Doses should be rounded to the nearest tablet size.
 - If ferritin is consistently less than 500 – suspend treatment.

DEFERRIOXAMINE MESYLATE

Preparations: INJECTION 500mg and 2g.

Dosage: **PATHOLOGICAL IRON OVERLOAD**
IV or SC infusion starting dose should not exceed 30mg/kg for established overload. The dose is usually between 20-50mg/kg/day. Dose can be increased to 180mg/kg/24 hours in severe iron overload.
IM injection initial dose 500mg-1g a day as 1-2 injections. Maintenance dose depends on iron excretion rate.

ACUTE IRON POISONING

For indications discuss with the medical toxicology unit.

In **confirmed** cases and where there is doubt about potential toxicity, *IV infusion* of 15mg/kg/hour initially. Reduce rate after a few hours to ensure maximum dose 80mg/kg in 24 hours is not exceeded.

In **serious** cases larger amounts have been used. Discuss with the medical toxicology unit. If oliguric or anuric consider peritoneal dialysis or haemodialysis to remove ferrioxamine.

IF IN ANY DOUBT CONTACT THE MEDICAL TOXICOLOGY UNIT

☎ 020 7188 0600 ☎

ALUMINIUM OVERLOAD IN DIALYSIS PATIENTS

Haemodialysis, haemofiltration 5mg/kg via fistula once a week over the last hour of dialysis for 3 months. Remeasure aluminium levels 4 and 8 weeks after completing course.

CAPD or CCPD 5mg/kg once a week prior to the last exchange of the day. Desferrioxamine is equally effective IV, IM, SC or intraperitoneally. Aluminium levels generally fall to acceptable levels within 12-18 months.

Administration: Dissolve contents of vial in 5ml water for injection to give 500mg in 5ml (10% solution). Only a clear solution should be used for parenteral administration. For IV infusion the 10% solution can then be further diluted with sodium chloride 0.9% or glucose 5%. Up to 2g of desferrioxamine per unit of blood may also be given at the time of blood transfusion, provided that the desferrioxamine is **NOT** added to the blood and **NOT** given through the same line as blood (but the two may be given through same cannula).

Notes:

- a) Theoretically 100mg of desferrioxamine binds 8.5mg of ferric iron or 4.1mg of aluminium.
- b) Patients should be monitored for acute side effects including allergic or anaphylactic reactions, hypotension, hypokalaemia and cardiac arrhythmias.
- c) Chronic usage may be associated with auditory and visual problems and acceleration of bone disease. Hearing and vision should be monitored regularly; effects can be reversed on cessation of therapy.
- d) Oral vitamin C 100mg (200mg in patients on high doses) may be given on treatment days to enhance urinary iron excretion.
- e) Heparin is incompatible with desferrioxamine mesylate solutions.

DESMOPRESSIN (ADH ANALOGUE)

Preparations: NASAL SPRAY 10microgram in each spray.
 INTRANASAL SOLUTION 100microgram in 1ml (Fridge).
 INJECTION 4microgram in 1ml (Fridge).
 TABLETS 100microgram (**Non-formulary**) and 200microgram.
 LYOPHILISATE TABLET (Desmomelt[®]) 120microgram and 240microgram.

Dosage: **TREATMENT OF ESTABLISHED DIABETES INSIPIDUS**

	Intranasal		Oral	
Birth - 2 yrs	1.25-5mcg	1-2	5-50mcg	2-3 times
2 - 12 yrs	5-10mcg	times	50-200mcg	daily
> 12 yrs	10-20mcg	daily	50-300mcg	

PRIMARY NOCTURNAL ENURESIS

Over 6 years of age (see note a).

Desmospray is no longer indicated for the treatment of PNE.

Orally, 200microgram at night. Increased to maximum of 400microgram. Taper off slowly.

Orally, Lyophilisate tablet: 120 microgram at night. Increasing if necessary to 240 micrograms at night.

Discontinue after 3 months for 1 week for reassessment.

WATER DEPRIVATION TEST – FOR SUSPECTED DIABETES INSIPIDUS

Under 5 years 2.5-5microgram (0.025-0.05ml) intranasally or 400nanogram (0.4microgram, 0.1ml) *IM*.

5 - 10 years 10microgram (0.1ml or 1 spray) intranasally or 1microgram (0.25ml) *IM*.

Over 10 years 20microgram (0.2ml or 2 sprays) intranasally or 2microgram (0.5ml) *IM*.

Stop test if body weight is reduced by 3%. Measure urine osmolality after 0 hours, 0.5 hours, 1 hour and 2 hours.

A dramatic increase in urine osmolality indicates sensitivity to vasopressin. In diabetes insipidus urine flow is reduced.

TO TREAT/PREVENT BLEEDING

This is unlicensed for the intranasal route.

IV infusion, 0.2-0.5microgram/kg diluted in 30ml of sodium chloride 0.9% and given over 20 minutes (see note c). Doses may be repeated 12 hourly until no longer required or bleeding stopped.

Intranasally, 4microgram/kg.

Notes:

- a) **CSM warning:** To minimise the risk of hyponatraemic convulsions patients with primary nocturnal enuresis should be advised to avoid excessive fluid intake (including during swimming) and to stop desmopressin treatment during episodes of vomiting or diarrhoea.
- b) Fluid intake should be restricted from 1 hour before to 8 hours after administration of desmopressin tablets.
- c) Desmopressin injection must **not** be diluted with doses of 4microgram or less, as there is a tendency for the peptide to adhere to surfaces when in diluted solutions. For treatment of uraemic bleeding the dose used is higher, and the adherence less critical, therefore dilution is possible.
- d) Desmopressin intranasal solution should be used for doses less than 10microgram as it employs a calibrated plastic catheter capable of measuring doses as low as 5microgram.

DEXAMETHASONE

Preparations: TABLETS 500microgram and 2mg.
 INJECTION 3.3mg in 1ml (Dexamethasone base) (see note e).
 LIQUID 2mg in 5ml.

Dosage:

DOSE IN TERMS OF DEXAMETHASONE BASE
--

ANTI-INFLAMMATORY

Adjust on the basis of individual response.

Orally, 10-100microgram/kg once a day.

IV, SC or IM injection, 200-400microgram/kg once a day.

CEREBRAL OEDEMA

High IV dose schedule:

	Children below 35kg	Children over 35kg
Initial dose	16.5mg (5ml)	20.8mg (6.25ml)
1st-3rd day	3.3mg (1ml) 3 hourly	3.3mg (1ml) 2 hourly
4th day	3.3mg (1ml) 6 hourly	3.3mg (1ml) 4 hourly
5th-8th day	1.65mg (0.5ml) 6 hourly	3.3mg (1ml) 6 hourly
Thereafter	decrease by daily reduction of 0.83mg (0.25ml)	decrease by daily reduction of 1.65mg (0.5ml)

SUSPECTED LARYNGEAL OEDEMA FOLLOWING TRAUMATIC INTUBATION OR INSTRUMENTATION OF THE AIRWAY OR SUSPECTED SUBGLOTTIC OEDEMA AFTER LONG TERM VENTILATION

IV injection, neonates, up to 1mg/kg/dose for up to 6 doses around extubation. Infants and children up to 0.5mg/kg/dose for up to 6 doses around extubation.

UPPER AIRWAY OBSTRUCTION

IV 0.15mg/kg three/four times daily.

CROUP

IV and orally: 0.15mg/kg. The dose may be repeated every 12 hours as required or 600mcg/kg single dose (maximum of 12mg).

WEANING OFF A VENTILATOR IN BRONCHOPULMONARY DYSPLASIA

IV injection, orally, (doses expressed as dexamethasone base).

1st-3rd day	0.1mg/kg three times a day
4th-6th day	0.1mg/kg twice a day
7th-9th day	0.1mg/kg once a day

Then stop or modify according to response.

Administration: *IV injection*, dilute if required with sodium chloride 0.9% or glucose 5%.

Notes:

- a) Budesonide, nebulised, is the preferred first line corticosteroid in the management of croup.
- b) Dexamethasone administration results in increased serum levels of phenytoin.
- c) For relative potencies see Hydrocortisone, (note b).
- d) Injection can be given orally.
- e) Dexamethasone 1mg ≡ dexamethasone phosphate 1.2mg ≡ dexamethasone sodium phosphate 1.3mg.

DEXAMFETAMINE SULPHATE - (CD)

Preparations: TABLETS 5mg.

Dosage: **ATTENTION DEFICIT HYPERACTIVITY DISORDER**
Orally, initially,
3 - 5 years 2.5mg once a day, increase by 2.5mg a day at weekly intervals, using twice daily dosing. Maximum 10mg twice daily.
6 years and over 5mg once to twice a day, increase by 5mg a day at weekly intervals, using twice daily dosing. Maximum 20mg twice daily.

Dose may need to be given in up to 3-4 divided doses.

Notes:

- a) Patients should be monitored at least weekly for side effects whilst dose is being established.
- b) Dexamfetamine sulphate can decrease appetite and lead to reversible growth retardation. Baseline assessment of weight and height should be performed and subsequently monitored 3 monthly.
- c) If anorexia is a problem, give dose after breakfast and lunch.
- d) A baseline blood pressure should be performed. Blood pressure should be monitored whilst dose being established and after any dosage increases.
- e) Doses may be given in 3-4 divided doses if rebound hyperactivity occurs in the latter part of the day but because dexamfetamine sulphate may cause insomnia, the last dose should not usually be given later than 4pm.
- f) Caution; use is not recommended in patients with a diagnosis or family history of tics or Tourette's syndrome. Use with caution in epilepsy.

DEXTROMETHORPHAN HYDROBROMIDE

Preparations: LIQUID (Delsym[®]) Long acting polystyrene equivalent to 30mg of hydrobromide in 5ml. (**Import**).

Dosage: **NON KETOTIC HYPERGLYCAEMIA**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

This is an unlicensed indication

Orally, initially, 2.5mg/kg twice a day, increasing to 10mg/kg/day. Doses as high as 35mg/kg/day have been used.

If using the hydrobromide salt administer total daily dose in 3 divided doses. See note c).

Notes:

- a) Caution, may cause respiratory depression.
- b) Delsym[®] is relatively alcohol free (0.26%) but does contain 1.7g of sugar in 5ml and sodium 5mg/5ml.
- c) Dextromethorphan hydrobromide 7.5mg in 5ml liquid (Robitussin[®]) is available; however it is on the government "black list". This product is not a long acting formulation and contains alcohol.

DIAMORPHINE - (CD)

Preparations: INJECTION 5mg.

Dosage: **SEVERE (PROCEDURAL) PAIN: INTRANASAL**
This indication is unlicensed for use in children.
Intranasally, over 1 year, 0.1mg/kg single dose. Measure pain score and reassess at 15 minutes

Administration: Intranasal: Dilute 5mg of diamorphine powder with the specified volume of water for injection (see table). Tilt the head back to about 45 degrees and instil 0.2ml of the solution into ONE nostril using a 1ml syringe. Use a mucosal atomisation device (MAD), if available. This gives a dose of 0.1mg/kg in 0.2ml. Use immediately after preparation.

Child's Weight (kg)	Volume of water (mls)
8	1.25
9	1.1
10	1
11	0.9
12	0.8
13	0.75
14	0.7
15	0.65
20	0.5
25	0.4
30	0.35
35	0.3
40	0.25
50	0.2
60	0.15

Notes:

Measure baseline pain score and reassess at 15 minutes.

DIAZEPAM

Preparations: TABLETS 2mg, 5mg and 10mg.
LIQUID 2mg in 5ml and 5mg in 5ml.
RECTAL TUBES 2.5mg in 1.25ml, 5mg in 2.5ml and 10mg in 2.5ml.
INJECTION 10mg in 2ml, for IM use.
EMULSION 10mg in 2ml, for IV use.

Dosage:

ANXIOLYTIC

This indication is unlicensed for use in children.

Orally, initially,

4 weeks - 1 year	50microgram/kg	twice a day
1 - 4 years	500microgram	twice a day
5 - 12 years	1-1.5mg	twice a day
Over 13 years	2mg	twice a day

PREMEDICATION AND SPASMOLYTIC DOSE

Orally, 200-300microgram/kg/dose,

OR

4 weeks - 1 year	250microgram/kg	twice a day
1 - 4 years	2.5mg	twice a day
5 - 12 years	5mg	twice a day
Over 13 years	10mg	twice a day

IV injection: 100-200microgram/kg to a maximum total daily dose of 10-20mg.

The above doses are used on an as required basis in post-operative skeletal muscle spasm.

The above doses may initially be used for the control of tension and irritability of cerebral spasticity, however larger doses may be required.

SEVERE STATUS DYSTONICUS

>1month IV 100-300microgram/kg repeated every 1-4 hours (max 400microgram/kg).

STATUS EPILEPTICUS – SEE STATUS EPILEPTICUS GUIDELINES

Slow IV injection,

300-400microgram/kg, repeated after 10 minutes if necessary.

OR

Rectally, (see note d).

Under 1 year 2.5mg via rectal tube

1 - 3 years 5mg via rectal tube

Over 3 years 10mg via rectal tube

If necessary this dose may be repeated after 5 minutes. Best expressed dose is 0.5mg/kg and thus always review dose against weight as well as age.

Notes:

- For slow IV injection Diazemuls® should be used. Other brands of diazepam injection should not be given by the IV route because they are more irritant.
- Beware of respiratory depression during acute use.
- Paradoxical reactions (restlessness, agitation) are more likely in children.
- Injection can be given orally and rectally.

DIAZOXIDE

Preparations: LIQUID 250mg in 5ml (**Import**).

Dosage: **REFRACTORY HYPOGLYCAEMIA/HYPERINSULINISM IN INFANCY**
Orally, initially, 1.7mg/kg three times a day up to **15mg/kg/day** according to response. Doses up to **20mg/kg/day** have been used in Leucine-sensitive hypoglycaemia.

SEVERE HYPERTENSION

Rapid IV injection **5mg/kg/dose**. Repeat after 1 hour if necessary. Max. 4 doses 24 hourly. Monitor blood glucose for hyperglycaemia.

Administration: Rapid IV injection over 30 seconds or less. Do not dilute.

Notes:

- a) Never give by IM or SC injection as it is very irritant, pH 11-12.
- b) In hypertensive encephalopathy a rapid reduction in blood pressure to normotensive levels can result in water shed cerebral infarction, blindness or death. Diazoxide is **NOT** the first line drug in this condition.
- c) Diazoxide and chlorothiazide are recommended for initial treatment and should always be given together as both activate K⁺ channels by different mechanism as well as chlorothiazide counteracts fluid retention.
- d) During prolonged therapy children should be monitored for leucopenia and thrombocytopenia and have regular assessments of growth and bone.

DICLOFENAC SODIUM

- Preparations:* TABLETS 25mg and 50mg. DISPERSIBLE TABLETS 50mg.
LIQUID 50mg in 5ml (**Manufactured Special**).
MODIFIED RELEASE TABLETS 75mg and 100mg.
SUPPOSITORIES 12.5mg, 25mg, 50mg and 100mg.
INJECTION 75MG IN 3ML
- Dosage:* **NON-STEROIDAL ANTI-INFLAMMATORY ANALGESIC**
All ages > 6 months
Orally or rectally, 0.5-1mg/kg two or three times a day. Maximum
of **3mg/kg/day (max 150mg/day)**.
IM (Gluteal muscle) or Intravenous infusion 0.3-1mg/kg twice daily.
Max. total daily dose for all formulations is 150mg daily.
- Administration* IV infusion: Dilute with 100-500ml of either sodium chloride solution
(0.9%) or glucose solution (5%). Both solutions should be buffered
with sodium bicarbonate solution (0.5ml 8.4% or 1ml 4.2%). Only
clear solutions should be used. Give over 30-120 minutes.
- Notes:*
- Diclofenac is contraindicated in patients with a history of hypersensitivity (including asthma, angioedema, urticaria or rhinitis) to aspirin or any other non-steroidal anti-inflammatory drug or with a coagulation defect.
 - Caution, use in renal, cardiac or hepatic failure may cause a deterioration in renal function (monitor); the dose should be kept as low as possible.
 - Increased risk of convulsions with concomitant quinolones. Increased risk of nephrotoxicity with concomitant ciclosporin.
 - The dispersible tablets should be dissolved in water in order to administer full 50mg doses only.
 - Additional IV diclofenac contraindications includes use of anticoagulant (including LMWH) and operations with high risk of haemorrhage.
 - Max duration of treatment with IV Diclofenac: 2 days.

DIGOXIN

Preparations: TABLETS 62.5microgram, 125microgram and 250microgram.
 PAEDIATRIC LIQUID 50microgram in 1ml.
 INJECTION 500micrograms in 2ml.
 PAEDIATRIC INJECTION 100microgram in 1ml (**GSTT Special**)
 (Fridge).

Dosage: **DIGITALISATION**
 Only necessary in urgent situations
 See note a)

Age	Total loading dose (microgram/kg/24hours)	
	<i>Orally</i>	<i>IV</i> (Only if oral not possible)
Premature neonate (<1.5kg)	25	20
Premature neonate (1.5-2.5kg)	30	30
Neonate - 2 years	45	35
2 - 5 years	35	35
5 - 10 years	25	25

Over 10 years, 750micrograms to 1.5mg.
 Give 50% of loading dose immediately, then 25% at 6 hours and 12 hours assessing clinical response before giving dose.
 Start maintenance 12 hours after end of full loading dose.

Maintenance

Orally, IV injection:

Premature neonates 2-3micrograms/kg twice a day

Neonates - 5 years 5micrograms/kg twice a day

5 - 10 years 3micrograms/kg twice a day

Total daily dose may be given once a day. Monitor levels.

Over 10 years, 125microgram to 750microgram once a day determined by clinical response and monitoring of levels.

IN RENAL FAILURE

Monitor levels carefully.

Creatinine clearance (ml/minute/1.73m ²)	Dosage
10-50	50% of dose
<10	25% of dose

FETAL ARRHYTHMIAS

Maternally administered drugs	Orally, 250 micrograms three times a day
Maternal levels: 0.8 - 2microgram/L.	

Digoxin is not significantly cleared by dialysis. Give 25% of maintenance dose after haemodialysis or automated peritoneal dialysis session. Monitor levels.

Administration: Give IV injection diluted with sodium chloride 0.9%, glucose 5% or glucose/saline over 10-20 minutes for maintenance doses.
 Loading doses should be administered over 30-60 minutes.

Notes:

- a) Reduced loading dose required if cardiac glycosides have been administered in the preceding two weeks.
- b) IV route should only be used for life threatening arrhythmias or where oral route is impossible. The IM route should **never** be used.
- c) Therapeutic drug monitoring:

Approx. time to steady state: 5-10 days.

Therapeutic range: 0.8-2.2microgram/L.

Take sample at least 6 hours after oral or IV dose.

- d) The oral bioavailability of the liquid (80%) and tablets (70%) differs. Although this may not be clinically significant, blood levels should be checked if preparation is changed. When changing from the IV to the oral preparation dose may be increased by 20% (liquid) or 30% (tablets) to maintain the same blood levels.
- e) The clinical effect of digoxin is potentiated by amiodarone, diltiazem, flecainide, quinidine, quinine and verapamil and the maintenance dose should be halved if any of these drugs are introduced.
- f) Erythromycin, omeprazole and tetracycline may also cause blood levels of digoxin to double in approximately 10% of patients and this effect may last for several months after discontinuation of the aforementioned drugs.
- g) Digoxin toxicity may occur if child has hypokalaemia.
- h) Injection can be given orally, however bioavailability is unpredictable.

DINOPROSTONE (PROSTAGLANDIN E2)

Preparations: INJECTION 0.75mg in 0.75ml ampoule (Fridge).
LIQUID (**Extemporaneously Prepared**).

Dosage: **TO MAINTAIN PATENCY OF THE DUCTUS ARTERIOSUS**
This is an unlicensed indication.
IV infusion, initially 5nanogram/kg/minute. This may then be increased to 10-20nanogram/kg/minute in 5nanogram increments until effective unless side effects occur. Doses up to 100nanograms/kg/min have been used but they are associated with an increased number of S/E – rarely recommended.
Orally, initially 20-40microgram/kg hourly. Reduce the frequency of the dose to 4 hourly over several days after one week.

Administration: IV infusion, dilute in sodium chloride 0.9% or glucose 5%, glucose 10%.

Notes:

- a) IV dinoprostone can cause respiratory depression, apnoea, pyrexia and jitteriness. May be associated with NEC. Facilities for intubation and ventilation must be available and should be considered for babies being transferred with a prostaglandin infusion. Monitor heart rate, respiratory rate, temperature and blood pressure (arm and leg).
- b) Injection can be given orally. Dilute first with water.

DIPYRIDAMOLE

Preparations: TABLETS 25mg and 100mg. INJECTION 10mg in 2ml.
LIQUID 50mg in 5ml.

Dosage: **MODIFICATION OF PLATELET FUNCTION**
Orally, all ages, 2.5mg/kg twice a day.
> 12 years 100-200mg three times a day.

PULMONARY HYPERTENSION

This is an unlicensed indication.

Orally, all ages, 1mg/kg 2-3 times a day.

IV injection, all ages, 0.6mg/kg (give over 10 minutes) up to three times daily according to response.

IV infusion, all ages, 1-20micrograms/kg/minute.

Administration: Dilute dose with same volume of 5% glucose.

Notes:

- a) The effects of aspirin and dipyridamole on platelet behaviour may be synergistic.
- b) Injection can be given orally.
- c) Give before meals, avoid use with antacids.

DOBUTAMINE

Preparations: INJECTION 250mg in 20ml.

Dosage: **INOTROPIC SUPPORT**

This indication is unlicensed for use in children.

IV infusion, 2-20microgram/kg/minute (start at 5-10microgram/kg/minute). Maximum dose 40mcg/kg/min (neonates 20mcg/kg/min)

Administration: Dilute further with sodium chloride 0.9% or glucose 5%. Concentrations as high as 5mg in 1ml have been used in fluid restricted patients although these concentrations must be infused via a central line.

Notes:

- a) Dobutamine may cause vasodilation and reduce blood pressure.
- b) Dobutamine and dopamine can be mixed together in glucose 5% or sodium chloride 0.9%.
- c) Solutions of dobutamine may turn pink due to a slight oxidation of the drug. Such solutions are safe to use and there is no significant loss of potency.
- d) Dobutamine can **NOT** be mixed with sodium bicarbonate or other strongly alkaline solutions.
- e) If extravasation occurs refer to extravasation guidelines.

DOCUSATE SODIUM

Preparations: LIQUIDS Paediatric 12.5mg in 5ml and Adult 50mg in 5ml.
CAPSULES 100mg.
MICRO-ENEMA 120mg in 10g (approximately 8ml).

Dosage: **CONSTIPATION**
Only the 12.5mg in 5ml elixir is licensed for use in children, over 6 months of age. The micro-enemas are unlicensed for children under 3 years.

Orally,

All ages	2.5mg/kg	2-3 times a day
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OR

> 1 month	12.5mg	2-3 times a day
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1 - 4 years	12.5-25mg	2-3 times a day
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5 - 12 years	25-50mg	2-3 times a day
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Initial doses should be large and then reduced as condition improves.

Rectally,

(See notes below).

Under 3 years: Approx. half an enema as necessary.

Over 3 years: One enema as necessary.

Notes:

- a) Regular oral treatment for 1-3 days is required before stools soften.
- b) Many small children who experience pain or fear during defecation find rectally administered treatment very distressing and alternatives should be considered.
- c) Response from rectal administration usually occurs within 20 minutes.
- d) The enema is not recommended for use in children under 3 years as a smaller volume cannot be measured accurately, and dehydration may occur.
- e) Liquid may be diluted with milk or squash.
- f) The Paediatric liquid is sucrose and colourant free.

DOMPERIDONE

Preparations: TABLETS 10mg. SUPPOSITORIES 30mg. LIQUID 1mg in 1ml.

Dosage: **CYTOTOXIC AND RADIOTHERAPY INDUCED NAUSEA AND VOMITING**

Orally, 2 - 12 years, 200-400microgram/kg every 4-8 hours.

Rectally, 2 - 12 years,

10-15kg 15mg 2 times a day

16-25kg 30mg 2 times a day

26-35kg 30mg 3 times a day

36-45kg 30mg 4 times a day

GASTRO-OESOPHAGEAL REFLUX, GASTRIC STASIS

This indication is unlicensed for use in children.

Orally, all ages, 200-400microgram/kg 3-4 times a day.

Notes:

- a) Domperidone liquid is often used in children less than 1 month, however extrapyramidal side effects may occur in these young children.
- b) Domperidone liquid (Motilium[®]) is sugar free and contains sorbitol.
- c) MHRA warning: Avoid co-administration with erythromycin as risk of QT prolongation increased.

DOPAMINE

Preparations: INJECTION 200mg in 5ml.

Dosage: **LOW DOSE FOR RENAL EFFECT**
IV infusion, 1-5microgram/kg/minute.

INOTROPIC SUPPORT

This indication is unlicensed for use in children.

IV infusion, 2-20microgram/kg/minute (start at 5microgram/kg/minute and titrate upwards).

Administration: It is preferable to dilute dopamine with sodium chloride 0.9% or glucose 5% for accuracy, although, if fluid is restricted, it can be administered undiluted via a syringe pump. Infuse via a central line. Low doses may be infused peripherally if no other choice, however, use a dilute solution, not more than 3.2mg/ml via a large peripheral vein. Monitor for signs of peripheral ischaemia.

Notes:

- a) Dopamine and dobutamine can be mixed together in glucose 5% or sodium chloride 0.9%.
- b) Dopamine can **NOT** be mixed with sodium bicarbonate and other strongly alkaline solutions.
- c) Peripheral infusions of inotropic doses should be used with caution as vasoconstriction and gangrene of the fingers or toes may occur.

DORNASE ALFA

- Preparations:** NEBULISER SOLUTION: 2,500 units (2.5mg) in 2.5ml (Fridge).
- Dosage:** **MUCOLYTIC USED IN MANAGEMENT OF CYSTIC FIBROSIS PATIENTS**
> 5 years *nebulise* 2,500 units (2.5mg) once a day
SUSPECTED AIRWAY MUCUS PLUGS (see note a) – PICU only
Unlicensed indication
All ages, endotracheally 1ml/kg (up to a maximum of 20ml) of the reconstituted solution.
- Administration:** **Nebulised:** Do not mix with other drugs or solutions in the nebuliser. Compressor with an output of 6-6.5L should be used. Wait for at least 1 hour after a dose is given before physiotherapy to see most benefit.
Endotracheally: Dissolve 2.5mg vial with 10ml sodium chloride 0.9% (0.25mg/ml). Draw up the required dose (in volume). Ensure patient is muscle relaxed, sedated and adequately oxygenated. Directly instill the DNase solution via ETT. Procedure can be repeated after 6-8 hours if needed. Immediately perform physiotherapy to treat affected lobe(s).
- Notes:**
- a) Suspected airways plugs (either segmented or widespread) resulting in high ventilatory requirements and hypoventilation despite high ventilatory pressures (PAP > 28cm/H₂O). Dornase should only be used after conventional attempts to clear the mucus plugs have failed.
 - b) Avoid atracurium as it can produce bronchospasm.
 - c) Dornase alfa has no dispersion co-efficient therefore unlike surfactant it will not spread to the lungs but it relies on aggressive physiotherapy to ensure maximal dislodging of mucus plugs.
 - d) Adverse reactions attributed to Dornase alfa are rare (< 1/1000).

DOXAZOSIN

Preparations: TABLETS 1mg, 2mg and 4mg. LIQUID (**Extemporaneously Prepared**).

Dosage: **HYPERTENSION**
This indication is unlicensed for use in children.
Orally, initially,
6 - 12 years 0.5mg once a day
Over 12 years 1mg once a day
Increase dose according to response at weekly intervals. Usual daily dose between 2-4mg. Maximum dose 16mg/day.

IN RENAL FAILURE

No dosage reduction is required in renal failure. Doxazosin is not dialysable.

Notes:

- a) Blood pressure should be monitored closely after the first dose as doxazosin may cause postural hypotension.
- b) Administer with caution to patients with impaired liver function.
- c) Daily dose of Prazosin (adults) = Daily dose of Doxazosin (adults).

DROPERIDOL

Preparations: INJECTION 2.5mg/ml.

Dosage: **PREVENTION AND TREATMENT OF POST-OPERATIVE NAUSEA AND VOMITING. SEE ANTIEMETIC GUIDELINES**

Intravenous injection,

Children over 2 years: 20 to 50 micrograms/kg (max 1.25mg)

Administration is recommended 30 minutes before the anticipated end of surgery. Repeat doses may be given every 6 hours as required.

IN RENAL FAILURE

Patients with renal impairment are more susceptible to the side effects of droperidol, start with 50% of dose (max 0.625mg) and titrate if necessary.

Administration: IV injection, as a bolus over 3-5 minutes. Dilute if required with sodium chloride 0.9%.

Notes:

- a) **Caution:** In patients with known or suspected prolonged QT interval. Including patients on medications that prolong QT interval.
- b) Droperidol may potentiate respiratory depression caused by opioids.
- c) Caution in hypokalaemia, hypomagnesaemia and bradycardia.
- d) The dosage should be adapted to each individual case. Factors to consider include age, body weight, use of other medicinal products, type of anaesthesia and surgical procedure.

EDROPHONIUM

Preparations: INJECTION 10mg in 1ml. (Import only)

Dosage:

SEEK EXPERT ADVICE BEFORE PRESCRIBING

DIAGNOSTIC TEST FOR MYASTHENIA GRAVIS

IV injection, 100microgram/kg. Initially give one fifth of the dose (i.e. 20microgram/kg) followed after 30 seconds (if no reaction has occurred) by the remainder of the dose (i.e. 80microgram/kg).

TEST TO DIFFERENTIATE BETWEEN MYASTHENIC OR CHOLINERGIC CRISIS

This indication is unlicensed for use in children.

IV injection, 20microgram/kg. Test should be performed just before next dose of anticholinesterase and only in conjunction with someone skilled in intubation.

If anticholinesterase treatment is excessive, edrophonium will either have no effect or symptoms will intensify. A transient improvement is seen if anticholinesterase treatment is inadequate.

ANTAGONIST TO NON-DEPOLARISING NEUROMUSCULAR BLOCKADE

Slow IV injection, (over several minutes), 500-700microgram/kg of edrophonium with 7microgram/kg of atropine.

Administration: IV injection, can be diluted, immediately before use, with water for injection.

Notes:

- a) Have atropine sulphate drawn up in a syringe before test, as edrophonium may cause profound bradycardia.
- b) Use with extreme caution in patients with asthma.

ENALAPRIL MALEATE

Preparations: TABLETS 2.5mg, 5mg and 10mg.

Dosage: **HYPERTENSION, CONGESTIVE CARDIAC FAILURE, PROTEINURIA**
This indication is unlicensed for use in children.
Orally, initially, 0.1mg/kg/day, adjusting according to response to a maximum of 1mg/kg/day (max 40mg daily). Dose is usually given once a day although twice a day doses have been used.

KEEP THE DOSE AS LOW AS POSSIBLE IN RENAL FAILURE AND IF A DIURETIC IS INDICATED, USE A LOOP RATHER THAN A THIAZIDE.

Notes:

- a) Enalapril should be avoided whenever possible in neonates, particularly pre-term neonates due to the risk of renal failure and hypotension.
- b) ACE inhibitors reduce glomerular filtration rate leading to severe and progressive renal failure in patients with severe bilateral renal artery stenosis (or severe stenosis in a single kidney).
- c) 1mg enalapril may substitute for 7.5mg of captopril (total daily dose).
- d) Hyperkalaemia may occur particularly in renal failure, and with other potassium retaining drugs (e.g. spironolactone).
- e) Severe hypotension may occur particularly following the first dose. Patient should be observed every 15 minutes for the first hour.
- f) Concomitant diuretic dosages may need to be reduced or not administered concurrently to avoid severe hypotension.
- g) Tablets may be crushed and dispersed in water prior to administration.

ENOXIMONE

Preparations: INJECTION 100mg in 20ml.

Dosage:

CONGESTIVE CARDIAC FAILURE

This indication is unlicensed for use in children.

IV Injection, all ages, loading dose of 0.5mg/kg, followed by 5-20microgram/kg/minute, according to response. Dose should not normally exceed 24mg/kg/**24 hours**.

Orally, all ages, 1mg/kg 3 times a day.

IN RENAL FAILURE

Dose should be reduced when creatinine clearance falls below 20ml/minute/1.73m².

Administration:

Immediately before use, dilute with an equal volume of water for injection or sodium chloride 0.9%. Do **NOT** dilute further or use glucose solutions - this may result in precipitation of enoximone. Administer via a dedicated IV line (see note f).

Notes:

- a) Do **NOT** mix enoximone injection with dopamine, dobutamine or adrenaline due to pH incompatibility.
- b) Hyperosmolality and lactic acidosis may occur with large doses of enoximone infusion as injection contains 43.4% w/v of propylene glycol.
- c) Injection can be given orally, however the solution has a very alkaline pH and should therefore be mixed with milk feeds. Once an ampoule is open, draw up the next three doses required in syringes and these may be kept at room temperature for up to 24 hours.
- d) Half life may increase in severe liver impairment causing accumulation.
- e) When changing IV to oral stop IV infusion and after 4 hours administer first oral dose.
- f) Occasionally enoximone has produced "furring of the lines". In practice a dedicated line is recommended for its administration.
- g) Plastic apparatus should be used, crystal formation if glass is used.

EPHEDRINE

Preparations: TABLETS 15mg and 30mg. NOSE DROPS 0.5%.
NOSE DROPS 0.25% (**Extemporaneously prepared**)

Dosage: **NASAL CONGESTION**
Neonates not recommended.
1 - 3 months: if sodium chloride nose drops are ineffective, ephedrine 0.25% nose drops (extemporaneously prepared) can be used (see note b and c). Place 1-2 drops into each nostril when required, 15 minutes before feeds. Maximum 7 days treatment.
Over 3 months: 1-2 drops of 0.5% into each nostril when required, 15 minutes before feeds if appropriate. Maximum 7 days treatment.

BLADDER NECK WEAKNESS OR CONGENITAL MYASTHENIA GRAVIS

This is an unlicensed indication.

Orally, 800microgram/kg 3 times a day. Maximum dose is 30mg 3 times a day.

OR

1 - 5 years 15mg three times a day

Over 6 years 15-30mg three times a day

Notes:

- a) Avoid excessive use of nose drops as tolerance develops with rebound congestion on stopping therapy.
- b) Use nose drops with caution in infants under 3 months (no good evidence of value and irritation may narrow nasal passages) - see sodium chloride nose drops.
- c) Ephedrine 0.5% nose drops can be diluted with sodium chloride 0.9% to produce 0.25% nose drops (7 day expiry).
- d) Ephedrine's effect on sleep pattern may vary from child to child. It may act as a stimulant in some and disturb sleep patterns. In others it may act as a sedative.

ERYTHROPOETIN

Preparations: EPOETIN BETA PREFILLED SYRINGE (NeoRecormon®) 500 and 2,000units.
EPOETIN ZETA PREFILLED SYRINGE (Retacrit®) 4000, 6,000 and 10,000units.
EPOETIN ZETA PREFILLED SYRINGE (Retacrit®) 3000, 5000 8000 and 20,000units (**ordered on request**).
DARBEPOETIN ALFA PREFILLED SYRINGE (Aranesp®) 10, 20, 30, 40, 50, 60, 80, 100, 130, 150micrograms.
DARBEPOETIN ALFA SURECLICK (Aranesp®) 20, 40, 50, 60, 80, 100, 130, 150micrograms (**ordered on request**).

Dosage: **TREATMENT OF RENAL ANAEMIA IN HAEMODIALYSIS PATIENTS**
Epoetin Zeta, *IV injection* over 1–5 minutes, initially 50units/kg three times a week, adjusted according to response in steps of 25units/kg three times a week, at intervals of at least four weeks.

Maintenance dose:

< 10kg	75-100units/kg three times a week
10 - 30kg	60-150units/kg three times a week
> 30kg	30-100units/kg three times a week

TREATMENT OF RENAL ANAEMIA IN PERITONEAL DIALYSIS AND PRE-DIALYSIS PATIENTS (LONGER ACTING DARBEPOETIN ALFA)

Long acting Darbepoetin Alfa is used in these patients with the exception of some smaller children (usually <20kg), because dose sizes may not be suitable - use Epoetin Beta prefilled syringes in children who weigh <20 kg (see below).

Patients on dialysis:

Darbepoetin Alfa, *SC or IV injection*: initially 450nanograms/kg once a week, adjusted according to response by approx 25%, at intervals of at least 4 weeks.

Maintenance dose: can be given once a week, or every two weeks, by *SC or IV injection*.

Patients not on dialysis:

Darbepoetin Alfa: initially 450nanograms/kg once a week by *SC or IV injection*, or 750nanograms/kg by *SC injection* once every two weeks, adjusted according to response by approximately 25%, at intervals of at least 4 weeks.

Maintenance dose: can be given by *SC or IV injection* once a week, or by *SC injection* every two weeks, or by *SC injection* once a month.

TREATMENT OF RENAL ANAEMIA IN PERITONEAL DIALYSIS AND PRE-DIALYSIS PATIENTS (SHORTER ACTING EPOETIN BETA)

Epoetin Beta is reserved for patients for whom the long acting Darbepoetin Alfa is not suitable (usually < 20kg).

Epoetin Beta, *SC injection*: initially 50-100units/kg three times a week until target haemoglobin reached, then adjust until maintenance dose achieved.

Epoetin Beta, *IV injection*: initially 100-150units/kg three times a week until target haemoglobin reached, then adjust until maintenance dose achieved.

For both routes the maximum total weekly dose is 720units/kg.

ANAEMIA OF PREMATURITY

Epoetin Beta, *SC injection*, 200units/kg on alternate days, or 250 units/kg three times a week.

Administration: Epoetin Beta, *SC injection*: reconstitute or dilute to obtain a final concentration not exceeding 2000units in 1ml with water for injection.

Epoetin Beta, *IV injection*: reconstitute or dilute to obtain a final concentration not exceeding 1000units in 1ml with water for injection; inject over 2 minutes.

Notes:

- a) Target haemoglobin is between 9-11g/100ml. Aim to increase haemoglobin at a rate not exceeding 2g/100ml/month.
- b) Deficiencies of folic acid, cobalamin (vitamin B₁₂) and iron, and aluminium toxicity may reduce the effectiveness of epoetin.
- c) The clinical efficacy of epoetin alpha, beta and zeta is similar, they can be used interchangeably.
- d) Hypertension, haemodialysis access thrombosis and convulsions are reported as side effects of epoetin.
- e) A rough conversion from Epoetin Beta to Darbepoetin Alfa.
$$\frac{\text{Weekly dose of Epoetin Beta(units)}}{240} \times 2 = \text{Fortnightly dose of Darbepoetin (micrograms)}$$
- f) Darbepoetin Alfa SureClick is a pre-filled disposable injection device - it can be ordered on request from pharmacy.

EPOPROSTENOL (PROSTACYCLIN)

Preparations: INJECTION 500microgram.

Dosage: **PULMONARY HYPERTENSION, PLATELET AGGREGATION INHIBITOR, DIGITAL ISCHAEMIA**

These are unlicensed indications.

IV infusion, 2nanogram/kg/minute, increasing to 40nanogram/kg/minute if necessary. Doses of up to 120nanogram/kg/minute have occasionally been necessary.

Administration: Reconstitute each vial with 10ml of the glycine buffer. Return the resulting epoprostenol solution into the residue of the 50ml vial of glycine buffer, and mix well to give a solution of **10microgram in 1ml**. This solution should then be filtered using the 0.2micron filter provided. The 10microgram in 1ml solution can be further diluted with sodium chloride 0.9%. Do not dilute below 1.7microgram in 1ml. (In general 10ml of the epoprostenol 10microgram in 1ml solution is added to 40ml of sodium chloride 0.9% to give 2 microgram in 1ml). The 10microgram in 1ml solution can be infused neat via central line. The manufacturers recommend changing the infusion every 12 hours due to instability, however in practice the loss in potency following 12 hours is not clinically significant as the dose is titrated to the response. Infusions can be used for **up to 24 hours**.

Notes:

- a) 5nanogram equals 0.005microgram.
- b) As epoprostenol is very unstable, **only** the glycine buffer, which has a very alkaline pH is suitable for reconstitution and sodium chloride 0.9% must be used for further dilution.
- c) Vasodilation can produce flushing, headache and profound hypotension during infusion.
- d) Platelet aggregation inhibition can result in unwanted bleeding therefore anticoagulant monitoring is required especially if concomitant heparin is infused.

ERYTHROMYCIN

Preparations: TABLETS Erythromycin 250mg and 500mg.
LIQUIDS Erythromycin ethylsuccinate 125mg in 5ml and 250mg in 5ml.
INJECTION Erythromycin lactobionate 1g.

Dosage: **TREATMENT OF INFECTION**
All ages,
Orally or IV injection, 12.5mg/kg 4 times a day
OR
Orally
Up to 2 years 62.5-125mg 4 times a day
2 - 8 years 125-250mg 4 times a day
Over 8 years 250-500mg 4 times a day
Doses can be doubled in severe infection. Maximum dose 1g 4 times a day.
Total oral daily dose may be given in 2 divided doses, although gastrointestinal side effects may occur.

GASTRIC STASIS

This is an unlicensed indication.

Orally or IV injection, all ages, 3mg/kg 4 times a day.

Administration: Reconstitute each 1g vial with 20ml water for injection to give 1g in 20ml (i.e. 50mg in 1ml). Dilute to 5mg in 1ml with sodium chloride 0.9% (**do not use glucose 5%**) and give slowly over 20-60 minutes to avoid thrombophlebitis (see note c).
Give centrally if possible and convert to oral as soon as clinically possible. CENTRALLY concentrations up to 10mg/ml have been used. Administer over 1 hour.

Notes:

- a) Use with caution in impaired liver function and **severe** renal failure.
- b) Erythromycin inhibits the hepatic metabolism of carbamazepine and theophylline, therefore blood levels should be monitored. Warfarin, digoxin, midazolam, and ciclosporin may also be potentiated.
- c) If for clinical reasons sodium chloride 0.9% is not suitable **neutralised** glucose 5% can be used as a diluent. This is prepared by adding 5ml of 8.4% sodium bicarbonate injection to 1L of glucose 5%.
- d) MHRA warning: Avoid co-administration with erythromycin as risk of QT prolongation increased.

ESMOLOL

Preparations: INJECTION 100mg in 10ml and 2.5g in 10ml.

Dosage: **ANTIARRHYTHMIC**
This indication is unlicensed for use in children.

SEEK EXPERT ADVICE BEFORE PRESCRIBING

IV injection, loading dose of 500microgram/kg over 1 minute then maintenance *infusion* of 50microgram/kg/minute. Reduce rate to 25microgram/kg/minute if heart rate or blood pressure is low. If inadequate response after 5 minute intervals, repeat loading dose and increase maintenance infusion by 50microgram/kg/minute increments. Doses above 200microgram/kg/minute have not been shown to have a significantly increased benefit. (Doses above 300microgram/kg/minute not recommended).

After adequate control achieved initiate oral therapy with digoxin or alternative, see tachycardia guidelines. Decrease infusion rate by 50% one hour after first oral dose and stop infusion one hour after second oral dose, as long as patient is stable.

Administration: Dilute to 10mg in 1ml or less with sodium chloride 0.9% or glucose 5% and administer via a large vein. In fluid restricted patients dilute to 20mg in 1ml and administer via a central line. Esmolol causes venous irritation, avoid extravasation. No need to double pump.

Notes:

- a) Esmolol is very short acting (half life is approximately 9 minutes) and is only indicated for short term treatment.
- b) Esmolol blood levels may be increased by warfarin and morphine - whilst esmolol may increase digoxin levels by 10-20% and prolong neuromuscular blockade duration.
- c) Esmolol is chemically stable up to concentrations of 60mg/ml in sodium chloride 0.9%, however, due to possible irritation on extravasation maximum concentration recommended is 20mg/ml.
- d) Esmolol concentrated solution 2.5g in 10ml contains propylene glycol.

ETHAMBUTOL

Preparations: TABLETS 100mg and 400mg.
LIQUID 500mg in 5ml (**Extemporaneously Prepared**).

Dosage: **TUBERCULOSIS THERAPY**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Treatment: *Orally*, all ages, 15mg/kg once a day. Give for the first 2 months of treatment only. Only include if there is a high risk of resistant infection.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dosage
10-20	50% of normal dose
<10	25% of normal dose

CAPD and HD dose as in GFR<10ml/min. CAV/VVUD Dose as in GFR 10-20ml/min.

Maintain levels between 2-5mg/L.

Notes:

- a) Ethambutol may cause visual impairment due to optic neuritis and routine ophthalmological examinations should be carried out, particularly in young children, every 6 months. The condition is difficult to diagnose in children under 6 years of age and is more likely to occur in renal failure.
- b) Ethambutol may be omitted in previously untreated patients who are HIV negative, on negative risk assessment and not a contact of a suspected drug resistant case.

ETHINYLOESTRADIOL

Preparations: TABLETS 10microgram

Dosage: **INDUCTION OF PUBERTAL MATURATION IN FEMALES**
This indication is unlicensed for use in children.
Orally, initially 2 microgram daily, increasing every six months to 5 micrograms, then to 10 micrograms, then to 20micrograms daily.

Notes: After 12 to 18 months of treatment give progestogen for 7 days of each 28 day cycle.

ETHOSUXIMIDE

Preparations: CAPSULES 250mg. LIQUID 250mg in 5ml.

Dosage: **EPILEPSY**
Initially, *orally*,
5mg/kg twice a day increased gradually by 5mg/kg increments
as necessary, to a maximum of 20mg/kg twice a day.
OR
Over 6 years 250mg twice a day
Increase dose by 125-250mg a day at 4 to 7 day intervals (max.
1g twice a day).

Notes:

- a) A full blood count is recommended before and 4-6 weeks after starting treatment. Counsel patients or their carers to report any fever, sore throat, mouth ulcers, bruising or any other symptoms of blood disorders.
- b) Blood levels of ethosuximide may be reduced by carbamazepine, phenytoin, phenobarbitone or primidone and increased by isoniazid and sodium valproate.
- b) Ethosuximide may increase blood levels of phenytoin.
- d) Use with caution in renal and hepatic impairment.
- e) The liquid (Zarontin[®]) is raspberry flavoured and contains 3g of sucrose in 5ml and is alcohol free.

ETHYL CHLORIDE

- Preparations:* Fast-acting vapo-coolant TOPICAL SPRAY
- Dosage:* **TRANSIENT ANALGESIA TO RELIEVE THE PAIN ASSOCIATED WITH NEEDLE PROCEDURES**
Topical Spray
Children over 5 years: Spray continuously until a thin snow film appears on the skin
- Administration:* Hold the aerosol 8" away from the skin when spraying and perform the procedure within 45 seconds of application.
- Notes:*
- a) **Do not** spray for more than 10 seconds or repeat application on the same skin area.
 - b) **Do not** use on wounds, broken skin, eczema or other skin disorders.
 - c) **Do not** use on mucous membranes or spray near the eyes or face.
 - d) Clean skin before spraying.

ETILEFRINE

Preparations: TABLETS 25mg (**Import**).
ORAL SOLUTION 7.5mg in 1ml (**Import**).

Dosage: **PRIAPISM IN SICKLE CELL PATIENTS**
Etilefrine is not licensed in children and adolescents
Orally,

Oral solution

< 2 years: 1mg - 2.5mg 3 times a day

2 - 6 years: 2.5mg - 5mg 3 times a day

> 6 years: 5mg - 10mg 3 times a day

Tablets

All ages: 0.25mg/kg 2-3 times a day

Doses up to 50mg daily have been used in patients > 6 years

Notes:

- a) Etilefrine can be used as prophylactic treatment for recurrent priapism in sickle cell disease and can be used to relieve acute obstruction.
- b) Etilefrine should be used with caution in patients with diabetes mellitus, hypercalcaemia, hypokalaemia, severe impairment of renal function and cor pulmonale.
- c) Etilefrine may induce palpitations, restlessness, sleeplessness, diaphoresis, dizziness and gastrointestinal symptoms. Symptoms of angina, tachycardia, ventricular arrhythmias and hypertensive episodes associated with headaches and tremor may occur.
- d) 1ml of etilefrine oral solution 7.5mg in 1ml contains 30% alcohol.
- e) Etilefrine should be taken with a small amount of liquid before a meal.
- f) Etilefrine should not be taken late in the afternoon or in the evening as its stimulating effect may cause difficulties with sleeping.
- g) Etilefrine tablets and oral solution are gluten and lactose-free.

ETOMIDATE

Preparations: INJECTION 20mg in 10ml.

Dosage: **INDUCTION OF ANAESTHESIA**
>2 years, *Slow IV injection*, 0.3mg/kg
Do not exceed a total dose of 60mg (3 ampoules)

Administration: May be diluted with sodium chloride 0.9% or dextrose 5%.
Incompatible with Hartmann's solution.

Notes:

- a) In patients with liver cirrhosis, or those who have already received neuroleptic, opiate or sedative agents, the dose should be reduced.
- b) Convulsions may occur in unpremedicated patients.
- c) Etomidate should not be administered to patients with evidence or suggestion of reduced adrenal cortical function.
- d) Injection contains propylene glycol.

FENTANYL - (CD)

Preparations: INJECTION 50microgram in 1ml (2ml, 10ml).

Dosage: **OPIATE ANALGESIA/RESPIRATORY DEPRESSANT FOR CHILDREN WITH ASSISTED VENTILATION**

IV injection, 1-5microgram/kg with supplemental doses of 1-3 microgram/kg as necessary.

IV infusion, initially 1-3microgram/kg/hr although may require 4-8microgram/kg/hr.

OPIATE ANALGESIA FOR CHILDREN WITH SPONTANEOUS RESPIRATION

IV injection, 1-3microgram/kg with supplemental doses of 1microgram/kg as necessary.

NEONATAL INTUBATION

IV, 5mcg/kg (together with Atropine and suxamethonium).

Administration: Dilute if required with glucose 5% or sodium chloride 0.9%.

Notes:

- a) Short acting but potentially cumulative. Dependency may also be seen sooner than with a longer acting opiate.
- b) In intensive care it is an alternative opiate when a patient has an unstable cardiovascular system.
- c) Use with caution in infants under 1 year, because of their increased susceptibility to respiratory depression.
- d) Risk of rigid chest syndrome in neonates if given without muscle relaxants.
- e) To avoid excessive dosage in obese children, doses may need to be calculated using ideal body weight.

FLECAINIDE ACETATE

Preparations: TABLETS 100mg. INJECTION 150mg in 15ml.
LIQUID 25mg in 5ml (**Specials Manufacturer**).

Dosage: **SUPRAVENTRICULAR, RE-ENTRY & VENTRICULAR TACHYCARDIA**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

These indications are unlicensed for use in children.

IV injection, 2mg/kg/dose. Continue if required by *IV infusion*, 1.5mg/kg/hour for the first hour and then 100-250microgram/kg/hour subsequently. Infusion should be stopped when arrhythmia is controlled.

The IV route should only be used with ECG monitoring and facilities must be available for cardiopulmonary resuscitation.

Orally, initially, 2mg/kg 2-3 times a day (max 8mg/kg/day or 300mg daily). Adjust dose according to levels.

ANTENATAL ARRHYTHMIAS

100mg three times a day to the mother.

IN RENAL FAILURE

Reduce dose by 50% if creatinine clearance is less than 35ml/minute/1.73m² and monitor plasma levels.

Administration: IV injection over at least 10-30 minutes. Dilute if required with glucose 5% **not** sodium chloride 0.9%.

Notes:

- a) Flecainide has a negative inotropic effect and can itself precipitate serious arrhythmias.
- b) Do not use in patients with severe liver failure unless benefits clearly outweigh risks. In this case reduce dose.
- c) Phenytoin, phenobarbitone and carbamazepine may reduce blood levels. Flecainide may increase blood levels of digoxin
- d) Flecainide dose should be reduced by 50% with concomitant amiodarone.
- e) Blood levels:
Steady state: 2 days. Therapeutic range: 200-800microgram/L.
Take trough sample after 2-4 days.
- f) Do **NOT** store liquid in a **fridge** as precipitation occurs. The liquid has a local anaesthetic effect and should be given at least 30 minutes before or after food.

FLUCLOXACILLIN

Preparations: CAPSULES 250mg and 500mg.
LIQUIDS 125mg in 5ml and 250mg in 5ml.
INJECTION 250mg and 500mg.

Dosage: **TREATMENT OF INFECTION**

Orally,

Neonates,	as for IV dosing	
1 month - 2 year	62.5mg -125mg	4 times a day
2 - 10 years	125mg – 250mg	4 times a day
Over 10 years	250mg -500mg	4 times a day

IV or IM injection,

Neonates	< 7 days	25-50mg/kg twice a day
Neonates	7-21 days	25-50mg/kg 3 times a day
Neonates	> 21 days	25-50mg/kg 4 times a day
All children > 1 month		12.5-25mg/kg 4 times a day

In severe infection the above doses can be doubled.

Maximum dose is 2g 4 times daily.

IN RENAL FAILURE

If creatinine clearance is less than 10ml/minute/1.73m², increase the dosage interval to every 8 hours. Flucloxacillin is not significantly dialysed.

Administration: IM injection, reconstitute (using appropriate displacement value) with water for injection to give 250mg in 1.5ml and to give 500mg in 2ml.

IV injection, dilute reconstituted dose to 5-10ml with water for injection, sodium chloride 0.9% or glucose 5% and give over 3-5 minutes.

Notes:

- a) In confirmed penicillin allergy, cephalosporins may be an alternative treatment although approximately 10% of these patients will also be allergic to cephalosporins. Where severe allergy symptoms have occurred previously or the extent of the allergy is unknown an alternative antibiotic should be given. Contact the microbiology department for further information.
- b) **CSM warning:** Cholestatic jaundice may occur up to several weeks after treatment stopped. Risk is increased with prolonged courses.
- c) Flucloxacillin liquid is not very palatable.

FLUCONAZOLE

Preparations: CAPSULES 50mg, 200mg. INJECTION 2mg in 1ml, (25ml and 100ml). LIQUIDS 50mg in 5ml and 200mg in 5ml.

Dosage: **MUCOSAL CANDIDIASIS**
Orally, IV infusion, 7 – 14 days for oropharyngeal candidiasis.
14-30 days in other mucosal infections
Loading dose with 3-6mg/kg then:

Neonates	<2 weeks	3mg/kg every 72 hours
Neonates	2 - 4 weeks	3mg/kg/every 48 hours
1 month - 12 years		3mg/kg once a day
12 - 18 years		50mg daily

SYSTEMIC CANDIDIASIS, CRYPTOCOCCAL MENINGITIS

Orally, IV infusion,

Neonates	<2 weeks	6-12mg/kg every 72 hours
Neonates	2 - 4 weeks	6-12mg/kg/every 48 hours
Children	>4 weeks	6-12mg/kg once a day (maximum dose 800mg)

PROPHYLAXIS WHILST NEUTROPENIC

Orally, IV infusion,

Neonates	<2 weeks	3-12mg/kg every 72 hours
Neonates	2 - 4 weeks	3-12mg/kg/every 48 hours
Children	>4 weeks	3-12mg/kg once a day (maximum dose 400mg)

PRETERM PROPHYLAXIS (<26 weeks gestation or <800g) - from birth

3mg/kg IV	72 hourly for 2 weeks, then
	48 hourly for 2 weeks, then
	24 hourly for 2 weeks unless ETT & all invasive lines removed before that.

IN RENAL FAILURE

Children with impaired renal function should receive the normal dose on days 1 and then dose adjusted as per table.

Creatinine clearance (ml/min/1.73m ²)	Dosage interval (hours)
>50	100% of normal daily dose
<50	50% of normal daily dose
Haemodialysis	100% of normal daily dose after each dialysis.

In intermittent peritoneal dialysis, give normal dose on day 1 and then give half the normal dose once a day after dialysis.

Administration: Infuse undiluted over 10-20 minutes.

Notes:

- a) Susceptibility to QT prolongation – consider ECG in at risk children (e.g. cardiac cases). Avoid concomitant administration with other drugs that increase QT intervals.
- b) Fluconazole may potentiate the effects of warfarin and also increase blood levels of phenytoin, theophylline, ciclosporin, tacrolimus and zidovudine.
- c) Fluconazole liquid contains 2.8g of sucrose in 5ml.

FLUCYTOSINE

Preparations: INJECTION 2.5g in 250ml.

Dosage: **SEVERE FUNGAL INFECTIONS**

This indication is unlicensed for use in neonates.

IV injection,

neonates	50mg/kg	2 times a day
1 month – 18 years	50mg/kg	4 times a day (note a)

IN RENAL FAILURE

Creatinine clearance (ml/min/1.73m ²)	Dosage interval (hours)
20-40	12
10-20	24
Less than 10	Initial dose of 50mg/kg then according to blood concentration (maximum 80mg/L).

Flucytosine is cleared by haemodialysis.

Administration: Infuse over 20-40 minutes using a giving set incorporating a 15 micron filter. Dilute further if required with sodium chloride 0.9% or glucose 5%.

Notes:

- a) If organism known to be very sensitive to flucytosine dose can be reduced to 25-35 mg/kg to decrease risk of side effects.
- b) **Caution:** monitor blood count and liver function during treatment.
- c) Blood levels:
 - Approx. time to steady state: 1 day.
 - Therapeutic range: 25-50mg/L. Do not exceed 80mg/L.
 - Take trough sample, 2-3 times per week.
 - Send sample to department of microbiology.
- d) Resistance may develop rapidly, so flucytosine should not be used alone for fungal or yeast infections other than localised candidiasis (e.g. urinary tract or peritoneal infection). Amphotericin acts synergistically with flucytosine.
- e) Flucytosine (Ancotil[®]) infusion contains 34.5mmol of sodium in 250ml.

FLUDROCORTISONE

Preparations: TABLETS 100microgram. LIQUID (**Extemporaneously Prepared**).

Dosage: **ADRENOCORTICAL INSUFFICIENCY**
Orally, adjust according to response.
All ages, initially 100micrograms once daily (usual range 50-300microgram daily).

Notes:

- a) Fludrocortisone is a potent mineralocorticoid, dose and electrolytes should be monitored to avoid hypertension, fluid overload and electrolyte disturbances.
- b) Tablets may be dispersed in water.

FLUMAZENIL

Preparations: INJECTION 500microgram in 5ml.

Dosage: **REVERSAL OF BENZODIAZEPINE-INDUCED SEDATION**
This indication is unlicensed for use in children.
IV injection, 10microgram/kg repeat at 1 minute intervals to a maximum of 40microgram/kg(2mg). If necessary this may be followed by an infusion of 2-10microgram/kg/hour.

Administration: IV infusion, dilute with sodium chloride 0.9% or glucose 5%.

Notes:

- a) The half-life of flumazenil is very short (50-60 minutes) and is shorter than midazolam or diazepam therefore an infusion may be necessary if drowsiness returns after single doses.
- b) As flumazenil is metabolised in the liver, careful titration of the dose is necessary in hepatic failure.
- c) Flumazenil is not recommended in epileptics who have received prolonged benzodiazepine therapy as it may induce a withdrawal syndrome.
- d) Flumazenil is expensive and is **NOT** indicated for routine reversal of benzodiazepine pre-medications.
- e) Although flumazenil may antagonise the obvious effects of sedation, higher cognitive functions may still be impaired.

FLUNARIZINE

Preparations: TABLETS 10mg (**Import**).

Dosage: **ALTERNATING HEMIPLEGIA OF CHILDHOOD**
Orally, All ages 5-20mg daily.

Administration: Tablets can be crushed and dissolved in water.

Notes: Flunarizine is best administered at night due to sedative effects but can be administered twice a day if tolerated.

FLUOXETINE

Preparations: CAPSULES 20mg. LIQUID 20mg in 5ml.

Dosage:

SEEK EXPERT ADVICE BEFORE PRESCRIBING

OBSESSIVE COMPULSIVE DISORDER

This indication is unlicensed for use in children.

Orally, initially, 0.5mg/kg once a day. Increase dose according to response. Maximum 60mg/day.

OR

initially,

6 - 8 year

10mg once a day

8 years and over

20mg once a day

DEPRESSION

This indication is licensed for use in children over 8 years (see note d).

>6 years, initially 10mg once daily, gradually increase dose over 3 weeks to 20mg once daily.

Notes:

- a) Patients should be monitored weekly for side effects whilst dose is being established.
- b) Use with caution in epilepsy, seizure threshold may be lowered. Fluoxetine may increase carbamazepine and phenytoin levels.
- c) Fluoxetine has a long duration of action and this should be taken into account when adjusting dosage. It may take up to 5 weeks to clear after discontinuing.
- d) Moderate to severe major depressive episode, if depression is unresponsive to psychological therapy after 4-6 sessions. Antidepressant medication should be offered to a child or young person with moderate to severe depression only in combination with a concurrent psychological therapy.

FLUTICASONE

Preparations: INHALER 25microgram per metered inhalation, 50microgram per metered inhalation, 125microgram per metered inhalation*, 250microgram per metered inhalation*.
ACCUHALER 50micrograms per blister, 100 micrograms per blister, 250micrograms per blister*.
NASAL SPRAY 50micrograms per spray.
NASAL DROPS 400micrograms per unit dose*.
* Not licensed for use in children.

Dosage:

ASTHMA THERAPY

ON CONSULTANT ADVICE ONLY

This indication is unlicensed for use in children under 4 years.

Inhaled, doses (see note a).

Under 1 year	25-50microgram	twice a day
1 - 4 years	50-100microgram	twice a day
4 - 12 years	50-250microgram	twice a day
Over 12 years	250-500microgram	twice a day

ALLERGIC RHINITIS (TREATMENT AND PROPHYLAXIS)

Intranasal, spray

4 - 11 years	50micrograms per nostril	daily
> 12 years	100 micrograms per nostril	daily

Increase to maximum of twice daily.

Intranasal, drops

All ages	≤200micrograms per nostril	twice a day
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(about 6 drops)

Notes:

- Many children's asthma will be well controlled using the 50 to 100mcg once daily regime.
- A Volumatic[®] spacer can be used with fluticasone inhalers.
- Rinse mouth and wash face (if using mask) after use.
- See also guidelines on management of chronic asthma.
- Dose for nasal drops is dependent on patient age and symptoms.

FOLIC ACID

Preparations: TABLETS 5mg. LIQUID 2.5mg in 5ml.

Dosage: **FOLIC ACID SUPPLEMENTATION, PROPHYLAXIS IN DIALYSIS**
Orally,
Premature neonates 50microgram once a day
Start at two weeks of age and full enteral feeding – continue until term corrected age.
Infants and children 250microgram/kg once a day
OR,
4 weeks - 12 months 250microgram/kg once a day
1 - 4 years 2.5mg once a day
5 - 12 years 5mg once a day
Over 12 years 5-10mg once a day

IN JUVENILE IDIOPATHIC ARTHRITIS TO LIMIT METHOTREXATE ASSOCIATED S/E

1mg once daily

OR

5mg weekly

TO TREAT MEGALOBLASTIC ANAEMIA

Orally,

Up to 1 year 500microgram/kg once a day } for up to
Over 1 year 5mg once a day } 4 months

Doses up to 15mg may be necessary in malabsorption states.

MAINTENANCE THERAPY

The above treatment doses - at daily to weekly intervals.

Notes:

- a) Folic acid is well absorbed orally even in malabsorptive states, therefore parenteral therapy is only necessary when the oral route cannot be used.
- b) Before treating megaloblastic anaemia with folic acid, vitamin B12 deficiency must be excluded, as neuropathy may be precipitated.
- c) Folic acid liquid (Lexpec[®]) is sugar free.

FORMOTEROL FUMARATE (EFORMOTEROL)

Preparations: TURBOHALER 6microgram per metered inhalation and 12microgram per metered inhalation.

Dosage: **ASTHMA THERAPY**

ON CONSULTANT ADVICE ONLY

This indication is unlicensed for use in children under 6 years.
Inhaled, over 6 years, 6 - 12 microgram once or twice a day.
Increase dose according to response.
Maximum 24microgram twice daily in severe obstruction.

Notes:

- a) **Note:** Formoterol is not for immediate relief of acute attacks and existing corticosteroid therapy should not be withdrawn or reduced.
- b) Turbohalers are breath activated and are effective at low inspiratory flow rates i.e. 30L/minute.
- c) If a metered dose inhaler device is required, prescribe salmeterol.
- d) See chronic asthma management guidelines

FUROSEMIDE (FRUSEMIDE)

Preparations: TABLETS 20mg, 40mg and 500mg. LIQUID 50mg in 5ml.
INJECTION 20mg in 2ml, 50mg in 5ml and 250mg in 25ml.

Dosage: **DIURESIS**
Orally,
Neonates - 12 years 0.5mg-2mg/kg (2-3 times a day).
(Preterm babies once daily).
(Maximum single dose 6mg/kg)
Cardiac patients may require the above dose 3 to 4 times a day.
Maximum dose is **12mg/kg/day**.
IM injection, (all ages) 1-2mg/kg/dose.
IV injection, (all ages) 0.5-1mg/kg/dose, every 6 to 12 hours.
May increase to 5mg/kg/dose in resistant cases.
IV infusion, 0.1-2mg/kg/hour.

Administration: Give IV injection at a rate of 0.1 mg/kg/min (maximum 4mg/min).
Can be given by continuous infusion in sodium chloride 0.9%
(do not use glucose 5% - see note d). IV infusions do not need
to be protected from light.

Notes:

- a) Nephrocalcinosis has been reported in preterm neonates.
- b) A marked fall in blood pressure may occur if an ACE-inhibitor is added to treatment with furosemide.
- c) Do **not** mix furosemide injection with dopamine or dobutamine.
- d) If for clinical reasons sodium chloride 0.9% is not suitable neutralised glucose 5% can be used as a diluent. This is prepared by adding 5ml of 8.4% sodium bicarbonate injection to 1L of glucose 5%.
- e) Injection can be given orally.
- f) Frusemide liquid (Frusol[®]) contains 10% v/v alcohol and is sugar free.
- g) Monitor potassium levels. Oral furosemide is usually given in combination with a potassium sparing diuretic.
- h) Transient and permanent ototoxicity has been associated with administration rates > 0.5mg/kg/min (4mg/min)

GABAPENTIN

Preparations: CAPSULES 100mg, 300mg and 400mg.
LIQUID 250mg in 5ml (**Manufactured Special**).

Dosage: **EPILEPSY**
This indication is unlicensed for use in children under 6 years.
Orally, initially, (see note a),

Day 1	10mg/kg (maximum 300mg)	once a day
Day 2	10mg/kg (maximum 300mg)	twice a day
Day 3	10mg/kg (maximum 300mg)	three times a day (recommended maintenance dose)

Doses of up to a maximum **90mg/kg/day** or 3.6g/day in adults have been used. Maximum time between maintenance doses should not exceed 12 hours.

NEUROPATHIC PAIN

Day 1	5mg/kg (maximum 300mg)	once daily
Day 2	5mg/kg	twice a day
Day 3	5mg/kg	three times a day

May increase to 10mg/kg for a minimum of 6 weeks for a range of 2-6 months. Maximum adult dose 3.6g/day.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Maintenance dose	Interval
30-60	8mg/kg	twice a day
15-30	8mg/kg	once a day
<15	8mg/kg	alternate days

Haemodialysis: 8-12mg/kg loading dose then 6-8mg/kg after each 4 hour dialysis period.

Notes:

- a) Although the manufacturer's recommend daily increments in initial adult doses, some children may not tolerate such rapid increases and up to weekly increases may be more appropriate.
- b) Avoid concomitant administration with antacids as they reduce the absorption of gabapentin.
- c) Gabapentin is bitter; however capsules may be opened and mixed with a strong tasting liquid i.e. blackcurrant, immediately before administration. An aliquot may be given for doses less than the capsule strength.
- d) Solutions of gabapentin have very poor absorption if used rectally.

GANCICLOVIR

Preparations: INJECTION 500mg. INFUSION 200mg in 100ml (**GSTT Special**) (Fridge).

Dosage: **LIFE OR SIGHT THREATENING CMV INFECTION IN IMMUNOCOMPROMISED PATIENTS**

Treatment.

IV injection, 5mg/kg every 12 hours for 14-21days.

Maintenance for patients at risk of relapse.

IV injection, 6mg/kg/day given for 5 days of each week

OR 5mg/kg/day for 7 days per week.

CONGENITAL CMV

IV injection, 6mg/kg every 12 hours for 6 weeks.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dose reduction (mg/kg)	Dosing Interval (hours)
>80	normal dose	Normal 12 hourly
50-80	50% normal dose	Normal 12 hourly
10-50	25-50% normal dose	24 hourly
<10 and peritoneal and haemodialysis	25% normal dose	24 hourly

Ganciclovir is removed by haemodialysis therefore doses should be given following dialysis.

Clearance of ganciclovir during peritoneal dialysis is unknown therefore dose as for creatinine clearance less than 10ml/minute/1.73m² ensuring dose is given after dialysis session.

Administration: Reconstitution by the pharmacy manufacturing department is advised. Reconstitute (see note d) each vial with 10ml of water for injection to produce a 50mg in 1ml solution and dilute to at least 10mg in 1ml with sodium chloride 0.9% or glucose 5%. Infuse over 1 hour via a large vein.

Notes:

- a) Neutropenia occurs in 40% of patients. If neutrophil count is less than 500 cells/mm³ discuss with Virology. Thrombocytopenia occurs in 20% of patients.
- b) The risk of neutropenia is greatly increased with concomitant administration of zidovudine and the two are not normally given together especially during initial ganciclovir therapy. White blood cell counts should be taken every 2 days for the first 2 weeks.
- c) Toxicity is additive if flucytosine, amphotericin or co-trimoxazole are administered concomitantly.
- d) When reconstituting the vial the use of polythene gloves and safety glasses is recommended as the resulting solution is very irritant (pH11) and ganciclovir is a potential carcinogen. If solution comes in contact with skin or mucosa, wash immediately with soap and water.
- e) Ganciclovir can cause aspermatogenesis, mutagenicity, teratogenicity and carcinogenicity and should be considered as a potential carcinogen and teratogen.
- f) Valganciclovir is the oral pro-drug of ganciclovir.
- g) Sodium content is 2mmol per 500mg vial.

GAVISCON

Preparations: INFANT SACHETS, TABLETS. [PEPTAC® is the equivalent LIQUID].

Dosage: **GASTRIC REFLUX, DYSPEPSIA**

Orally,

Sachets - Prescribe in terms of “dose” units.

(See note a).

① Premature neonates on very small volumes of feeds.

Use with caution in premature babies – observe fluid balance.

Dissolve 1 dose (half a dual sachet) in 5mls of sterile water and administer as follows:

Breastfed babies: Prepare as above and administer after feeds.

Bottle fed babies: Prepare as above and use the table below to calculate the amount to be added to a feed:

Volume of milk (ml)	Gaviscon solution to be added (ml)
100	5.0
90	4.5
80	4.0
70	3.5
60	3.0
50	2.5
40	2.0
30	1.5
20	1.0
10	0.5

Having added the gaviscon to the feed, any unused milk must be stored in the refrigerator and must be used within 12 hours.

In the home, reconstituted gaviscon must be used immediately and not stored.

② Full term neonates and infants under 4.5kg, one dose (half a dual sachet) mixed with each feed.

③ Infants over 4.5kg and young children, two doses (one dual sachet) mixed with each feed **or** half a glass of water, after each meal.

Liquid and tablets

1-12 years, 1 tablet or 5-10ml after meals and at bedtime.

Administration: Bottle fed infants ②/③ – one dose should be added to not less than 115ml of feed/water.

Breast fed infants ②/③ – Add 5ml of boiled, cooled water to the powder, mix to a smooth paste and add another 10ml of water.

Notes:

- a) One dose is equal to half a dual sachet.
- b) Each sachet contains 0.92mmol of sodium, 225mg of sodium alginate, 87.5mg of magnesium alginate, 112.5mg of aluminium hydroxide with colloidal silica and mannitol.
- c) Each tablet contains 2mmol of sodium, 500mg alginic acid, 100mg of aluminium hydroxide, 25mg of magnesium trisilicate and 170mg of sodium bicarbonate.
- d) Each 5ml of liquid Peptac contains 3.1mmol of sodium.
- e) Gaviscon infant sachets are sucrose and lactose free, the liquid and tablets are sugar free.
- f) Gaviscon should not be used in combination with feed thickeners.

GENTAMICIN

Preparations: PAEDIATRIC INJECTION 20mg in 2ml and ADULT 80mg in 2ml.
INTRATHECAL INJECTION 5mg in 1ml.

Dosage: **TREATMENT OF INFECTION**
IV infusion,

NEONATES

<32 weeks	5mg/kg	36 hourly
32 weeks and over	5mg/kg	24 hourly

INFANTS AND CHILDREN

initially 7mg/kg (max. 450mg)	24 hourly
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SEPTIC PATIENTS (PICU)

initially 8mg/kg (max. 450mg)	24 hourly
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In very overweight or grossly oedematous patients lean body weight must be used for calculating the dose.

IN RENAL FAILURE

All ages, give first dose as above and await plasma level result before further dosing. If trough level is still high after 36 hours consider reducing dose

INTRATHECAL, INTRAVENTRICULAR DOSE

INTRATHECAL PREPARATIONS ONLY AVAILABLE FROM PHARMACY.
SEEK EXPERT ADVICE BEFORE PRESCRIBING

1 - 5mg daily (see note a). CSF levels not to exceed 10mg/L. In addition, an IV/IM injection of 2mg/kg 8 hourly (3mg/kg by IV or IM injection 12hourly if under 2 weeks old) should be administered.

CYSTIC FIBROSIS

IV or IM injection: Due to the increased Volume of Distribution of aminoglycosides in cystic fibrosis, the dose given needs to be increased (unless renal function is compromised) to 8-10mg/kg/day in divided doses. Adjust dose according to levels.
Nebulised: 40-80mg diluted to 3-4ml with sodium chloride 0.9% 2-3 times a day, after physiotherapy, depending on patient's age and clinical condition (see note d).

PERITONITIS IN AUTOMATED PERITONEAL DIALYSIS

Peritonitis sensitive to gentamicin add to dialysis fluid: 5mg/L in every bag for 7 days (see protocol in Paediatric Peritoneal Dialysis Unit).

PROPHYLAXIS OF RENAL PROCEDURES

2.5mg/kg stat dose

Administration: IV infusion over 30 minutes. Dilute if required with 0.9% sodium chloride

Alternative: IV injection over 3-5 minutes, either directly into a vein or into an IV giving set, **OR** by IM injection.

Notes:

- a) Only intrathecal preparations of gentamicin should be used intrathecally. Do **NOT** use intravenous preparations as they often contain bacteriostats.
- b) Increased risk of ototoxicity with concomitant furosemide. Increased risk of nephrotoxicity with concomitant amphotericin, cisplatin or ciclosporin.
- c) Blood levels:
 - i) Take level 6 hours before 3rd dose (6 hours before 2nd dose if renal function is unstable). Repeat daily until stable then every 3 doses.
 - ii) Therapeutic level: trough < 1mg/L (Paediatrics)

peak < 2mg/L (NICU and PICU)
NOT USUALLY REQUIRED.
But should be 8-20mg/L. 1 hour
post infusion.

- iii) Redose patient at 24 hours if trough level achieved (at 36 hours if on 36 hour dosing). If trough is high, recheck level 12 hours after that level was taken and redose after that if level now in range. Dosing adjustment is to avoid accumulation, but do not delay at the detriment of not treating the patient – discuss with pharmacy.
- d) To reduce environmental contamination, gentamicin should be nebulised using a scavenging system or 'elephant' tubing vented via an external window or with a filter attached. Contact PICU ventilator technician for filter and advice on setting up tubing.
- e) Use Ideal weight for height to calculate dose.
- f) Contraindicated in Myasthenia Gravis.

GLUCAGON

Preparations: INJECTION 1mg (Fridge).

Dosage: **TREATMENT OF HYPOGLYCAEMIA ASSOCIATED WITH DIABETES**
IV, IM or SC injection,
Neonate 20microgram/kg
1 month - 2 years 500microgram
Over 2 years <25kg 500microgram
Over 2 years >25kg 1mg
If not effective within 15 minutes for treatment of hypoglycaemia give IV glucose.

GROWTH HORMONE STIMULATION TEST

This is an unlicensed indication.

USE ENDOCRINE PROTOCOL

IM injection, 15microgram/kg, maximum 1mg, as a single dose.

ENDOGENOUS HYPERINSULINAEMIA

IV infusion, all ages 1-10micrograms/kg/hr.

IM/IV injection, all ages 200micrograms/kg (**Max 1mg** per dose)

TREATMENT OF CARDIOGENIC SHOCK DUE TO BETA BLOCKER POISONING

IF IN ANY DOUBT CONTACT THE MEDICAL TOXICOLOGY UNIT

☎ 020 7188 0600 ☎

IV injection, 50-150microgram/kg. Repeat if necessary, or more commonly followed by an infusion of 50micrograms/kg/hr.

If glucagon is not available isoprenaline is an alternative.

Administration: Reconstitute each vial with 1ml of diluent provided. Dilute if required with sodium chloride 0.9% or glucose 5%.

Notes:

- a) If particles are observed in the solution, discard immediately.
- b) Glucagon can **NOT** be added to infusion fluids containing calcium ions as this causes precipitation of the glucagon.
- c) Patients must eat a meal before discharge to prevent rebound hypoglycaemia.
- d) Packs can be stored up to 25°C for 18 months, provided expiry date is not exceeded

GLUCOSE

Preparations: INFUSIONS 5%, 10%, 15%, 20% and 50% (500ml).
INFUSIONS 5% (100ml and 250ml).
INJECTION 50% (50ml).
PREFILLED SYRINGE 50% (50ml).
GLUCOGEL (10g glucose per single dose)

Dosage: **HYPOGLYCAEMIA**
Preterm and term neonates, *slow IV injection*, 200mg/kg (2ml/kg of glucose 10%), followed by an infusion of 3-6mg/kg/minute adjusting as necessary to maintain normoglycaemia.
Over 1 month, *IV injection*, 500mg-1g/kg (5-10ml/kg of glucose 10%).

HYPERKALAEMIA

IV injection, 500mg-1g/kg (2.5-5ml/kg of glucose 20%) and soluble insulin (0.3-0.6units/kg/hour in neonates / 0.05-0.2units/kg/hour in children >1 month).

GLUCOSE TOLERANCE TEST

Orally, 1.75g/kg of anhydrous glucose, (maximum 75g). (See note c). This should then be made into a flavoured drink with concentration no greater than 25g in 100ml.

Administration: Slow IV injection over 5 minutes, not greater than 25% concentration, or as an infusion not greater than 30%, via central access. 50% glucose should only be administered in emergency situations. Concentrations greater than 10% should not be administered peripherally, see note d).

Notes:

- a) To avoid rebound hypoglycaemia after injections of 50% glucose, use an infusion of 10% glucose after initial injection.
- b) 50% glucose from the pre-filled syringe may be given orally for hypoglycaemia.
- c) Glucose Tolerance Test is used for the diagnosis of Acromegaly, Pituitary Gigantism, diabetes mellitus. Lucozade® (from food stores), Fortical® (from dietitian), glucose powder or 50% glucose can be used for the glucose tolerance test.
- d) Concentrations of glucose greater than 12.5% are irritant to peripheral veins and greater than 25% are irritant to central veins.
- e) Hypostop is lemon flavoured and contains no colouring.

GLYCEROL (GLYCERINE)

Preparations: SUPPOSITORIES: Infant 1g, child 2g and adult 4g.

Dosage: **CONSTIPATION**
Rectally, insert appropriate suppository moistened with water, as necessary.
Premature neonates usually only require a slice off of a 1g suppository – known as a “glycerine chip”.

Notes: Many small children who experience pain or fear during defecation find rectal administration very distressing, alternatives should be considered.

GLYCERYL TRINITRATE

Preparations: INJECTION 50mg in 10ml and 50mg in 50ml. PATCHES 5mg.

Dosage:

VASODILATION

This indication is unlicensed for use in children.

IV infusion, all ages, initially 0.1microgram/kg/minute, increasing to a maximum of 10microgram/kg/minute. Tolerance may occur with prolonged infusion.

Transdermally, initially,

Below 5kg 2.5mg (see note b)

5 - 10kg 5mg

Above 10kg 10mg

Patches should be changed daily. (See note c). Tolerance may occur with prolonged use.

Administration:

If required dilute with sodium chloride 0.9% or glucose 5%. Maximum recommended final concentration is 400mcg/ml although concentrations of 1mg/ml have been used. Dilutions are stable for 24 hours at room temperature. As nitrates are adsorbed onto PVC, administration should be via a syringe pump (with plastipak or gillette sabre syringe) or via a rigid burette set with non-PVC tubing (Lectrocath or Gloucester tubing).

Notes:

- a) Hypotension is more likely if patient is hypovolaemic, therefore central venous pressure should be monitored.
- b) The 5mg patches can be cut in half to provide a 2.5mg dose.
- c) The site of the patch should be rotated each time it is changed to avoid skin sensitisation. Consider a patch free period if tolerance develops.
- d) GTN might reduce the effect of Heparin if given concomitantly.

GLYCOPYRRONIUM (GLYCOPYRROLATE)

Preparations: INJECTION 200microgram in 1ml and 600microgram in 3ml.
TABLETS 1mg and 2mg (**Import**).
SUSPENSION 2mg in 5ml (**Special Manufacturer**).

Dosage: **PREMEDICATION AND INTRA-OPERATIVE USE**
IM or IV injection, 4-8microgram/kg. Maximum dose
200microgram. Dose may be repeated.

ANTAGONISM OF NEOSTIGMINE MUSCARINIC EFFECTS

IV injection, 10microgram/kg with 50microgram/kg neostigmine.
Both can be mixed in the same syringe. See note below.

CONTROL OF UPPER AIRWAY SECRETIONS

Orally, 40-100microgram/kg 3 to 4 times a day.

Notes:

- a) A 1ml premixed ampoule containing glycopyrronium 500microgram and neostigmine 2.5mg (Robinul-Neostigmine[®]) is available.
- b) The tablets are scored and can be dispersed in water.
- c) Suspension has an expiry of 90 days and is relatively expensive.

GONADOTROPHIN (HUMAN CHORIONIC)

Preparations: INJECTION 1,500 units (Fridge), 5,000units.

Dosage: **HUMAN CHORIONIC GONADOTROPHIN STIMULATION TEST**
Intramuscularly, 1500-2000 units IM on days 1-3.

SEEK EXPERT ADVICE BEFORE PRESCRIBING

GRANISETRON

Preparations: TABLETS 1mg. INJECTION 1mg in 1ml and 3mg in 3ml.

Dosage: **CYTOSTATIC INDUCED EMESIS**

Orally, over 1 month, 20microgram/kg, up to 1mg, twice a day. Initial dose to be administered approximately 1 hour prior to starting cytostatic therapy.

IV, over 1 month, 40microgram/kg, up to 3mg, immediately prior to starting cytostatic therapy. An additional dose may be given within a 24 hour period (at least 10 minutes after initial dose).

POST-OPERATIVE NAUSEA AND VOMITING

This indication is unlicensed for use in children.

IV injection, over 1 month, 40microgram/kg, up to 1mg, before, during or after induction of anaesthesia.

An additional dose may be given within a 24 hour period (at least 10 minutes after initial dose). **Maximum 2mg/day.**

Administration: Slow IV injection, over 5 minutes. Dilute if required with sodium chloride 0.9% or glucose 5%.

Notes:

- a) Granisetron and other 5HT₃ antagonists are very effective at controlling early emesis (24-48 hours) however they are not very effective at controlling late emesis.
- b) Granisetron is not first line treatment for post-operative nausea and vomiting and should only be used where first line therapy has failed or is contra-indicated.

GRISEOFULVIN

Preparations: TABLETS 500mg. LIQUID 125mg in 5ml.

Dosage: **TREATMENT OF DERMATOPHYTE INFECTIONS OF SKIN, HAIR, NAILS**
Orally, over 1 month, 10mg/kg once a day, after food. May be given in divided doses if not tolerated as a single dose. Treatment is usually continued for 4-6 weeks for hair and skin and 6 to 12 months for nails. Continue for at least 2 weeks after signs of infection have disappeared (see note d).
Doses as high as 20mg/kg/day may be required for resistant ringworm. (Dermatologist advice must be given).

Notes:

- a) Griseofulvin is contraindicated in severe liver disease and porphyria. It may also aggravate systemic lupus erythematosus.
- b) Photosensitivity reactions may occur. Sunblock creams are required during periods of intense artificial or natural sunlight.
- c) Griseofulvin reduces the effect of warfarin and may also reduce ciclosporin blood levels. Phenobarbitone and primidone reduce the effectiveness of griseofulvin.
- d) Tinea capitis may respond slowly. If still infected after 8 weeks seek advice from dermatologist.
- e) Liquid is peppermint flavoured and sugar free.

HALOPERIDOL

Preparations: CAPSULES 500microgram. TABLETS 1.5mg, 5mg and 10mg.
LIQUID 2mg in 1ml. INJECTION 5mg in 1ml and 20mg in 2ml.

Dosage: **PSYCHOTIC DISORDERS, BEHAVIOURAL DISORDERS WITH SEVERE AGGRESSION/VIOLENCE, GILLES DE LA TOURETTE SYNDROME**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Orally, Over 1 year, 12.5-25microgram/kg twice a day.
Maximum 10mg/**day**, although adolescents may require up to 30mg or exceptionally up to 60mg/day for psychotic disorders.

PREMEDICATION

This is an unlicensed indication.

IM injection, 50-150microgram/kg.

INTRACTABLE HICCUP

Orally,

> 12 years 1.5mg three times a day

Notes:

- a) Extrapyramidal side effects occur at higher doses and are more common in children than adults. Beware of Tardive Dyskinesia which may be irreversible.
- b) Haloperidol is less sedating and has fewer antimuscarinic or hypotensive effects than chlorpromazine and is therefore the preferred treatment. On PICU alternative agents such as levomepromazine has successfully been used when psychosis is due to long term sedatives. Discuss with clinical pharmacist before prescribing.
- c) Haloperidol liquid (Rosemont[®]) is sucrose free.

HEPARIN SODIUM

Preparations: INJECTION 1,000 units in 1ml, 5,000 units in 1ml, 50 units in 5ml, 200 units in 2ml, 1,000 units in 1ml (5ml and 20ml), Heparin Sodium 500units in Sodium Chloride 0.9% (500ml).

Dosage: **ANTICOAGULANT THERAPY**
 All ages, *IV injection*, of 75units/kg then *IV infusion*, starting at 20 units/kg/hour. (start at 28units/kg/hour if <1 year)
 Adjust dose/rate according to APTT (Activated Partial Thromboplastin Time) to maintain between 60 and 85 seconds using the table below as a guide. Recheck APTT after 4 hours if any changes made; if no change needed recheck APTT in 24 hrs

APTT RATIO	APTT (s)	DOSE/RATE CHANGE
<1.7	< 50	increase by 10%❶
1.7-1.9	50-59	Increase by 10%
2-2.7	60-85	no change
2.8-3.2	86-95	reduce by 10%
3.3-4	96-120	reduce by 10%❷
>4	> 120	reduce by 15%❸

❶ Give *IV bolus* 50units/kg, before recommencing at increased infusion rate.

❷ Stop infusion for 30 minutes before recommencing at reduced infusion rate.

❸ Stop infusion for 60 minutes before recommencing at reduced infusion rate

PROPHYLACTIC DOSE

This indication is unlicensed for use in children.

All ages > 1 month, *SC injection*, 100units/kg up to 5000units, every 12 hours.

MAINTENANCE OF ARTERIAL CATHETER

- Neonates run 0.5ml/hour of 50units in 50ml 0.45% sodium chloride
- All others run 1ml/hour of 50units in 50ml 0.9% sodium chloride

Administration: To prepare infusion take (1000 x Wt (kg)) units of heparin and make up to 50ml with sodium chloride 0.9% to give a solution where 1ml/hour = 20units/kg/hour.

e.g. 20kg child: $1000 \times 20 = 20,000$ units of heparin made up to 50ml with sodium chloride.

Notes:

- a) **Warning:** For all patients receiving un-fractionated heparin (UFH), alternate day platelet counts should be performed from days 4 to 14. For surgical and medical patients receiving LMWH, platelet counts should be performed every 2–4 days from days 4 to 14. If the platelet count falls by 50% or more and/or the patient develops new thrombosis or skin allergy between days 4 and 14 of heparin administration, Heparin Induced Thrombocytopenia (HIT) should be considered and a clinical assessment made. If the pretest probability of HIT is high, heparin should be stopped and an alternative anticoagulant started in full dosage whilst laboratory tests are performed unless there are significant contraindications. Warfarin should not be used until the platelet count has recovered. When introduced, an alternative anticoagulant must be continued until the INR is therapeutic for two

- consecutive days
- b) A baseline full blood count, INR and APTT should be performed prior to commencing heparin infusion.
 - c) High doses of penicillins may prolong bleeding time and therefore increase the effects of heparin when used concurrently.
 - d) Antidote is **protamine** (see protamine sulphate).
 - e) For maintaining peripheral catheter patency, sodium chloride 0.9% is as effective as heparinised saline 50 units in 5ml.
 - f) Intravenous GTN might reduce the effect of Heparin if given concomitantly.
 - g) Inhibition of aldosterone secretion by heparin can result in hyperkalaemia. Potassium should be monitored, especially in those children on heparin for more than 7 days.
 - h) Risk of bleeding increases in severe hepatic and renal impairment – doses may need to be decreased.

HEPATITIS B IMMUNOGLOBULIN

Preparations: INJECTION 200 units and 500 units (**Named patient**) (Fridge).

Dosage: **PASSIVE IMMUNISATION**
IM injection, neonates 200units ideally within 12 hours but up to 24-48 hours of delivery.
Under 5 years 200 units
5 - 9 years 300 units
10 years and over 500 units
Hepatitis B vaccine should be administered concurrently, at a different site. See also immunisation guidelines.

Administration: IM into the anterolateral thigh.

Notes:

- a) Hepatitis B immunoglobulin should only be given when specific criteria are met. For use in neonates see hepatitis B vaccine. For post exposure prophylaxis see immunisation guidelines.
- b) Guy's and St Thomas' supplies Hepatitis B immunoglobulin for babies of known Hepatitis B mothers registered on High Risk register held on delivery suite. For other babies contact virology.

HISTAMINE

Preparations: INJECTION 0.1mg in 1ml (**Extemporaneously Prepared**).

Dosage: **TEST FOR FAMILIAL DYSAUTONOMIA**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Intradermal injection of 0.2-0.5ml.

Notes:

Injection produces a wheal but no pain or axon flare in a positive test.

HYDRALAZINE HYDROCHLORIDE

Preparations: TABLETS 25mg and 50mg. INJECTION 20mg.
LIQUID (**Extemporaneously Prepared**).

Dosage: **HYPERTENSION**
This indication is unlicensed for use in children.
Slow IV injection, all ages, 300-500microgram/kg/dose, maximum 4 hourly, (i.e. maximum 3mg/kg in 24 hours).
IV infusion, (preferred route in cardiac patients), all ages, 25-50microgram/kg/hour. Maximum dose 3mg/kg in 24 hours.
Orally, all ages, initially 250-500microgram/kg 2-3 times a day.

IN RENAL FAILURE

Dose may need to be reduced in patients with a creatinine clearance less than 30ml/minute/1.73m².

Administration: Slow IV injection, reconstitute each vial with 1ml of water for injection and use immediately. Administer over at least 5 minutes. IV infusion, further dilute with sodium chloride 0.9%.

Notes:

- a) Treatment for longer than 6 months, particularly with high doses may be associated with a lupus-like syndrome which may require steroid therapy. This is more common in slow acetylators.
- b) Injection solution can be given orally.

HYDROCORTISONE

Preparations: TABLETS 10mg and 20mg. PELLETS (lozenges) 2.5mg.
INJECTION 100mg, 25mg.
LIQUID 10mg in 5ml (**Manufactured Special**).

Dosage: **ASTHMA, ACUTE ADRENAL INSUFFICIENCY AND EMERGENCIES**
IV injection or IM injection,
Neonates 2.5mg/kg bolus then 2mg/kg 6 hourly.
All others: 4mg/kg every 6 hours.
Doses may need to be increased depending on the condition being treated and the patient's response.

OR

Up to 2 year	2mg/kg (max 25mg)	3-4 times a day
2 - 5 years	50mg	3-4 times a day
Over 5 years	100mg	3-4 times a day

REPLACEMENT THERAPY MAINTENANCE

Orally, all ages, initially, 4-5mg/m² three times a day (or start at 2mg/kg four times a day). The correct dose is determined by a profile of plasma cortisol levels.

CONGENITAL ADRENAL HYPERPLASIA

Orally, all ages, 5-7mg/m² three times a day.
Fludrocortisone may be required and high doses may cause growth suppression. Dose can be reduced over next 2 years.

REFRACTORY HYPOTENSION

IV injection, premature (VLBW) neonates, 2.5mg/kg every 4 hours for 2 doses then every 6 hours. Once normotension has been maintained for 24 hours wean the hydrocortisone by halving the doses every 48 hours. If hypotension recurs resume therapy at previous dose

Administration: Over at least 1-5 minutes. Dilute if required with sodium chloride 0.9%, glucose 5% or glucose/saline.

Notes:

- a) Injection can be given orally or tablets may be crushed and dissolved.
- b) For relative potencies see table 1.

Table 1. RELATIVE POTENCIES AND APPROXIMATE EQUIVALENT DOSES

Drug	Relative Glucocorticoid (Anti-inflammatory) Potency	Relative Mineralocorticoid Potency	Approximate Biological Half-life	Equivalent Anti-inflammatory dose ^❶
Dexamethasone	25	0	36-72 hours	4mg
Betamethasone (NF)	25	0	36-72 hours	4mg
Methylprednisolone	5	0.5	12-36 hours	20mg
Triamcinolone (NF)	5	0	12-36 hours	20mg
Prednisolone	4	0.8	12-36 hours	25mg
Hydrocortisone	1	1	8-12 hours	100mg
Fludrocortisone	--	125	8-12 hours	--

❶ Applies only to oral or intravenous administration; relative potencies may differ greatly when injected intramuscularly or into joint spaces.

HYDROXOCOBALAMIN

Preparations: INJECTION 1mg in 1ml.
LIQUID 500mg in 5ml (**Manufactured Special**).

Dosage: **INBORN ERRORS OF METABOLISM**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Neonates and infants, *IM injection*, initially, 1mg once day for 5 days then assess. Adjust dose according to response. Maintenance dose may be as high as 1mg 1-2 times each week. *Orally*, may be used at 10mg 1-2 times each week for maintenance once a response is established *IM* (see note a).

CONFIRMED VITAMIN B12 DEFICIENCY

Adults and children (all ages), *IM injection*, initially 250microgram-1mg 3 times weekly for 2 weeks, then 250microgram weekly until blood count is normal. Maintenance *IM injection*, 1mg every 2-3 months.

Notes:

Injection solution can be given orally, but the effect will not be prolonged and it will not be absorbed in pernicious anaemia, post gastrectomy or other malabsorption syndromes.

HYDROXYCARBAMIDE (HYDROXYUREA)

Preparations: CAPSULES 500mg, TABLETS 100mg

Dosage: **SICKLE CELL DISEASE & THALASSAEMIA**
Orally, 15mg/kg daily (in 1-2 doses) titrated by 5mg/kg every 6-8 weeks up to 35mg/kg daily, depending on haematological tolerance. Doses should be rounded to the nearest 500mg where appropriate (100mg tablets are expensive)
Monitor – FBC and serum chemistry every 2 weeks until established MTD then monthly plus HbF% every 6-8 weeks.

Notes:

- a) The content of the capsules may be opened and mixed with water and taken immediately. The contents of the capsules should not be inhaled or allowed to come into contact with skin or mucous membranes. Spillages must be wiped immediately.
- b) Bone marrow suppression is a major toxic side effect of hydroxycarbamide, while leucopenia, thrombocytopenia and anaemia may occur in that order. Neutropenia of $<2 \times 10^9/l$ should trigger a dose reduction. Haemoglobin $>10g/dl$ should trigger a dose reduction.
- c) Nausea and skin reactions are other common toxic reactions.
- d) The 100mg tablets are available for small dose adjustments. Dose adjustments should be made in increments of 500mg where possible.
- e) The 100mg tablets can be disintegrated in water if necessary. Place tablet on a spoon and add a small amount of water. Once disintegrated, the contents should be swallowed. The dose should be followed with a large glass of water.

HYDROXYTRYPTOPHAN

Preparations: CAPSULES 50mg (**Specials Manufacturer**). TABLETS 100mg (**Specials Manufacturer**).

Dosage: **TETRAHYDROBIOPTERIN DEFECTS**
1-2mg/kg/day divided between 4-6 doses, increasing every 2-3 days to target of 8-10mg/kg/day.

Notes:

- a) Monitor response clinically and CSF 5-HIAA levels to adjust dosage.
- b) Use with levodopa aiming for dose 2mg/kg/day less than levodopa to maintain appropriate ratio HVA to 5-HIAA in CSF. This may be difficult to achieve at low doses.
- c) Poor phenylalanine control impairs neurotransmitter levels in the CSF.

HYDROXYZINE

Preparations: TABLETS 10mg, 25mg. LIQUID 10mg in 5ml

Dosage:

PRURITIS

Hydroxyzine is unlicensed for use in children under 1 year.

Orally,

6 mths - 6 yrs	5-15mg	At night (increase if required to 50mg daily in 3-4 divided doses)
6 - 12 yrs	15-25mg	At night (increase if required to 50-100mg daily in 3-4 divided doses)

Notes:

Paradoxical excitation can be seen in children.

HYOSCINE HYDROBROMIDE (SCOPOLAMINE HYDROBROMIDE)

Preparations: INJECTION 400microgram in 1ml. PATCHES 1mg.
TABLETS 300micrograms (Kwells).

Dosage: **PREMEDICATION**
Orally, SC or IM injection – stat dose
1 - 12 years 15microgram/kg/dose (max. 600microgram)
Over 12 years 200-600microgram/dose

HYPERSALIVATION

This is an unlicensed indication.

Transdermally

Under 3 years ¼ patch every 72 hours
3 - 9 years ½ patch every 72 hours
>10 years 1 patch every 72 hours

Notes:

- a) Injection can be given orally.
- b) Tolerance may develop - patches may need changing every 48 hours.
- c) Patches may be cut or just cover the portion of the patch that is not required so that it is not in touch with the skin.
- d) Patches need to be applied to dry hairless areas (e.g. behind the ear).

HYOSCINE-N-BUTYLBROMIDE (SCOPOLAMINE BUTYLBROMIDE)

Preparations: TABLETS 10mg. INJECTION 20mg in 1ml.

Dosage:

RENAL OR BILIARY COLIC

This indication is unlicensed for use in children.

IM or IV injection,

1 - 5 years 5mg up to 3 times a day

Over 6 years 5-10mg up to 3 times a day

GASTROINTESTINAL SPASM

Orally,

6 - 12 years 10mg 3 times a day.

Over 12 years 20mg 4 times a day.

Administration: IV injection over at least 3-5 minutes. Dilute if required with glucose 5% or sodium chloride 0.9%.

Notes:

Injection can be given orally.

IBUPROFEN

Preparations: TABLETS 200mg and 400mg.
MODIFIED-RELEASE TABLETS 800mg. LIQUID 100mg in 5ml.
INJECTION 5mg in 1ml.

Dosage: **ANALGESIA FOR MILD TO MODERATE PAIN, ANTIPYRETIC**
These indications are unlicensed for use in children under 6 months.

Orally, 4-10mg/kg every 6 to 8 hours.

OR

1 month - 3 months	5mg/kg	3 times a day
3 months - 12 months	2.5ml (50mg)	3-4 times a day
1 - 3 years	5ml (100mg)	3 times a day
4 - 6 years	7.5ml (150mg)	3 times a day
7 - 9 years	10ml (200mg)	3 times a day
10 - 12 years	15ml (300mg)	3 times a day

JUVENILE ARTHRITIS

Orally, 10-15mg/kg 3 times a day.

Children over 12 years: 800mg MR tablets: 2 tablets to be taken as a single daily dose, preferably in the early evening well before retiring to bed. The tablets should be swallowed whole with plenty of fluid. In severe or acute conditions, total daily dosage may be increased to three tablets in two divided doses.

CLOSURE OF PATENT DUCTUS ARTERIOSUS

Neonates, *IV injection*, at 24 hour intervals (monitor weight, urine output, U+E's, platelet function and severe hyperbilirubinaemia):

Doses expressed as ibuprofen base:

1st dose	10mg/kg
2nd dose	5mg/kg
3rd dose	5mg/kg

Above course may be repeated if the duct reopens or has not successfully closed 48 hours after the first course.

Administration: IV injection over 15 minutes. If necessary the injection volume may be adjusted with sodium chloride 0.9% or glucose 5%.

Notes:

- Ibuprofen is contraindicated in patients with a history of hypersensitivity (including asthma, angioedema, urticaria or rhinitis) to aspirin or any other non-steroidal anti-inflammatory drug or with a coagulation defect.
- Caution, use in renal, cardiac or hepatic failure may cause a deterioration in renal function; the dose should be kept as low as possible and renal function monitored.
- Ibuprofen liquid is colour and sugar free.

IMIPRAMINE

Preparations: TABLETS 10mg and 25mg. LIQUID 25mg in 5ml.

Dosage: **ATTENTION DEFICIT HYPERACTIVITY DISORDER, TOURETTES SYNDROME**

These are unlicensed indications.

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Orally, initially, 10mg at night for 1 week, then 25mg at night. Increase if necessary, usual maintenance dose between **0.5-1.5mg/kg/day**. Doses over 1.5mg/kg/day should be given in 2 divided doses to decrease risk of cardiotoxic effects.

NOCTURNAL ENURESIS

Child 6 - 8 years: 25mg at bedtime

Child 8 - 11 years: 25 – 50mg at bedtime

Child 11 - 18 years: 50 – 75mg at bedtime

Maximum period of treatment (including gradual withdrawal) 3 months. Full physical examination required before further course.

Notes:

- a) Baseline ECG must be performed and further monitoring is advisable at higher doses i.e. between 1.5 and 2.5mg/kg/day.
- b) Imipramine is contraindicated in patients with arrhythmias, heart block and severe liver disease. Should be used with caution in patients with a history of epilepsy, thyroid disease or hepatic impairment.
- c) Avoid concomitant administration with astemizole and terfenadine, antiarrhythmics including sotalol and anaesthetic agents due to increased risk of arrhythmias. Methylphenidate may also inhibit the metabolism of imipramine.
- d) Tricyclic antidepressants are not indicated for childhood depression.

INDOMETACIN

Preparations: CAPSULES 25mg. LIQUID 25mg in 5ml (**Import**).
INJECTION 1mg.

Dosage: **RENAL FANCONI SYNDROME, CYSTINOSIS, NEPHROTIC SYNDROME (STEROID RESISTANT).**

These indications are unlicensed.

Orally, all ages, initially, 300microgram/kg 2-3 times a day up to 4mg/kg/day.

CLOSURE OF PATENT DUCTUS ARTERIOSUS

Neonates, *IV injection*, at 12-24 hour intervals (only if renal function has returned to normal):

Age at time of first dose	1 st dose (microgram/kg)	2 nd dose (microgram/kg)	3 rd dose (microgram/kg)
< 48 hours	200	100	100
2 - 7 days	200	200	200
> 7 days	200	250	250

OR *IV injection* 100microgram/kg every 24 hours for 6 doses.

Administration: Reconstitute vial with 1-2ml of water for injection. Administer over 20 minutes (see note b). Dilute if required with sodium chloride 0.9%. Precipitation may occur below pH6, **DO NOT** use glucose solutions.

Notes:

- Indometacin is contraindicated in patients with a history of hypersensitivity (including asthma, angioedema, urticaria and rhinitis) to aspirin or any other non steroidal drug or with a coagulation defect.
- Indometacin causes a reduction in cerebral blood flow. A 20 minute infusion results in a smaller reduction than a bolus.
- Indometacin reduces glomerular filtration, therefore, in neonates with a PDA reduce fluid intake. Plasma creatinine, digoxin and aminoglycoside levels will rise.
- Indometacin may antagonise thiazide diuretics and frusemide, and can potentiate warfarin effect.
- Used as a second line for PDA after Ibuprofen.

INFLIXIMAB

Preparations: INTRAVENOUS INFUSION 100-mg vial (powder for reconstitution).

Dosage: **CROHN'S DISEASE (SEEK PHARMACY APPROVAL)**
By *intravenous infusion*,
Child 6 - 18 years initially 5 mg/kg, then 5 mg/kg 2 weeks and 6 weeks after initial dose, then 5 mg/kg every 8 weeks; interval between maintenance doses adjusted according to response; discontinue if no response within 10 weeks of initial dose.

Administration: For intravenous infusion reconstitute each 100mg vial of powder with 10 mL Water for Injections; to dissolve, gently swirl vial without shaking; allow to stand for 5 minutes; dilute required dose with Sodium Chloride 0.9% to a final volume of 250 mL and give through a low protein-binding filter (1.2 micron or less) over at least 2 hours; start infusion within 3 hours of reconstitution.

Notes:

- a) Children should be evaluated for tuberculosis before treatment. Active tuberculosis should be treated with standard treatment for at least 2 months before starting infliximab. Children and their carers should be advised to seek medical attention if symptoms suggestive of tuberculosis (e.g. persistent cough, weight loss, and fever) develop.
- b) Hypersensitivity reactions reported during or within 1–2 hours after infusion (risk greatest during first or second infusion or in children who discontinue other immunosuppressants). All children should be observed carefully for 1–2 hours after infusion and resuscitation equipment should be available for immediate use. Prophylactic antipyretics, antihistamines, or hydrocortisone may be administered. Readministration not recommended after infliximab-free interval of more than 16 weeks—risk of delayed hypersensitivity reactions. Children and carers should be advised to keep alert card with them at all times and seek medical advice if symptoms of delayed hypersensitivity develop.

INSULIN

Preparations: Common examples of preparations are given below.

SHORT ACTING	Human Actrapid (soluble) 10ml vials.	OR	Humulin S (soluble) 10ml vials and 3ml pen cartridges.	OR	Novorapid (Insulin Aspart) 10ml vial, 3ml cartridges, and prefilled pen.
MEDIUM ACTING	Human Insulatard (isophane) 10ml vials, 3ml pen cartridges, and pre-filled insulin doser.	OR	Humulin I (isophane) 10ml vials, 3ml pen cartridges and pre-filled pen.	OR	Human Monotard (insulin zinc suspension) 10ml vial.
BIPHASIC FIXED MIXTURES	Human Mixtard 30, Novomix 30 (soluble + isophane) 10ml vial, 3ml pen cartridges, and pre-filled insulin doser.	OR	Humulin M3 (soluble and isophane) 3ml pen cartridges and pre-filled pen.	OR	Humalog Mix 25/50 (lispro + isophane) 3ml pen cartridge, pre-filled pen.
LONG ACTING	Lantus (Insulin Glargine) 10ml vial and 3ml cartridges.	OR	Levemir (Insulin Detemir) 3ml cartridges, pre-filled pen.		

Dosage:

A) INSULIN DEPENDENT DIABETES MELLITUS

Starting dose 0.5units/kg SC (independently on whether patient was on IV infusion previously). $\frac{2}{3}$ of the dose in the morning and $\frac{1}{3}$ in the evening when on twice daily insulin regimen.

Children 0 - 4 years should be started on Humalog Mix 25 twice daily.

MAINTENANCE THERAPY

Some children are now on analogue preparations. This allows them to eat and inject or inject and eat with no need to wait. Other children are maintained on twice a day *subcutaneous* human preparations, usually a mixture of short and medium acting preparations. Some children may benefit from more intensive therapy regimes (dosing up to four times a day). More recently some children are on continuous insulin pump regimen.

B) HYPERKALAEMIA

Soluble insulin:

Neonates 0.3-0.6 units/kg/hour

>1 month 0.2 units/kg/hour

PLUS: IV Glucose injection, 500-1g/kg (2.5-5ml/kg of glucose 20%).

C) DIABETIC KETOACIDOSIS/HYPERGLYCAEMIA

Initially start IV infusion (soluble insulin - Actrapid®) at 0.05-0.1units/kg/hr, rate should be adjusted following frequent blood glucose estimations (See Guidelines).

SUGGESTED SLIDING SCALE FOR HYPERGLYCAEMIA

IV infusion: 0.05-1unit/kg/hr following the scale:

<10mmol/L	No insulin
10 - 12mmol/L	0.05 units/kg/hr
12 - 16mmol/L	0.1 unit/kg/hr
16 - 20mmol/L	0.15 units/kg/hr
>20mmol/L	Seek medical advice

D) INSULIN TOLERANCE TEST

Administer an IV bolus of short acting insulin (actrapid) 0.15units/kg. Reduce dose to 0.05units/kg if pituitary insufficiency.

E) PERI-OPERATIVE MANAGEMENT AND PATIENTS WHO ARE "NIL BY MOUTH"

See diabetes guidelines.

Administration: IV Infusion: Dilute 50units of Actrapid® with 50ml of 0.9% sodium chloride.

Neonates priming of line: Draw up 250units of insulin (2.5ml) and add into a 50ml syringe with 47.5ml of glucose 5%. This will give a concentrate solution of 5units/ml. Attach an extension line to the syringe and prime the line with concentrated solution. Leave it for 10 minutes and then discard. Flush the line completely before attaching to normal infusion.

Notes:

- a) All preparations contain 100 units in 1ml (store in Fridge).
- b) Can remain out of Fridge when in use for one month.

INTERFERON BETA-1a

Preparations: Rebif[®] 8.8 micrograms in 0.5ml SYRINGE
Rebif[®] 22 micrograms in 0.5ml syringe + multidose CARTRIDGES
Rebif[®] 44 micrograms in 0.5ml syringe + multidose CARTRIDGES

Dosage: **RELAPSING, REMITTING MULTIPLE SCLEROSIS**

SEEK EXPERT ADVICE AND PHARMACY APPROVAL

Administration: This indication is unlicensed for use in children
> 12 years: Subcutaneous injection, initially 8.8micrograms three times a week for 2 weeks, then 22micrograms three times a week. Syringes for single use only. Multidose cartridges deliver one weeks treatment. Rotate injection site with each dose.

Notes:

- a) Prior to injection and for an additional 24 hours after each injection, paracetamol is advised to decrease flu-like symptoms. Flu-like symptoms tend to be most prominent at the initiation of therapy and decrease in frequency with continued treatment.
- b) Monitor liver enzymes, platelets and full blood count at regular intervals (1, 3 and 6 months) following introduction of Rebif[®] therapy and periodically thereafter.
- c) Caution in patients with epilepsy, severe renal or hepatic failure.
- d) Interferons have been reported to reduce the activity of hepatic cytochrome P450-dependent enzymes. Caution in combination with drugs with a narrow therapeutic index metabolised by cytochrome P450.
- e) Store in a refrigerator (2°C – 8°C) in the original package to protect from light. For the purpose of ambulatory use, the patient may remove Rebif[®] from the refrigerator and store it not above 25°C for one single period of up to 14 days. Rebif[®] must then be returned to the refrigerator and used before the expiry date.

INTRAVENOUS IMMUNOGLOBULIN (HUMAN)

Preparations: INJECTION OCTAGAM[®] 10% liquid containing 2g in 20ml, 5g in 50ml, 10g in 100ml and 20g in 200ml (Fridge).

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Dosage: **CHRONIC INFLAMMATORY DEMYELINATING POLYRADICULONEUROPATHY, GUILLAIN-BARRE SYNDROME, MYASTHENIA GRAVIS, KAWASAKI DISEASE, NECROTISING STAPHYLOCOCCAL SEPSIS, STAPHYLOCOCCAL TOXIC SHOCK SYNDROME, MYOCARDITIS, HYPERHAEMOLYSIS, IMMUNE THROMBOCYTOPENIA, RENAL TRANSPLANT REJECTION**
Intravenous Infusion, all ages 2g/kg total dose
Total dose can be infused in one infusion or split over a number of days to reduce fluid volume for patients if necessary (usually 1g/kg for 2 consecutive days, but renally impaired patients should receive 0.4g/kg for 5 consecutive days)

HYPERBILRUBINAEMIA ASSOCIATED WITH RHESUS OR ABO HAEMOLYTIC DISEASE

If bilirubin increasing by more than 8.5micromol/L/hr: intravenous infusion, 0.5g/kg over 4 hours, stat dose.

Administration: Ensure solution is clear before administering.

For IV infusion,

Infants and children: initial starting rate is 0.01ml/kg/minute for 30 minutes. If well tolerated increase rate gradually to maximum of 0.12ml/kg/minute. (see note c)

Observe patient for signs of anaphylaxis.

Notes:

- a) All requests for IVIG must be made on EPR. Follow up and documentation on national database of all cases is the responsibility of the prescriber
- b) Intravenous immunoglobulin has been associated with anaphylactoid reactions. These are most likely during the first infusion. Patient should be monitored for a further 20 minutes after infusion completed. Cardiopulmonary resuscitation facilities should be available.
- c) Suggested increasing schedule: 0.01ml/kg/min for 30 mins, 0.03ml/kg/min for 30 mins, 0.06ml/kg/min for 30 mins, 0.09ml/kg/min for 30 mins then 0.12ml/kg/min for rest of infusion.
- d) Octagam[®] is stored in the fridge – remove at least 15 minutes before use.
- e) Live and attenuated vaccination should be avoided post IVIG infusion for 3 months.

INUTEST[®] (POLYFRUCTOSAN)

Preparations: INJECTION (25%) 5g in 20ml (**Import**).

Dosage: **MEASUREMENT OF GLOMERULAR FILTRATION RATE (GFR)**
IV injection, all ages, 75mg/kg, up to a maximum of 5g.

Administration: Slow IV injection over 1-2 minutes. See notes below.

Notes:

- a) **Caution:** Bronchospasm and anaphylaxis have rarely been reported. Caution required in asthmatic patients. Resuscitation facilities must be available.
- b) Inulin is almost entirely cleared by glomerular filtration without secretion or reabsorption in the renal tubule.
- c) Dose administered should be recorded on the inulin test form sent to the ECH Wellchild Laboratory.
- d) Blood samples should be taken at 5 minutes, 1 hour, 2 hours, 3 hours and 4 hours post injection. Accurate time of injection and sampling must be recorded.
- e) Height (cm) and weight (kg) must be recorded on inulin test form for calculation of surface area as GFR is expressed as ml/minute/1.73m².

IODINE

Preparations: AQUEOUS LIQUID containing iodine 130mg in 1ml.

Dosage: **THYROTOXICOSIS (PRE-OPERATIVE)**
Children (all ages), *orally*, 0.1-0.3ml 3 times a day for 6 days.

MIBG SCAN

0.3ml three times a day commencing 2 days before scan and continue for 3 days after (5 consecutive days total) – see separate protocol.

Administration: Dilute well with milk or water prior to administration.
For tablets, look at Potassium Iodide.

IOHEXOL (OMNIPAQUE)

Preparations: INJECTION 300mg (containing 647 mg Iohexol per ml, equivalent to 300 mg iodine per ml).

Dosage: **MEASUREMENT OF GLOMERULAR FILTRATION RATE (GFR)**
IV injection,
> 25kg: 2.5ml
≤ 25kg: 1ml

Administration: Slow IV injection over 1min. (this is the start time).
The dose should be flushed with 5-10ml of saline to ensure complete dose delivery. This is infused into the antecubital vein in the arm opposite sampling.

Notes:

- a) Accurate measurement of GFR requires accurate delivery and recording of the dose of Iohexol and accurate timing.
- b) The dose of Iohexol for children is independent of both body size and renal function.
- c) Accurate height (cm) and weight (kg) are essential for correction of GFR to body surface area.
- d) Insert an intravenous catheter, for blood sampling, into an antecubital vein. Blood samples, 2ml lithium heparin, are taken at approximately 5, 120, 180, and 240min after dosing. The timings do not need to be exact, but it is essential that the actual times are recorded. The 5min sample is taken to check that the dose has been administered intravenously and not, inadvertently, subcutaneously.
Please deliver the blood samples at the end of the procedure directly to the WellChild laboratory on level 1 in the Evelina Children's Hospital. If this is not possible the blood samples must be separated at the end of the procedure and the heparinised plasma stored frozen, preferably at -70°C/-80°C, until transfer to the laboratory for analysis.
The GFR is calculated using a single compartmental model based on the Iohexol clearance rate between 120 and 240min. Results are then corrected using the formula proposed by Brochner-Mortensen.
The GFR is then corrected for body surface area.
- e) WellChild Laboratory, Evelina Children's Hospital, London SE1 7EH
Telephone: 020 7188 0159

IPRATROPIUM

Preparations: NEBULISER SOLUTION 250microgram in 1ml and 500microgram in 2ml.

INHALERS 20microgram per metered inhalation.

Dosage:

ASTHMA THERAPY

Nebulised,

This route is unlicensed for use in children under 3 years.

4 weeks - 1 year 62.5microgram every 6-8 hours

1 - 4 years 125-250microgram every 6-8 hours

5 - 12 years 250-500microgram every 6-8 hours

Optimal volume for nebulisation is 4ml, unless smaller reservoir is used when 2ml is usually sufficient. Dilute dose where appropriate with sodium chloride 0.9%.

Nebulisers may be administered more frequently in hospital with close monitoring. (Up to 2 hourly).

Inhalation,

Up to 6 years 20microgram (1 puff) 3 times a day

6 - 12 years 20-40microgram (1-2 puffs) 3 times a day

Over 12 years 20-40microgram (1-2 puffs) 3-4 times a day.

NB. Up to 120microgram (6 puffs) 4 times daily may be required in any age group.

Notes:

- a) As paradoxical bronchospasm can occur, first dose should be inhaled under medical supervision.
- b) Children under 10 years are usually incapable of using metered dose inhalers effectively.
- c) The ipratropium aerosol inhaler fits into the Aerochamber or Volumatic® spacers.
- d) Ipratropium and salbutamol solutions are compatible and may be nebulised concomitantly.
- e) See also guidelines on acute asthma and guidelines on chronic asthma.
- f) Patient should be advised to close their eyes during nebulisation unless using a mouth piece. Long term eye contact may cause glaucoma.

IRBESARTAN

Preparations: TABLETS 75mg, 150mg, 300mg

Dosage:

HYPERTENSION / RENOPROTECTION FOR NEPHROPATHY

Orally, Children 6 – 12 years: Initial dose of 75mg (or 2mg/kg) once daily. Dose may be titrated to 150mg once daily.

Children 13 – 16 years: Initial dose of 150mg once daily. May be titrated to 300mg once daily. Doses above 300mg are not recommended.

No dosage adjustment is necessary for patients with impaired renal function.

Notes:

- a) Increased risk of hyperkalemia (more common in patients with renal impairment) with ciclosporin, NSAID's, potassium salts, tacrolimus.
- b) Like ACE inhibitors Irbesartan can lead to renal failure in patients with severe bilateral renal artery stenosis (or stenosis of an artery for a solitary kidney).
- c) Patients should be warned of 1st dose hypotension.
- d) Irbesartan is contraindicated in pregnancy.
- e) Caution in aortic and mitral valve stenosis.
- f) Tablets have been crushed and dissolved (no evidence base).

IRON (INTRAVENOUS SUPPLEMENTATION)

Preparations: INJECTION 20mg in ml. Each 5ml ampoule contains 100mg of iron, as iron (III)-hydroxide sucrose complex (Venofer®).

Dosage: **FUNCTIONAL IRON DEFICIENCY**
Functional Iron Deficiency or alternative to oral iron in haemodialysis patients prescribed erythropoietin.

Calculation of Correction Dose:

- Total Iron Deficit Equals: $[\text{wt}(\text{kg}) \times (\text{target HB (g/L)} - \text{actual HB (g/L)} \times 0.24)] + \text{depot Iron requirements}$.
- Depot Iron requirements <35kg: 15mg/kg up to max. 500mg, >35 kg: 500mg.
- Round up the total iron deficit to nearest 10mg.
- Aim to administer the correction dose in divided amounts over approximately 5 consecutive dialysis sessions.
- Each divided dose should not exceed 3mg/kg/dose or 200mg/dose, whichever is the smallest.

Maintenance Dose:

- Weight < 50kg: 2mg/kg, corrected to nearest 5mg, every 2 weeks as single IV dose.
- Weight > 50kg: 100mg every 2 weeks as single IV dose.

Administration: **A doctor must administer ALL first doses of IV iron.**

Correction Dose:

- i) Dilute 100mg of Venofer in 100ml of Sodium Chloride 0.9% (concentration 1mg/ml). Solution should be used within 3 hours if stored at room temperature.
- ii) Test Dose: <14kg 1.5mg/kg or >14kg 20mg. Administered over the first 20 minutes of the IV infusion via venous injection port of dialysis circuit. If no adverse reactions occur during the infusion or within at least 15 minutes after administration the remaining portion of the initial dose can be given a maximum rate of 0.05ml/kg/min (3ml/kg/hr).

Maintenance Dose:

The dose can be given as a slow bolus of undiluted Venofer (20mg/ml), given via venous injection port of dialysis circuit at a rate of no faster than 1ml (20mg) per minute.

Notes:

- a) Monitoring:
 - i) Before starting IV iron monitor FBC, reticulocytes, ferritin, Tsat.
 - ii) The FBC, reticulocytes, ferritin and Tsat should be measured 2 weeks after completion of the loading dose (i.e. 5 consecutive dialysis sessions).
 - iii) Maintenance treatment: FBC (weekly), ferritin and Tsat (monthly two weeks after the previous maintenance dose).
- b) Drugs for resuscitation and anaphylaxis should always be available.
- c) If the patient complains of nausea, back pain, abdominal pain, breathlessness, or other acute symptoms, or develops hypotension, STOP THE INFUSION IMMEDIATELY and call of medical assistance.
- d) **Overdose:** Stop the infusion if still running. Supportive management measuring glucose levels, blood counts, check for metabolic acidosis.

IRON (ORAL SUPPLEMENTATION)

Preparations: Ferrous sulphate TABLETS 200mg (65mg elemental iron).
Sytron[®] LIQUID (sodium iron edetate) 55mg elemental iron in 10ml.
Ferrous fumarate LIQUID 45mg elemental iron in 5ml)

Dosage: **IRON DEFICIENCY**
Dosage should be calculated using the amount of ELEMENTAL IRON (E.I.) in the preparation.

Infants and premature neonates:

Orally, 4-6mg/kg E.I. per day in 2 to 3 divided doses,

OR

Sytron[®] initially 1ml/kg once a day, larger volumes may be given in 2-3 divided doses.

Ferrous fumarate 0.6ml/kg once a day.

Children:

Orally, 1 - 5 years 40-50mg E.I. (approximately 7.5ml Sytron[®] or 5ml Fersamal) per day.

6 - 12 years 80-100mg E.I. (approximately 15ml Sytron[®] or 10ml Fersamal) per day. Sytron[®] should be given in 2-3 divided doses.

IRON PROPHYLAXIS

Premature neonates over 3 weeks or on discharge from unit, *orally*, 1ml (of Sytron[®]) once a day for 6-12 months.

Notes:

- a) Acute iron toxicity after accidental ingestion may occur with as little as 30mg/kg of E.I. and may be fatal in young children. Urgent treatment with oral or parenteral desferrioxamine is required, see desferrioxamine mesylate.

IF IN ANY DOUBT CONTACT THE MEDICAL TOXICOLOGY UNIT

☎ 020 7188 0600 ☎

ISOLEUCINE see Metabolic dietitian

Preparations: SACHETS 50mg (not from pharmacy).

Dosage: **SUPPLEMENTATION IN MAPLE SYRUP URINE DISEASE (MSUD)**
Only to be determined by Metabolic dietitian and Clinician based on blood results.

Notes:

- a) Minimum isoleucine and valine requirements are approximately 200-250mg/day.
- b) Intake must be frequently titrated against plasma concentrations.
- c) Mix the sachet with the patient's usual MSUD amino acid supplement.
- d) Not for intravenous use.

ISONIAZID

Preparations: TABLETS 100mg. LIQUID 50mg in 5ml (**Specials Manufacturer**).
INJECTION 100mg in 5ml (**Specials Manufacturer**).

Dosage: **TUBERCULOSIS THERAPY (UNSUPERVISED REGIMEN)**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

TREATMENT

Orally, IM or Slow IV injection,

Neonates, 3-5mg/kg once a day.

Over 1 month, 5-10mg/kg once a day. Maximum dose 300mg/day.

Exceptionally, a higher dose of 20mg/kg once a day (maximum 500mg/day), may be required in tuberculous meningitis.

PROPHYLAXIS

Orally, IM or Slow IV injection,

Over 1 month, 5-10mg/kg once a day. Max. dose 300mg/day.

IN RENAL FAILURE

Dosage adjustments are not usually necessary until creatinine clearance is less than 10ml/minute/1.73m². Maximum dose 200mg/day (see note b).

Isoniazid is removed by haemodialysis and peritoneal dialysis.

Administration: Slow IV injection over 2-5 minutes; dilute if required with water for injection, use immediately.

Notes:

- a) Main route of excretion is hepatic, reduce the dose and use with caution in liver impairment. See note below.
- b) Therapeutic drug monitoring:
 - i) Isoniazid blood levels are not routinely monitored however in severe renal failure and liver impairment monitoring may be useful to reduce the risk of side effects.
 - ii) Trough level should be below 1mg/L in liver impairment and severe renal failure.
 - iii) Take a trough sample, immediately prior to next dose.
- c) Hepatitis has been reported with isoniazid. Base line liver function tests should be performed before commencing treatment. Frequent checks in the first 2 months are then required in those with pre-existing liver disease. Further routine checks are not required if there is no evidence of liver disease or dysfunction. Patients/carer should be warned to seek medical advice immediately if there are any signs of liver disorder e.g. persistent nausea, vomiting, malaise, fever or jaundice.
- d) Pre-existing risk factors such as malnutrition, chronic renal failure, HIV infection, diabetes and slow acetylator status increase the risk of developing peripheral neuritis. **Pyridoxine** should be given concurrently (see pyridoxine).
- e) The metabolism of phenytoin, diazepam and carbamazepine may be reduced by isoniazid. Corticosteroid effects of prednisolone may also be enhanced.
- f) The absorption of isoniazid may be inhibited by concomitant administration of antacids.
- g) Isoniazid liquid (Martindale) is sugar free.

ISOPRENALINE

Preparations: INJECTIONS 200microgram in 10ml (**GSTT Special**) 5mg in 5ml (**GSTT Special**).

Dosage: **ASYSTOLE**
Neonates and older children, *IV injection*, 5microgram/kg.

BRADYCARDIA

IV infusion, 0.02microgram/kg/minute, increasing to a maximum of 0.5microgram/kg/minute if necessary (neonates maximum 0.2mcg/kg/minute).

INOTROPE FOR COMPLETE HEART BLOCK

IV infusion, 0.1-1microgram/kg/minute.

Administration: Dilute if required with glucose 5% or sodium chloride 0.9%.
For continuous infusion, dilute to a maximum concentration of 20mcg/ml. Concentrations as high as 64mcg/ml have been used safely and with efficacy in situations of extreme fluid restriction.

Notes:

- a) Isoprenaline may precipitate ventricular extrasystole and arrhythmias and should only be used with ECG monitoring and cardiopulmonary resuscitation facilities available.
- b) May cause hypotension.
- c) Isoprenaline sulphate 2.25mg \equiv isoprenaline hydrochloride 2mg.
Doses are prescribed as hydrochloride salt.

ITRACONAZOLE

Preparations: CAPSULES 100mg. LIQUID 10mg in 1ml.

Dosage:

CONSULT MICROBIOLOGY BEFORE PRESCRIBING

SYSTEMIC FUNGAL INFECTIONS

This indication is unlicensed for use in children.

Orally, all ages, 3-5mg/kg once a day. Up to 10mg/kg once a day in severe infections.

Notes:

- a) Itraconazole is predominantly hepatically metabolised; no dosage adjustment is required in renal failure.
- b) Liver function tests should be performed if pre-existing liver disease or treatment is to be continued for more than 1 month. Patient/carer should be warned to seek medical advice immediately if there are any signs of liver disorder e.g. persistent nausea, vomiting, malaise, fever or jaundice.
- c) Capsules have very poor bioavailability. Oral products are not bioequivalent.
- d) Phenytoin and rifampicin decrease blood levels of itraconazole.
- e) Itraconazole increases ciclosporin, midazolam, digoxin and possibly tacrolimus levels and potentiates warfarin.
- f) Itraconazole liquid (Sporanox[®]) is cherry flavoured and sugar free.

KETAMINE (CD restrictions apply)

Preparations: INJECTION 200mg in 20ml, 500mg in 10ml and 1g in 10ml.
S-KETAMINE PRESERVATIVE FREE INJECTION 5mg in 1ml (unlicensed)

Dosage: **INDUCTION OF ANAESTHESIA**
All ages (under 15 years), *IV injection*, 1-2mg/kg given slowly over 1 minute. Maximum initial dose 4.5mg/kg.
IM injection, 4-10mg/kg.

MAINTENANCE OF ANAESTHESIA

IV/IM injection, give additional dose of 50% of full induction dose.

IV infusion, 10-45 microgram/kg/minute.

The dosage used may require reduction if a long acting neuromuscular blocking agent is used.

PREMEDICATION PRIOR TO INVASIVE OR PAINFUL PROCEDURES.

Orally, 6-10mg/kg single dose.

IV, 1-2mg/kg single dose.

CAUDAL ANALGESIA

Use **preservative-free** S-ketamine 0.5mg/kg for caudal administration.

Administration: *Slow IV bolus:* Concentration must be no greater than 50mg/ml.

IV Infusion: Usual to use 1 or 2mg/ml.

Dilute with sodium chloride 0.9% or dextrose 5%.

Caudal administration: Mix preservative-free S-ketamine with 0.75-1ml/kg 0.25% levobupivacaine and administer as a bolus

Notes:

- a) The incidence of psychological reactions during recovery e.g. hallucinations, is higher in children over 15 years. The use of a benzodiazepine e.g. midazolam, diazepam, lorazepam as an adjunct to ketamine is effective in reducing the incidence of emergence reactions. Minimised verbal and tactile stimulation during the recovery phase may also reduce emergence reactions.
- b) Although ketamine has been used outside of the operating theatre, it should be remembered that it is a general anaesthetic, requiring appropriate skills and equipment such as those usually found within an intensive care environment. **Ketamine should not be administered on a general ward or department.**
- c) Injection may be given orally.
- d) Preservative-free Ketamine-S is reserved for caudal analgesia only.

KETOROLAC

Preparations: INJECTION 30mg in 1ml.

Dosage: **POST OPERATIVE ANALGESIA (SHORT TERM USE ONLY – MAINLY THEATRES AND RECOVERY)**

This indication is unlicensed for use in children.

IV injection, over 6 months: Initially 1mg/kg loading dose, then 0.5mg/kg every 6 hours.

Administration: *Slow IV injection* over 1-2 minutes.

Notes:

- a) Ketorolac is contraindicated in patients with a history of hypersensitivity (including asthma, angioedema, urticaria or rhinitis) to aspirin or any other non-steroidal anti-inflammatory drug or with a coagulation defect.
- b) Caution, use in renal, cardiac or hepatic failure may cause a deterioration in renal function: the dose should be kept as low as possible and renal function monitored.
- c) Increased risk of convulsions with concomitant quinilones. Increased risk of nephrotoxicity with concomitant ciclosporin.

KLEAN PREP

Preparations: Oral powder SACHET containing macrogol '3350' polyethylene glycol '3350' 59g, anhydrous sodium sulphate 5.685g, sodium bicarbonate 1.685g, sodium chloride 1.465g, potassium chloride 743mg. (Klean- Prep[®]). Each sachet is reconstituted in water to 1 litre.

Dosage: **PREOPERATIVE BOWEL CLEANSING**
These indications are unlicensed for use in children <20kg.
Orally, children, 20ml/kg/hr, increase to a maximum of 40ml/kg/hr to produce diarrhoea.

Administration: Adults, 4 litres over 4-6 hours (250ml every 10-15 minutes).
Give initial dose at least 2 hours after meal. Solution should be drunk or given via a naso-gastric tube. Continue solution until anal discharge is clear. Solution can be flavoured with clear fruit cordial if required.

Notes:

- a) Urticaria and allergic reactions have been reported.
- b) Metoclopramide administered 30 minutes before initial dose may prevent abdominal distention and bloating.
- c) Reconstitute 1L at a time and store in the fridge (for 24 hours), this improves taste.
- d) Contra-indications are bowel obstruction, gastric retention, perforated bowel, toxic colitis, obstructive megacolon or ileus.
- e) Klean-prep[®] is vanilla flavoured and contains aspartame.
- f) Oral medication taken within 1 hour of Klean-prep might be flushed from GI tract and not absorbed.
- g) No solid food should be taken for at least 2 hours before taking Klean-prep.

LABETALOL

Preparations: TABLETS 100mg and 200mg.
INJECTION 100mg in 20ml.

Dosage: These indications are unlicensed for use in children.

HYPERTENSIVE CRISIS

All ages, *IV infusion*, 1mg/kg/hour titrating according to response to maximum of 3mg/kg/hour (Neonates start at 500mcg/kg/hour).

HYPERTENSION

All ages, *orally*, 1-2mg/kg 3 to 4 times a day.

Administration: For continuous IV infusion, dilute in sodium chloride 0.9% or glucose 5%. Can be given undiluted in fluid restricted patients.

Notes:

- a) In hypertensive encephalopathy, rapid uncontrolled reduction in blood pressure to normotensive level can result in water shed cerebral infarction, blindness or death. Aim to reduce blood pressure to normal over 24-48 hours. If patient is fitting then a rapid initial decrease in blood pressure is required but not to normal levels.
- b) No dosage reduction is required in renal impairment and it is not significantly cleared by dialysis.
- c) **Caution:** Hepatotoxicity has been reported after both short and long term therapy. Avoid in hepatic impairment.
- d) Injection can be given orally with squash or juice.

LACTULOSE

Preparations: SOLUTION containing lactulose 3.35g in 5ml.

Dosage: **CONSTIPATION**
Orally, initially, under 1 year 2.5ml twice a day
1 - 5 years 5ml twice a day
5 - 10 years 10ml twice a day
Over 10 years 15ml twice a day
Then adjust dose to individual requirements.

Notes:

- a) Lactulose is an osmotic laxative and has a 48 hour onset of action therefore prescribe regularly for at least 2 days.
- b) Lactulose solution is sucrose free and 5ml provides approximately 20kJoules (5cals).
- c) May be diluted with water or fruit juice.

LAMOTRIGINE

Preparations: DISPERSIBLE TABLETS 2mg, 5mg, 25mg and 100mg.
TABLETS 25mg, 50mg, 100mg, 200mg (**Purchased on request**).

Dosage: **EPILEPSY**
Licensed for adjunct therapy of partial and generalised seizures and monotherapy of typical absence seizures in children over 2 years. Licensed for monotherapy of partial and generalised seizures in children over 12 years.

Orally,	AGE	INITIAL DAILY DOSE (Week 1 + 2)	SUBSEQUENT DAILY DOSE (Week 3 + 4)	MAINTENANCE DAILY DOSE (Week 5+)
Adjunctive WITH sodium valproate (± other AED's)	2-12 yrs	0.15mg/kg (2mg on alternate days if <13kg)	0.3mg/kg	Increase by max 0.3mg/kg every 1-2 weeks to 1-5mg/kg. Max daily dose 200mg.
	≥12 yrs	12.5mg (or 25mg alternate days)	25mg	Increase by max 25-50mg every 1-2 weeks to 100-200mg
Adjunctive WITH enzyme inducing AED's (see note b) WITHOUT sodium valproate (± other AED's)	<12 yrs	0.6mg/kg	1.2mg/kg	Increase by max 1.2mg/kg every 1-2 weeks to 5-15mg/kg. Max daily dose 400mg.
	≥12 yrs	50mg	100mg	Increase by max 100mg every 1-2 weeks to 200-400mg. Max daily dose 700mg.
Adjunctive WITHOUT enzyme inducing AED's WITHOUT valproate	2-12 yrs	0.3mg/kg	0.6mg/kg	Increase by max 0.6mg/kg every 1-2 weeks to 1-10mg/kg/day. Max daily dose 200mg.
	≥12 yrs	25mg	50mg	Increase by max 50-100mg every 1-2 weeks to 100-200mg.
MONOTHERAPY of partial and generalised seizures	≥12 yrs	25mg	50mg	Increase by max 50-100mg every 1-2 weeks to 100-200mg. Max daily dose 500mg
MONOTHERAPY of typical absence seizures	2-12 yrs	0.3mg/kg	0.6mg/kg	Increase by max 0.6mg/kg every 1-2 weeks to 1-15mg/kg/day. Max daily dose 200mg

The total daily dose can be given in one or two divided doses except when used as adjunctive therapy (without valproate) when it should be given in two divided doses.

Notes:

- a) **Caution:** Severe rashes have been reported in children. Increased risk associated with concomitant valproate, increased initial doses and rapid dose escalation. Discontinue lamotrigine at first sign of a rash unless it is clearly not drug related. Withdrawal should be considered if fever, influenza-like symptoms, drowsiness, worsening of seizure control or other symptoms associated with hypersensitivity develop.
- b) Phenytoin, phenobarbitone, primidone and carbamazepine increase the clearance of lamotrigine.
- c) Sodium valproate reduces the clearance of lamotrigine.
- d) Lamotrigine may raise plasma concentration of an active carbamazepine metabolite carbamazepine epoxide. If side effects

- occur these usually resolve with a reduction in carbamazepine dose.
- e) With concomitant antiepileptics where pharmacokinetic interactions are not known, use regimen for concomitant sodium valproate for initial therapy, the dose should then be increased until response is optimised.
 - f) Lamotrigine dispersible tablets (Lamictal[®]) are blackcurrant flavoured.
 - g) If required lamotrigine dispersible tablets could be administered for maintenance rectally. Same total daily dose as oral. Dissolve in small amount of tap water immediately prior to administration.
 - h) Dose titration should be repeated if restarting after interval of more than 5 days

LENOGRASTRIM (G-CSF)

Preparations: INJECTION 105 microgram (13.4 million units) and 263 microgram (33.6 million units).

Dosage: **CYTOTOXIC INDUCED NEUTROPENIA**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

This indication is unlicensed for use in children under 2 years.
SC injection, IV infusion, 5microgram/kg (19.2 million units/m²) once a day starting the day after completion of chemotherapy and continuing until neutrophil count is stable in acceptable range.

SEVERE CONGENITAL AND RELATED NEUTROPENIAS

These are unlicensed indications.

SC injection, initially, 5microgram/kg once a day, increase at weekly intervals to 20microgram/kg until neutrophil count stabilised. Reduce to minimum effective maintenance dose.

Administration: *SC injection*, reconstitute vial with 1ml water for injection.
IV infusion, dilute with sodium chloride 0.9% to not less than 2micrograms/ml and give over 30 minutes.

LEVAMISOLE

Preparations: TABLETS 50mg (**Import**).

Dosage: **NEPHROTIC SYNDROME**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Orally, 2.5mg/kg 3 times a week or alternate days.

Notes:

- a) Neutropenia, agranulocytosis and vasculitis have been reported, patient/carer should be advised to report any 'flu' like symptoms such as sore throat, fever, chills or rash.
- b) Crush and dissolve/disperse tablets.

LEVETIRACETAM

Preparations: TABLETS 250mg, 500mg, 750mg and 1g. LIQUID 500mg in 5ml.
INJECTION 500mg/5ml vials.

Dosage: **TREATMENT OF EPILEPSY**
Orally/IV, (IV only recommended >4 years).
1 - 6 months initially 7mg/kg ONCE daily. Increased every 2 weeks by a maximum of 7mg/kg TWICE daily (maximum of 21mg/kg TWICE daily).
6 months – 18 years (<50Kg) initially 10mg/kg ONCE daily. Increased every 2 weeks by a maximum of 10mg/kg TWICE daily (maximum of 30mg/kg TWICE daily).
12 – 18 years (>50Kg) initially 250mg TWICE daily. Increased every 2 weeks by a maximum of 500mg TWICE daily (maximum of 1.5g TWICE daily).

Administration: Dilute dose with 100ml of glucose 5% or sodium chloride 0.9% and give over 15 minutes. Smaller volumes can be used. Final concentration should be between 2.5-13mg/ml.

IN RENAL FAILURE

30-50ml/min	½ normal dose	twice daily
< 30ml/min	⅓ normal dose	twice daily

Notes:

- a) The tablets can be crushed and dispersed in water.
- b) Levetiracetam should not be discontinued suddenly. A gradual dose reduction is advisable. As a guide a reduction of 10mg/kg/day every 4 to 6 weeks may be advisable.
- c) No Significant interactions have been reported with levetiracetam.
- d) Liquid may be diluted with water prior to use.
- e) Liquid (Keppra®) is grape flavoured and contains no sugar, starch, lactose, gluten or dyes.

LEVODOPA PREPARATIONS

Preparations: TABLETS co-careldopa 62.5mg containing levodopa 50mg plus carbidopa 12.5mg (Sinemet 62.5mg).

Dosage: **TETRAHYDROBIOPTERIN DEFECTS**
This is an unlicensed indication.
1-2mg/kg/day of levodopa divided between 4-6 doses, increasing every 2-3 days to 10-12mg/kg/day.

DOPAMINE SENSITIVE DYSTONIAS

>3 months 250micrograms/kg of levodopa 3 times daily. Increase if required, every 2-3 days to a max. of 1mg/kg three times daily.

Notes:

- a) Monitor response clinically and CSF HVA levels to adjust dosage.
- b) Levodopa/carbidopa 4:1 ratio preferred to control peripheral levodopa effects. At higher doses consider a 10:1 levodopa:carbidopa preparation.
- c) Use with 5-hydroxytryptophan aiming for dose 2mg/kg/day more of levodopa to maintain appropriate ratio HVA to 5-HIAA in CSF.
- d) Take after meals.

LEVOSIMENDAN

Preparations: INFUSION 12.5mg/5ml (**Named Patient**)

PRESCRIBING MUST BE AGREED BY PICU CONSULTANTS

Dosage: **CARDIOGENIC SHOCK**

Loading dose

10 microgram/kg over 30 minutes

After loading, commence Levosimendan at 0.1mcg/kg/min for 24 hours. Increase infusion rate to 0.2 mcg/kg/min after 6 hours if clinical response inadequate.

Discontinue Levosimendan at 24 hours (active metabolites with very long half-life ~80 hours).

Administration: Dilute 1ml of Levosimendan (2.5mg) in 50ml of glucose 5% to get a final, standard concentration of 50mcg/ml. Use the same syringe for both loading and infusion, remembering to adjust the rate when changing from load to infusion.

For loading: 10microgram/kg equates to 0.2ml/kg of the standard concentration, given over 30 minutes.

For the infusion: 0.1mcg/kg/min equates to 0.12ml/kg/hr of the standard concentration.

Administer via central or peripheral route, use a dedicated line.

Notes:

- a) Beware hypotension during load (may need to give fluids)
- b) Reduce milrinone to 0.2microgram/kg/min at commencement of levosimendan load and leave at this rate. (May need to discontinue milrinone altogether if excessive vasodilatation occurs).
- c) Currently unlicensed in the UK.
- d) Vials stored in the fridge.

LEVOTHYROXINE SODIUM (THYROXINE SODIUM)

Preparations: TABLETS 25microgram, 50microgram and 100microgram.
LIQUID 50microgram in 5ml.

Dosage: **CONGENITAL HYPOTHYROIDISM**
< 2 years 10microgram/kg a day.
> 2 years 5microgram/kg a day, increasing by
5microgram/kg/day at intervals of 2-4 weeks, (see note a).

JUVENILE MYXOEDEMA

Under 1 year as above.

Over 1 year, initially 2.5-5microgram/kg/day, increase as above.

Notes:

- a) Dose may be adjusted by increasing until mild toxic symptoms occur then dose is reduced slightly. Dose is guided by clinical response, growth and plasma thyroxine and thyroid stimulating hormone levels.
- b) Thyroxine may potentiate the effects of anticoagulants and side effects of salbutamol may be aggravated. Thyroxine may also increase requirements for hypoglycaemic drugs and insulin.
- c) 20microgram of liothyronine (intravenous) is equivalent to 100microgram of thyroxine. Therefore if converting from oral to IV: divide daily thyroxine dose by 5 and then give this total daily dose of liothyronine in 2-3 divided doses.

LIDOCAINE (LIGNOCAINE)

Preparations: INJECTION 0.5% (10ml), 1% (2ml, 5ml, 10ml), 2% (2ml, 5ml).
INFUSION 0.2% and 0.4% in glucose 5% 500ml.
PREFILLED SYRINGES 100mg in 5ml.

Dosage: **VENTRICULAR TACHYCARDIA**
This indication is unlicensed for use in children.
All ages, *IV injection*, initially 500microgram-1mg/kg over 1 minute (0.05-0.1ml/kg of 1%). Repeat at 5 minute intervals to a maximum of 3mg/kg, followed by an, *IV infusion* of 1mg/kg/hour. Maximum rate of infusion 3mg/kg/hour.

NEONATAL SEIZURES

This is an unlicensed indication.

IV infusion, 2mg/kg over 10 minutes, followed by 6mg/kg/hour; reduce dose over the following 24 hours (4mg/kg/hour for 12 hours, then 2mg/kg/hour for 12 hours) (see note d)

Administration: Infusions can be made up in glucose 5% or sodium chloride 0.9%

Notes:

- a) See cardiopulmonary resuscitation guidelines.
- b) Lidocaine infusions can cause respiratory depression, convulsions, hypotension and bradycardia therefore they must be administered with concurrent ECG monitoring and with cardiopulmonary resuscitation facilities available.
- c) Dose should be reduced in liver or renal impairment.
- d) Pre-term neonates may require lower doses.
- e) Lidocaine should be used with great caution in neonates who have received phenytoin infusions because of the risk of cardiac toxicity.

LINEZOLID

Preparations: INJECTION 600mg in 300ml. TABLETS 600mg.
LIQUID 100mg in 5ml.

Dosage: **TREATMENT OF RESISTANT GRAM POSITIVE INFECTIONS
(MICROBIOLOGY APPROVAL ONLY)**
IV/Oral,
Neonates <7 days old - 10mg/kg, twice a day.
Neonates >7 days old - 12 years - 10mg/kg, three times a day.
>12 years, 600mg, twice a day.

RENAL IMPAIRMENT

No dose adjustment necessary but use with caution as two main metabolites may accumulate.

Administration: IV infusion over 1 hour. May be diluted with glucose 5% or sodium chloride 0.9%.

Notes:

- a) Recommended treatment duration is 10-14 days, with a maximum duration of 28 consecutive days.
- b) Should not be used in patients taking MAOIs.
- c) Should be used under supervision in patients with uncontrolled hypertension, depression, schizophrenia or on sympathomimetic vasopressors or dopaminergic agents.
- d) Oral solution contains 45.7mg of glucose in 1ml and is orange flavoured. IV injection 0.38mg sodium in 1ml.
- e) Side effects include myelosuppression, diarrhoea, nausea, headache.
- f) In severe hepatic dysfunction use only if potential benefit outweighs risk.

LIOTHYRONINE SODIUM (TRI-IODOTHYRONINE)

Preparations: INJECTION 20micrograms.

Dosage: **REPLACEMENT AFTER CARDIAC SURGERY**
Day 1 after surgery, *IV injection*, 2mcg/kg/day (can be given as a single dose or three divided doses)
Subsequent days, *IV injection* 1mcg/kg/day (can be given as a single dose or three divided doses)
Stop when catecholamines discontinued or after a maximum of 12 days.

Administration: Reconstitute with water for injection. Further dilute if necessary with sodium chloride 0.9% and give over 30 minutes.

Notes: 20-25 microgram liothyronine = 100 microgram levothyroxine.

LISINOPRIL

Preparations: TABLETS 2.5mg, 5mg, 10mg and 20mg.
LIQUID 5mg in 5ml (**Specials Manufacturer**).

Dosage: **HYPERTENSION, CONGESTIVE CARDIAC FAILURE, PROTEINURIA**
This indication is unlicensed for use in children.
Orally, initially 0.1mg/kg/day, adjusting according to response, usually aiming for 0.5-1mg/kg/day.
Maximum dose 40mg/day. Dose is usually given once a day.

RENAL FAILURE

Keep the dose as low as possible in renal failure and if a diuretic is indicated, use a loop rather than a thiazide.

Notes:

- a) Lisinopril should be avoided whenever possible in neonates, particularly pre-term neonates due to the risk of renal failure and hypotension.
- b) ACE inhibitors reduce glomerular filtration rate leading to severe and progressive renal failure in patients with severe bilateral renal artery stenosis (or severe stenosis in a single kidney).
- c) 1mg lisinopril may substitute for 5mg of captopril.
- d) Absorption of liquid may produce a different plasma concentration than tablets. Clinical effect should be monitored when switching between dosage forms.
- e) Hyperkalaemia may occur particularly in renal failure, and with other potassium retaining drugs (e.g spironolactone)
- f) Severe hypotension may occur particularly following the first dose. Patient should be observed every 15 minutes for the first hour, then hourly for 4-6 hours.
- g) Concomitant diuretic dosages may need to be reduced or not administered concurrently to avoid severe hypotension.

LOPERAMIDE

Preparations: CAPSULES 2mg. LIQUID 1mg in 5ml.

Dosage:

CHRONIC DIARRHOEA

This indication is unlicensed for use in children < 12 years old.

Orally,

Under 1 year	0.1mg/kg	2 times a day
1 - 2 years	0.25-0.5mg	2-3 times a day
2 - 5 years	1mg	3-4 times a day
6 - 12 years	2mg	3-4 times a day

Doses up to 1.25mg/kg/day may be required.

Over 12 years 2mg 2-4 times a day up to 16mg/day

Notes:

- a) Loperamide is **not** recommended for the treatment of acute diarrhoea in children. First line therapy is prevention of fluid and electrolyte depletion (see oral rehydration solution).
- b) Do not use if inflammatory bowel disease suspected due to risk of precipitating toxic bowel disease.
- c) Loperamide should be used with caution in the very young because of the risk of respiratory depression.
- d) Loperamide is contraindicated in children with chronic diarrhoea due to overflow as a result of chronic constipation.
- e) Loperamide liquid (Imodium[®]) is raspberry/redcurrant flavoured, sucrose free and contains a negligible amount of alcohol.
- f) Caution in hepatic dysfunction - extensive first pass metabolism.

LORAZEPAM

- Preparations:* TABLETS 1mg. INJECTION 4mg in 1ml (Fridge).
LIQUID 1mg/5ml (**Manufactured Special**) (Fridge).
- Dosage:* **PREMEDICATION, PRE OPERATIVE ANXIETY, SEDATION WITH AMNESIA**
Unlicensed in children under 5 years.
Over 1 month, *orally*, 50-100microgram/kg (to the nearest 500microgram) given the night before and/or at least 1 hour before the procedure.
IV infusion: Give a loading dose 50mcg – 200mcg/kg over 2 minutes followed by 10mcg/kg/hr – 100mcg/kg/hr.
Dose adjustments should be in increments of 10mcg/kg/hr.
- STATUS EPILEPTICUS**
IV injection, rectally, sub-lingually 50-100microgram/kg. Repeat if necessary. Maximum single dose of 4mg. Maximum of 8mg or 100microgram/kg in 12 hours.
- Administration:* *IV injection*, into large vein over 1-2 minutes; dilute if required with an equal volume of water for injection or sodium chloride 0.9%.
IV infusion: Prepare a 10mg in 50ml syringe (0.2mg/ml) with glucose 5%. Attach a 0.45 micron filter to the end of the syringe and a 0.2 micron in line filter to the end of the line before the 3 way tap.
- Notes:*
- Hypotension and apnoea may occur with intravenous lorazepam.
 - Use with caution in severe liver disease as may induce coma.
 - The injection solution can be given rectally or sublingually (undiluted).
 - Injection excipients include benzyl alcohol and propylene glycol.

LOSARTAN

Preparations: TABLETS 25mg and 50mg. Liquid 2.5mg/ml (purchased on request)

Dosage: **HYPERTENSION / RENOPROTECTION FOR NEPHROPATHY**
Initially 0.5mg/kg once a day increasing to a maximum of 2mg/kg/day if tolerated.
OR
For patients weighing 20 – 50kg: Recommended dose is 25mg, which can be increased if necessary to 50mg once daily.
For patients weighing > 50kg, the starting dose is 50mg, which can be adjusted to a maximum of 100mg once daily.
The total daily dose may be given in two divided doses.
Losartan is not recommended in neonates and children with glomerular filtration rate < 30ml/min/1.73m². Losartan is not recommended in children with hepatic impairment.
In severe Liver or Renal impairment (CrCl<20ml/min/1.73m²) consider a lower starting dose.

Notes:

- a) Increased risk of hyperkalemia (more common in patients with renal impairment) with ciclosporin, NSAID's, potassium salts, tacrolimus.
- b) Like ACE inhibitors Losartan can lead to renal failure in patients with severe bilateral renal artery stenosis (or stenosis of an artery for a solitary kidney).
- c) Patients should be warned of 1st dose hypotension.
- d) Losartan is contraindicated in pregnancy.
- e) Losartan liquid comes as a powder than must be reconstituted prior to administration. It has a 28 day expiry once reconstituted and must be stored in the fridge.

MAGNESIUM SALTS (See as listed below)

a) MAGNESIUM CARBONATE

- Preparations:* CAPSULES 500mg (5mmol Mg) (**Specials Manufacturer**).
- Dosage:* **PHOSPHATE BINDER**
Orally, all ages, 250mg-500mg three times a day and titrate according to plasma phosphate levels
- Notes:* Magnesium carbonate is used as a phosphate binder when calcium carbonate is contraindicated.

b) MAGNESIUM GLYCEROPHOSPHATE

- Preparations:* TABLETS 95mg (4mmol Mg) (**Specials Manufacturer**).
LIQUID 1mmol in ml (**Specials Manufacturer**).
- Dosage:* **MAGNESIUM SUPPLEMENT**
Orally, all ages, according to plasma magnesium levels.
0.2 mmol/kg three times a day.
- Notes:* Tablets can be dispersed in water immediately before administration.

c) MAGNESIUM OXIDE

- Preparations:* CAPSULES 160mg (4mmol Mg) (**Specials Manufacturer**).
- Dosage:* **MAGNESIUM SUPPLEMENT**
Orally, all ages, according to plasma magnesium levels.
0.2 mmol/kg three times a day.
- Notes:* Magnesium oxide is used as magnesium supplement when magnesium glycerophosphate is contraindicated.

d) MAGNESIUM SULPHATE

- Preparations:* INJECTION 50% 500mg (2mmol Mg) in 1ml, 1g in 2ml, 5g in 10ml.
- Dosage:* **MAGNESIUM SUPPLEMENT IN DEFICIENCY, NEONATAL HYPOCALCAEMIA**
All ages, *slow IV injection*, 100mg/kg (maximum 10 ml) as a single dose, repeated every 12 hours as necessary.
- CONVULSIONS ASSOCIATED WITH LOW MAGNESIUM LEVELS**
This indication is unlicensed for use in children.
All ages, *slow IV injection*, 20-40 mg/kg (0.2-0.4ml/kg of a 10% solution) repeated every 4-6 hours if necessary.
- SEVERE PULMONARY HYPERTENSION, VENTRICULAR TACHYCARDIA**
IV infusion, loading dose 200mg/kg over 20-30 minutes, then continuous infusion of 20-50mg/kg/hr. Monitor blood pressure, renal function, electrolytes and blood glucose.
- REFRACTORY ACUTE ASTHMA**
All ages, *IV* 50mg/kg over 30 minutes.
- Administration:* Dilute to concentration of 10% (100mg in 1ml) with glucose 5%, sodium chloride 0.9% or glucose/saline. If fluid restricted, maximum concentration is 20% (200mg in 1ml). Rate of administration should not exceed 10mg/kg/min. May be part of total parenteral nutrition regimen.
- Notes:* Magnesium sulphate administered orally produces purgative effects.

MALARONE

Preparations: TABLETS containing proguanil hydrochloride 100mg and atovaquone 250mg (Malarone®).
PAEDIATRIC TABLETS containing proguanil hydrochloride 25mg and atovaquone 62.5mg (Malarone® Paediatric).

Dosage: **MALARIA PROPHYLAXIS**
This indication is unlicensed for use in children <11kg.
Orally,
11 - 20kg One tablet once a day (Malarone® Paediatric)
21 - 30kg Two tablets once a day (Malarone® Paediatric)
31 - 40kg Three tablets once a day (Malarone® Paediatric)
> 40kg One tablet once a day (Malarone®)
Treatment should be started one – two days before entering an endemic area and continued for 1 week after leaving.

UNCOMPLICATED FALCIPARUM MALARIA TREATMENT

11 - 20kg One tablet once a day for 3 days (Malarone®)
21 - 30kg Two tablets once a day for 3 days (Malarone®)
31 - 40kg Three tablets once a day for 3 days (Malarone®)
> 40kg Four tablets once a day for 3 days (Malarone®)

Notes:

Advice on **PROPHYLAXIS** and **TREATMENT** can be obtained from:

Medicines Information Centre

or

The London Malaria Reference Laboratory

☎ 020-7636 3924 ☎

The Hospital for Tropical Disease

☎ 020-7387 4411 (all hours) ☎

- a) Malarone should be used with caution in renal and hepatic impairment, however if treatment is prolonged patients should be monitored for signs of bone marrow depression.
- b) Efficacy not evaluated in cerebral or complicated malaria (including hyperparasitaemia pulmonary oedema or renal failure).

MALATHION

Preparations: AQUEOUS LIQUID 0.5% (Derbac-M®).

Dosage: **PEDICULOSIS**

Use only under medical supervision in babies under six months. Rub liquid gently into dry hair until all hair is thoroughly moistened. Comb and allow to dry naturally, away from heat or sunshine. Leave for 12 hours and remove by washing. Comb hair while still wet. A repeat treatment maybe needed after 7 days – check guidelines. Do not use for more than 3 consecutive weeks.

CRAB LICE IN THE EYE LASHES

UNDER OPHTHALMOLOGY SUPERVISION

This is an unlicensed indication.

Apply **aqueous** lotion to eye lashes and eyebrows using a cotton bud. Allow to dry naturally. Wash face thoroughly after 12 hours. Repeat after 7 days if necessary.

SCABIES

Use only under medical supervision in babies under six months. Apply **aqueous** lotion to the whole body from the neck downwards. In children under 2 years, the scalp, face and ears, avoiding the eyes and mouth, should be treated as well. Leave for 24 hours. Wash off thoroughly. Can be repeated after 7 days.

Notes:

PEDICULOSIS

- a) Avoid contact with the eyes. Rarely, skin irritation has been reported.
- b) Alcoholic based preparation is preferred since it dries quickly after application. Aqueous preparation should be used in cases of skin sensitivity, abrasions of the scalp, in asthmatic patients and young children.
- c) Rotation of preparations is now outmoded. A mosaic pattern of use should be employed, i.e. an alternative preparation used if after repeat administration of the initial preparation there are still live lice.
- d) Household contacts should **NOT** routinely be treated, only treat if infestation has occurred. Prophylactic use of an insecticide is not recommended.

SCABIES

- a) Refer to guidelines on scabies.
- b) If hands are washed with soap and water during treatment period reapply lotion.
- c) It is often advisable, to repeat application after 7 days, to cover any areas that may have been missed.
- d) Only the aqueous solution should be used in the treatment of scabies.
- e) Household contacts should be treated for scabies.

MANNITOL

Preparations: INJECTION 50g in 500ml (10%) and 100g in 500ml (20%).

Dosage: **CEREBRAL OEDEMA & OCULAR OEDEMA**
IV infusion, all ages, 250-500mg/kg over 30-60 minutes (doses up to 1.5g/kg have been used).

May be repeated if required provided the serum osmolality is not greater than 310mOsm/L.

PERIPHERAL OEDEMA & ASCITES
> 1 month 1-2g/kg single dose

Notes: 20% solution is supersaturated, warming dissolves crystals that form.

MEBENDAZOLE

Preparations: TABLETS (CHEWABLE) 100mg. LIQUID 100mg in 5ml.

Dosage:

THREADWORM

Orally, >6 months 100mg single dose.

Family members should be treated at the same time. If re-infection suspected a 2nd dose should be given after 2-3 weeks.

WHIPWORM, LARGE ROUNDWORM, COMMON HOOKWORM

>1 year 100mg twice a day for three consecutive days

Dose may need adjusting in liver impairment but no dose reduction is required in renal failure.

Notes:

- a) Liquid is banana flavour.
- b) Plasma concentrations may be lowered with concurrent administration of phenytoin or carbamazepine.

MELATONIN

Preparations: TABLETS 3mg (**Import**). TABLETS PROLONGED RELEASE 2mg.
LIQUID 1mg in 1ml (**Specials Manufacturer**).

Dosage: **SLEEP DISTURBANCE**
Orally, all ages, initially, 2-4mg 30-60 minutes before bedtime.
Increase dose according to response (max 12mg).
- usual to use the Prolonged Release Tablets if able to swallow tablets.

SLEEP PROMOTION FOR EEG

<i>Orally</i> ,	children under 5 years of age	3mg
	children over 5 years of age	6mg
	Older teenagers and more difficult children may require a dose of 12mg.	

- usual to use the 3mg tablets or liquid

Melatonin should be given at the onset of electrode application.

Notes:

- a) Melatonin may have a proconvulsive effect and should be used with caution in neurologically impaired children.
- b) Tablets may be crushed and dispersed in water.
- c) Endogenous serum melatonin concentration is elevated in nocturnal asthmatic patients. Therefore any extra melatonin supplementation might worsen the attacks. Use with caution in this group of patients.

MERCAPTAMINE (CYSTEAMINE)

Preparations: CAPSULES 50mg and 150mg.
EYE DROPS 0.55% (**GSTT special**).

Dosage: **TREATMENT OF NEPHROPATHIC CYSTINOSIS**
Orally,
Initial dose, all ages, 200-300mg/m²/**day** increasing over 4-6 weeks to maintenance dose (see note a).
Maintenance dose,
Under 12 year, 1.3g/m²/**day** in 2 to 4 divided doses.
Over 12 year, 2g/**day** in 2 to 4 divided doses.

OR

Weight (kg)	Dose (given four times a day)
0-4.5	100mg
5-9	150mg
10-13	200mg
14-18	250mg
19-22	300mg
23-31	350mg
32-41	400mg
42-50	450mg
>50	500mg

Total daily dose can be given in 2 or 3 divided doses, if tolerated to aid compliance, especially in older children.

Instil, eye drops into affected eyes four to six times a day.

Notes:

- Doses should be increased slowly to ensure they are tolerated. Larger doses may cause nausea and vomiting.
- White cell cystine levels should be monitored regularly to assess effectiveness. A trough blood sample should be taken i.e. immediately prior to next dose.
- Cysteamine has an unpleasant taste and smell. Patients should be advised if opening capsules, to sprinkle on or mix in strongly flavoured drink or food. Cysteamine may cause an unpleasant smell on the breath of patients taking it. This may be masked using breath fresheners including Breathasure[®].
- Cysteamine capsules contain the bitartrate salt and the eye drops are the hydrochloride salt.

MEROPENEM

Preparations: INJECTION 500mg and 1g.

Dosage: **TREATMENT OF INFECTION (MICROBIOLOGY APPROVAL ONLY)**
This indication is unlicensed for use in children under 3 months.
IV injection,
Neonates < 7 days 20mg/kg twice a day
Neonates > 7 days 20mg/kg three times a day
> 1 month 10-20mg/kg three times a day.
Increase dose up to 40mg/kg in severe infection including meningitis, cystic fibrosis. Maximum 6g/day.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dose	Dosage Interval (hours)
25-50	100%	12
10-25	50%	12
<10	50%	24

CAPD, HD: Meropenem is dialysed. Give dose as in GFR < 10ml/min.

CAV/VVHD: Meropenem is dialysed: administer 50% of dose every 12 hours. In life threatening infections increase interval to every 8 hours.

Administration: Reconstitute with water for injection (using appropriate displacement values) to give 50mg in 1ml:
IV injection, give over at least 5 minutes, dilute if required with glucose 5% or sodium chloride 0.9% and give immediately.
IV infusion, dilute as above and give over 15-30 minutes.

Notes:

- a) Meropenem is a beta-lactam antibiotic. There is partial cross allergenicity between penicillins and cephalosporins. In confirmed allergy an alternative antibiotic should be prescribed. Contact the Microbiology department for further advice.
- b) Each 1g of powder (Meronem[®]) contains 3.9mmol of sodium.

MESALAZINE

Preparations: ASACOL[®] FOAM ENEMA, Mesalazine 1gram/metered application
SUPPOSITORIES, Mesalazine 250mg.
ASACOL[®] MR TABLETS, EC, Mesalazine 400mg.
PENTASA[®] TABLETS, MR, SCORED, Mesalazine 500mg.
GRANULES MR, mesalazine 1gram SACHET and 2gram SACHETS.
RETENTION ENEMA, Mesalazine 1gram in 100ml.
SUPPOSITORIES, Mesalazine 1gram.

Dosage: **TREATMENT OF MILD TO MODERATE ULCERATIVE COLITIS AND MAINTENANCE OF REMISSION**

For dose see under preparations below.

Note The delivery characteristics of oral mesalazine preparations may vary; these preparations should not be considered interchangeable.

ASACOL[®] FOAM ENEMA

Acute attack affecting the rectosigmoid region.

Rectally, Child 12 - 18 years 1 metered application (mesalazine 1g) once daily for 4–6 weeks.

Acute attack affecting the descending colon.

Rectally, Child 12 - 18 years 2 metered applications (mesalazine 2g) once daily for 4–6 weeks.

ASACOL[®] SUPPOSITORIES

Treatment and maintenance of remission of ulcerative colitis affecting the rectosigmoid region.

Rectally, Child 12 - 18 years 250–500 mg 3 times daily, with last dose at bedtime.

ASACOL[®] MR

Acute attack

Orally, Child 12 - 18 years 800 mg 3 times daily.

Maintenance of remission of ulcerative colitis & Crohn's.

Orally, Child 12 - 18 years 400–800 mg 2–3 times daily.

PENTASA[®] MR TABLETS

(Administration: tablets may be halved, quartered, or dispersed in water, but should not be chewed)

Acute attack

Orally, Child 5 - 15 years 15–20 mg/kg (max. 1 g) 3 times daily.
Child 15 - 18 years 1–2 g twice daily; total daily dose may alternatively be given in 3 divided doses.

Maintenance of remission

Orally, Child 5 - 15 years 10 mg/kg (max. 500 mg) 2–3 times daily.

Child 15 - 18 years 500 mg 3 times daily; total daily dose may alternatively be given in 2 divided doses.

PENTASA[®] GRANULES

(Administration: contents of one sachet can be weighed and divided immediately before use; discard any remaining granules. Granules should be placed on tongue and washed down with water or orange juice without chewing).

Acute attack

Orally, Child 5 - 12 years 15–20 mg/kg (max. 1 g) 3 times daily.
Child 12 - 18 years 1–2 g twice daily; total daily dose may alternatively be given in 3–4 divided doses.

Maintenance of remission

Orally, Child 5 - 12 years 10 mg/kg (max. 500 mg) 2–3 times daily.

Child 12 - 18 years 2 g once daily.

PENTASA® RETENTION ENEMA**Acute attack affecting the rectosigmoid region**

Rectally, Child 12 - 18 years 1 g at bedtime.

PENTASA® SUPPOSITORIES**Acute attack, ulcerative proctitis**

Rectally, Child 12 - 18 years 1 g daily for 2–4 weeks.

Maintenance, ulcerative proctitis

Rectally, Child 12 - 18 years 1 g daily.

Notes:

- a) Renal function should be monitored before starting an oral aminosalicylate, at 3 months of treatment, and then annually during treatment (more frequently in renal impairment).
- b) Renal impairment use with caution; avoid if estimated glomerular filtration rate less than 20 mL/minute/1.73 m²
- c) Avoid in severe hepatic impairment
- d) Asacol® (all preparations) not licensed for use in children under 18 years; Pentasa® tablets and suppositories not licensed for use in children under 15 years.
- e) Children receiving aminosalicylates and their carers should be advised to report any unexplained bleeding, bruising, purpura, sore throat, fever or malaise that occurs during treatment. A blood count should be performed and the drug stopped immediately if there is suspicion of a blood dyscrasia.

MESNA

Preparation: INJECTIONS 400mg in 4ml and 1g in 10ml.
TABLETS 400mg and 600mg.

Dosage: **PREVENTION OF UROTHELIAL TOXICITY BY CYCLOPHOSPHAMIDE**
Dose of Mesna is 20% (w/w) of the cyclophosphamide dose given *IV* at the time cyclophosphamide is given. Mesna is then given orally at 40% (w/w) of the cyclophosphamide dose at 2 and 6 hours following the initial dose.

Administration: Dose can be increased up to 160% of cyclophosphamide dose.
May be given neat as an IV bolus.

Notes:

- a) Injection can be given orally diluted with orange juice or cola.
- b) Mesna administration is to ensure that toxic cyclophosphamide metabolites are neutralised. Mesna has very low toxicity therefore rounding up of doses to facilitate administration is acceptable.

METARAMINOL

Preparations: Metaraminol 10mg (as tartrate)/ml INJECTION (**Specials Manufacturer**).

Dosage: **EMERGENCY TREATMENT OF ACUTE HYPOTENSION**
IV infusion, 12 - 18 years: initially by IV injection 0.5–5 mg, then by IV infusion 15–100 mg adjusted according to response.

ACUTE HYPOTENSION

IV infusion, 12 - 8 years: 15–100 mg adjusted according to response.

Administration: Dilute to a concentration of 30–200 micrograms/mL with Glucose 5% or Sodium Chloride 0.9% and give through a central venous catheter.

Notes: Metaraminol has a longer duration of action than noradrenaline, and an excessive vasopressor response may cause a prolonged rise in blood pressure

METFORMIN

Preparations: TABLETS 500mg and 850mg.
SLOW RELEASE TABLETS 500mg, 750mg and 1000mg.
POWDER FOR ORAL SOLUTION 500mg and 1000mg SACHETS
LIQUID 500mg in 5ml.

CAN ONLY BE PRESCRIBED BY A PAEDIATRIC ENDOCRINOLOGIST

Dosage: **DIABETES MELLITUS**
This indication is unlicensed for children under 10 years.
Orally,
Child 8 - 10 years, initially, 200mg once a day adjusted according to response at intervals of at least 1 week.
Child 10 - 18 years, initially, 500mg once a day adjusted according to response at intervals of at least 1 week.
SR tablets: initially, 500mg once a day, increased every 10-15 days to a maximum dose of 2g once daily with evening meal. If control not achieved, use 1g twice daily with meals and if control still not achieved, change to standard-release tablets.
Powder for oral solution: usual starting dose is 500mg or 850mg once daily, given during or after meals. After 10 to 15 days the dose should be adjusted on the basis of blood glucose measurements.
Maximum recommended dose is 2g daily in 2-3 divided doses.

Administration: Powder for oral solution: The powder should be poured into a glass and 150ml water should be added to obtain a clear to slightly opalescent solution. The solution should be taken immediately after being prepared. If necessary, the solution may be stirred (see note h).

Notes:

- Metformin is the drug of first choice in children with type 2 diabetes, in whom strict dieting has failed to control diabetes.
- Hypoglycaemia does not usually occur with metformin; other advantages are lower incidence of weight gain and lower plasma-insulin concentration
- Gastro-intestinal side-effects are initially common with metformin, and may persist in some children, particularly when high doses are given. A slow increase in dose may improve tolerability
- Metformin should be used cautiously in renal impairment because of increased risk of lactic acidosis; it is contra-indicated in children with significant renal impairment. To reduce the risk of lactic acidosis, metformin should be stopped or temporarily withdrawn in those at risk of tissue hypoxia or sudden deterioration in renal function, such as those with dehydration, severe infection, shock, sepsis, acute heart failure, respiratory failure or hepatic impairment.
- Cutting or crushing the slow release tablets is not recommended as this will destroy their slow release properties.
- Powder for oral solution does not have slow release properties.
- Powder for oral solution contains aspartame.
- Powder for oral solution can be added to sparkling water, cola, orange juice or milk.

METHIONINE

Preparations: TABLETS 500mg (**Import**).

Dosage: **PARACETAMOL OVERDOSE**

**IF IN ANY DOUBT CONTACT THE MEDICAL TOXICOLOGY UNIT
☎ 020 7188 0600 ☎**

Orally, methionine is highly effective in preventing toxicity and is easier to administer than acetylcysteine. It can be used if the child presents within 8 hours of ingestion, is conscious, not vomiting and has not been given activated charcoal.

Under 6 years,	1g 4 hourly for 4 doses
6 years and over,	2.5g 4 hourly for 4 doses

Notes:

- a) If the child presents after 8 hours from ingestion of paracetamol or cannot be given an oral preparation give acetylcysteine. Discuss with the Medical Toxicology Unit.
- b) Do not use in patients with metabolic acidosis.

METHOTREXATE

Preparations: TABLETS 2.5mg. INJECTIONS may be ordered via pharmacy.
LIQUID 10ml in 5ml (**Specials Manufacturer**).

Dosage: **SEVERE UNCONTROLLED PSORIASIS**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

This indication is unlicensed for use in children.

Orally, initially, 200-400microgram/kg **once a week**.

SC, initially, 10-15mg/m² **once a week**.

JUEVENILE IDIOPATHIC ARTHRITIS, CROHN'S DISEASE

Oral/SC/IM/IV 10-15mg/m² **once a week** starting dose followed by maintenance up to 25mg/m² **once a week** (increase dose only if necessary and tolerated).

IN RENAL FAILURE

Creatinine Clearance (ml/minute/1.73m ²)	Dose
20-50	50-100% of normal dose
10-20	50% of normal dose
<10	contraindicated

CAPD, HD, CAV/VVHD - not dialysed therefore contra-indicated.

Notes:

- CSM warning:** Monitor liver and renal function and perform a full blood count before starting therapy, weekly whilst stabilising and then every 2-3 months during therapy. Patient/carer should be warned to report the onset of sore throats, mouth ulcers, bruising and other indicators of blood dyscrasias.
- Aspirin and NSAIDs may reduce excretion of methotrexate and therefore increase toxicity, AVOID concomitant administration.
- Phenytoin, trimethoprim and co-trimoxazole, and antimalarials increase the antifolate effect of methotrexate. Penicillins, acitretin, probenecid and ciclosporin increase the risk of toxicity.
- Patient held methotrexate books must be filled in by the doctor each time Methotrexate is prescribed and checked by the pharmacist.
- Other strengths of methotrexate tablet are available (10mg). Only one strength should be prescribed and dispensed (usually 2.5mg).

METHYLCELLULOSE

Preparations: TABLETS 500mg. MUCILAGE 4% 200mg in 5ml, (**Specials Manufacturer**).

Dosage: **CONSTIPATION**
This indication is unlicensed for use in children.
Orally, 50mg/kg twice a day
OR
1 - 7 years 10ml or 500mg twice a day
7 - 14 years 20ml or 1g twice a day
Over 14 years 1.5 to 3g twice a day

Notes:

- a) Methylcellulose is a bulk forming laxative; the full effect may take some days to develop therefore prescribe regularly.
- b) Avoid in intestinal obstruction, infective bowel disease, faecal impaction and colonic atony.
- c) Should be taken with copious amounts of water and **NOT** at bedtime.
- d) Methylcellulose tablets contain lactose.

METHYLPHENIDATE - (CD)

Error! TABLETS 5mg, 10mg.

Bookmark not defined. Preparations:

PROLONGED RELEASE TABLETS 18mg and 27mg Concerta XL®.
MODIFIED RELEASE CAPSULES 10mg, 20mg Equasym XL®.

Dosage:

ATTENTION DEFICIT HYPERACTIVITY DISORDER (NARCOLEPSY – UNLICENSED INDICATION)

Orally,

4 - 6 years, 2.5mg twice daily – increase if necessary by 2.5mg/day at weekly intervals (max 1.4mg/kg daily in divided doses)

> 6 years, 5mg once or twice a day, 30 minutes after breakfast and lunch. Increase by 5-10mg a day every week. Usual maintenance dose 1mg/kg/day. If required, doses may be increased by 5mg a day every 3 days, side effects permitting. Maximum of 60mg/day given in 2-4 divided doses.

Oral, (Concerta XL®)

> 6 years, 18mg in the morning, increase if necessary by weekly increments of 18mg daily according to response. Maximum of 54mg daily. (Occasionally may be increased to 2.1mg/kg (max. 108mg daily)).

Oral, (Equasym XL®)

> 6 years, 10mg in the morning, increase if necessary by weekly increments of 10mg daily according to response. Maximum of 60mg daily. (Occasionally may be increased to 2.1mg/kg (max. 90mg daily)).

Notes:

- a) Clinicians should note any personal or family cardiovascular history including chest pain and syncope and consider performing an ECG. A baseline blood pressure should be performed. Methylphenidate may, rarely, cause leucopenia or thrombocytopenia, therefore watch for nose bleeds and bruising.
 - b) The release characteristics of the modified release preparations vary; thus prescribing must be brand specific.
- Continued over page.**
- c) Total of 15mg daily of immediate release formulations = 18mg daily of Concerta XL.
 - d) Patients/carers should be counselled to report any side effects particularly whilst dose is being established.
 - e) Methylphenidate decreases appetite and lead to reversible growth retardation if weight gain not maintained. Baseline assessment of weight and height should be performed and subsequently monitored 3 monthly.
 - f) If anorexia is a problem, give dose after breakfast and lunch.
 - g) Doses may be given in more divided doses if rebound hyperactivity occurs in the latter part of the day but because methylphenidate may cause insomnia, the last dose should not usually be given later than 4pm.
 - h) Use with caution in patients with a diagnosis or family history of tics, Tourette's syndrome or epilepsy.
 - i) Regimen should regularly be reviewed and drug holidays considered if prolonged poor weight gain.
 - j) Methylphenidate may inhibit the metabolism of tricyclic antidepressants,

phenytoin and possibly phenobarbitone and primidone.

- k) Concerta XL should be swallowed as a whole tablet. The tablet membrane may pass through the gut and the shell be seen in the stool
- l) Extended release capsules may be opened and taken mixed in a spoonful of apple sauce, do not chew beads.

METHYLPREDNISOLONE

- Preparations:* INJECTION (as sodium succinate) 40mg, 500mg and 1g.
- Dosage:* **GRAFT REJECTION**
IV injection, 600mg/m² body surface area, once a day for 3 days. (Maximum dose 1g/day). Can be given alternate days for 3 doses.
- RENAL TRANSPLANT PROTOCOL**
600mg/m² stat given pre renal transplant for induction of immunosuppression.
- SEVERE JUVENILE IDIOPATHIC ARTHRITIS, CONNECTIVE TISSUE DISORDERS, DEMYELINATION DISORDERS**
All ages, *IV* 30mg/kg once daily for 3-5days (maximum 1g/day) (see note d).
- Administration:* Reconstitute taking into account the displacement value as per manufacturer's instructions. Dilute if required with sodium chloride 0.9%, glucose 5% or glucose/saline and give over 30 minutes. Do not give more rapidly because of the risk of cardiovascular collapse.
- Notes:*
- a) Severe hypertension may occur after IV injection, especially if dose is given too rapidly.
 - b) Methylprednisolone is no longer recommended for septic shock.
 - c) High dose methylprednisolone, as above, increases blood ciclosporin levels.
 - d) Weaning to oral prednisolone is often required, but should be considered on an individual patient basis.

METOCLOPRAMIDE

Preparations: TABLETS 10mg. LIQUID 5mg in 5ml. INJECTION 10mg in 2ml.

Dosage:

NAUSEA AND VOMITING

The licensed use of metoclopramide in children is for severe intractable vomiting of known cause, vomiting associated with radiotherapy/chemotherapy, as an aid to gastrointestinal intubation and as a premedicant prior to surgery.

Orally, IM or slow IV injection,

Up to 1 year (<10kg)	100microgram/kg	3 times a day
1 - 3 years (10-14kg)	1mg	2-3 times a day
3 - 5 years (15-19kg)	2mg	2-3 times a day
5 - 9 years (20-29kg)	2.5mg	3 times a day
9 - 14 years (>30kg)	5mg	3 times a day
Over 15 years (>30kg)	5-10mg	3 times a day

Total daily dose should not exceed 500microgram/kg.

STIMULATION OF MILK PRODUCTION

Orally (to mother), 10-15mg three times a day.

Taper off treatment over 5-10days.

Administration:

Slow IV injection over 1-2 minutes. Dilute if required with sodium chloride 0.9% or glucose 5%.

Notes:

- a) Extrapyramidal disturbances may be experienced and are more common in the young. They can be treated with an anticholinergic, e.g. procyclidine.
- b) Injection can be given orally.
- c) Metoclopramide liquid is sugar free.

METOLAZONE

Preparations: TABLETS 5mg.

Dosage: **DIURESIS**

This indication is unlicensed for use in children.

Orally, 100microgram – 200microgram/kg once or twice a day.

Maximum 80mg/**day**.

Notes:

- a) Metolazone has a synergistic effect with frusemide and the combination will sometimes produce diuresis in patients with seriously impaired renal function.
- b) Suspension can not be prepared but the tablets may be crushed and mixed with water immediately before use.

METOPROLOL

Preparations: TABLETS 50mg and 100mg.
LIQUID (**Extemporaneously Prepared**).

Dosage: **HYPERTENSION**
This indication is unlicensed for use in children.
Orally, initially 1mg/kg twice a day. Increase to maximum of 8mg/kg/**day**. Daily dose can be given in up to 4 divided doses.

METRONIDAZOLE

Preparations: TABLETS 200mg and 400mg. LIQUID 200mg in 5ml.
SUPPOSITORIES 500mg and 1g. INJECTION 500mg in 100ml.

Dosage: **TREATMENT OF ANAEROBIC INFECTION, PROPHYLAXIS FOR SURGERY, TREATMENT OF CLOSTRIDIUM DIFFICILE DIARRHOEA**
Orally or IV injection,

AGE	LOADING DOSE	DOSE
Neonates	15mg/kg loading dose followed 24 hours later by	7.5mg/kg 12 hourly
Over 1 month	---	7.5mg/kg 8 hourly

Rectally,

AGE	DOSE	
Less than 1 year	125mg	three times a day
1 - 5 years	250mg	
5 - 10 years	500mg	
Over 10 years	1g	

After 3 days of rectal therapy, change to oral therapy or reduce frequency to twice a day.

GIARDIASIS

Orally,

AGE	DOSE	
Less than 1 year	40mg/kg	once a day for 3 days
1 - 3 years	500mg	
3 - 7 years	600-800mg	
7 - 10 years	1g	
Over 10 years	2g	

H. PYLORI

Orally,

AGE	DOSE	
1 - 6 years	100mg	three times a day
6-12 years	200mg	
> 12 years	400mg	

Treatment for 7 days with omeprazole and amoxicillin.

PROPIONIC AND METHYLMALONIC ACIDAEMIA

Orally, 10mg/kg/day divided between 2-3 doses.

Reduces propionate production by gut bacteria.

IN RENAL FAILURE AND LIVER FAILURE

Metronidazole is rapidly removed by dialysis and therefore dose should be administered immediately following period of haemodialysis. No dosing adjustments are necessary for intermittent or continuous ambulatory peritoneal dialysis.

Reduce dose in severe liver disease. Avoid in hepatic encephalopathy. If required, reduce daily dose to 1/3, give daily.

Administration: IV injection over 20 minutes.

Notes:

- a) Metronidazole is well absorbed orally and rectally. The IV preparation should only be used where the oral/rectal routes are not possible or for initiating treatment of serious conditions.
- b) The effects of oral anticoagulants may be potentiated by concurrent metronidazole, however heparin is not affected.
- c) Barbiturates may enhance the metabolism of metronidazole.
- d) Due to interactions between metronidazole and alcohol, prescribers should be cautious when prescribing liquid preparations that contain alcohol concurrently with metronidazole.
- e) Metronidazole suspension is available in the benzoate form and therefore requires a low stomach pH to be broken down into metronidazole. If patients are currently taking ranitidine or a proton pump inhibitor concurrently, then metronidazole is less effective and the tablets should be crushed and dispersed in water. This also applies for patients with diarrhoea as the reduced transit time in the gut may lead to insufficient absorption of the drug. Suspension is also not suitable for use in patients with tubes terminating in the jejunum.

MICONAZOLE

Preparations: ORAL GEL 2% (80g). CREAM 2% (30g).

Dosage:

ORAL CANDIDIASIS

Oropharangeally,

4 months - 2 years 2.5ml twice a day

2 - 6 years 5ml twice a day

6 - 12 years 5ml four times a day

Over 12 years 5-10ml four times a day

Gel should be retained in mouth for as long as possible before swallowing. Use for at least 2 days after the infection has cleared. For a localised infection the gel can be applied directly to the affected area. Administer after meals or feeds.

DERMATOPHYTE AND CANDIDA SKIN INFECTIONS

Apply cream to the affected area two to three times a day. To prevent relapse, continue for 10 days after lesions have healed.

Notes:

- a) Miconazole oral gel (Daktarin[®]) is orange flavoured and sucrose free but does contain alcohol.
- b) Not recommended under 4 months of age due to risk of choking.

MIDAZOLAM

Preparations: INJECTION 10mg in 5ml, 10mg in 2ml.
 LIQUID 2.5mg in 1ml (**Specials Manufacturer**).
 BUCCAL 5mg in 1ml [2.5mg, 5mg, 7.5mg, 10mg pre-filled oral syringes] (**Specials Manufacturer**).
 BUCCAL SOLUTION 10mg in 1ml (**Specials Manufacturer**).

Dosage: **SEDATION, PREMEDICATION**
 This indication is unlicensed for use in children.
Slow IV bolus
 All ages, 50mcg/kg single dose
 If after 2 minutes sedation is not adequate, incremental doses can be given. Doses > 5mg are rarely needed (may rarely need up to 10mg in the 6-12 year age group).
Orally, all ages, 500microgram/kg (maximum 20mg).
Buccal, all ages, 200-300microgram/kg (maximum 10mg).
 Prefilled syringes should be used where possible – dose as per Status Epilepticus.
Intranasal, all ages, 200-300microgram/kg (max. 10mg) (Half the dose should be given into each nostril).

SEDATION FOR ARTIFICIAL VENTILATION

All ages, *slow IV injection*, 100microgram/kg then an initial *IV infusion*, 5-200mcg/kg/hr. Dosage should be increased according to response.

INDUCTION OF ANAESTHESIA

Over 7 years, *slow IV injection*, 150microgram/kg. Up to 3 supplementary doses of 50microgram/kg can be given at 2 minute intervals.

STATUS EPILEPTICUS

This is an unlicensed indication. See note f).

Slow IV injection	all ages	100-200microgram/kg
<i>IV infusion</i>	all ages	30-300microgram/kg/hour
<i>Buccal</i>	0 – 3 months	300microgram/kg (maximum 500microgram/kg)
	3mths – 1year	2.5mg
	1year – 5year	5mg
	5years- 10years	7.5mg
	> 10years	10mg
		(doses may be repeated once after 10 minutes)

Administration: For IV infusion, dilute if required with sodium chloride 0.9% or 5% glucose.

Notes:

- a) When used with opiates, potentiation of respiratory or cardiovascular depression may occur. Intravenous midazolam has caused respiratory depression, sometimes with severe hypotension.
- b) Erythromycin and clarithromycin inhibits the metabolism of midazolam resulting in profound sedation. This effect is also seen with cimetidine, itraconazole, ketoconazole and possibly fluconazole.
- c) Flumazenil reverses midazolam induced respiratory depression.

- d) Treatment beyond one to two weeks, especially at large doses, has been associated with an acute benzodiazepine withdrawal syndrome. Infusions should be gradually reduced over several days.
- e) Injection is painful and may cause thrombophlebitis.
- f) Injection solution may be used intranasally, sublingually or orally however it is extremely bitter and may be irritant to mucosa. Orally it may be given with blackcurrant juice, chocolate sauce or cola
- g) Buccal administration – give half the dose between the upper lip and gum on each side of the mouth. Try to retain in the mouth for at least 5 minutes before swallowing

MILRINONE

Preparations: INJECTION 10mg in 10ml
PREFILLED SYRINGES 5mg in 50ml, 20mg in 50ml, 50mg in 50ml

Dosage: **CONGESTIVE CARDIAC FAILURE**
This indication is unlicensed for use in children.
IV injection, all ages, loading dose 50mcg/kg, followed by 0.5mcg/kg/minute, according to response. Dose should not normally exceed 0.75mcg/kg/minute.
PICU, IV infusion,
These Pre-filled syringes should be used on PICU and must be used in combination with the “smart” infusion pumps.
<4.9kg 5mg in 50ml
5-19.9kg 20mg in 50ml
>20kg 50mg in 50ml

IN RENAL FAILURE

Dose should be reduced by 25-50% in severe renal failure and the infusion adjusted to haemodynamic and clinical response.

Administration: Dilute with sodium chloride 0.45% and 0.9% or glucose 5%. Loading dose to be administered over 10-20 minutes. In fluid restricted patients can be given undiluted.

Notes:

- a) Do NOT mix milrinone injection with furosemide due to precipitation.
- b) The half life of milrinone is approximately 2 hours therefore there is no need to double pump when changing syringes.

MINOXIDIL

Preparations: TABLETS 2.5mg, 5mg and 10mg.
LIQUID (**Extemporaneously Prepared**).

Dosage: **SEVERE HYPERTENSION**
Under 12 years, *orally*, initially 200microgram/kg/day in 1-2 divided doses. Increase by 100-200microgram/kg/day every 3 days, to a maximum of 1mg/kg/day.
Over 12 years, *orally*, initially 5mg once a day, increasing by 5mg a day every 3 days. Maximum dose 100mg/day.

Notes:

- a) Minoxidil may cause sodium and water retention and tachycardia, thus it is generally prescribed along with a diuretic and a beta-blocker.
- b) Dose should be taken after dialysis where appropriate.
- c) Hypertrichosis occurs in most patients. This is generally reversible 1-3 months after treatment is stopped.
- d) Tablets may be crushed and dissolved.

MODAFINIL

Preparations: TABLETS 100mg.

Dosage: **NARCOLEPSY**

ON CONSULTANT ADVICE ONLY

This indication is unlicensed for use in children under 12 years and should only be used in exceptional circumstances.

Orally,

Child 5 - 12 years Initially 100mg daily (Max. 400mg)

Child 12 - 18 years Initially 200mg daily (Max. 400mg)

Notes:

- a) The total daily dose can be either given in the morning as a single dose or in divided doses (morning and noon).
- b) Monitor blood pressure and heart rate in patients with hypertension.
- c) Reduce dose in renal and liver impairment.
- d) Rarely serious rashes have been reported in children. Treatment should be discontinued at first signs of rash. This must be discussed with carers and documented.

MONTELUKAST

Preparations: PAEDIATRIC CHEWABLE TABLETS 4mg and 5mg. TABLETS 10mg.
PAEDIATRIC GRANULES 4mg.

Dosage: **ASTHMA THERAPY**

ON CONSULTANT ADVICE ONLY

This indication is unlicensed for use in children under 6 months.

Orally,

6 months - 5 years 4mg in the evening

6 -14 years 5mg in the evening

Over 14 years 10mg in the evening

Notes:

- a) **Note:** Montelukast is not for immediate relief of acute asthma attacks and existing corticosteroid therapy should not be withdrawn or reduced.
- b) Phenobarbitone, phenytoin, rifampicin may reduce montelukast levels.
- c) **Caution:** Leukotriene receptor antagonists (Montelukast) may be associated with the emergence of Churg-Strauss Syndrome.
- d) Chewable tablets are cherry flavoured and contain aspartame.
- e) Granules are administered either directly in the mouth or mixed with a spoonful of cold or room temperature soft food. The sachet should not be opened until ready to use. If mixed with food, this must not be stored for future use. The granules are not intended to be dissolved in liquid, however, liquids may be taken following administration.

MORPHINE SULPHATE - (CD)

Preparations: INJECTION 10mg in 1ml and 60mg in 2ml.
IMMEDIATE RELEASE TABLETS (Sevredol®) 10mg and 20mg.
SLOW RELEASE TABLETS (MST) 5mg, 10mg, 15mg, 30mg, 60mg.
CONTROLLED RELEASED GRANULES (MST) 20mg, 30mg (note h).
SUPPOSITORIES 5mg, 10mg (**Specials Manufacturer**), 15mg, 20mg and 30mg.
LIQUID 100micrograms in 1ml (**Manufactured Special**).
LIQUID 10mg in 5ml.
PRE-FILLED SYRINGES (**PICU only**) 3mg in 50ml, 10mg in 50ml and 50mg in 50ml
PRE-FILLED SYRINGES (**NICU only**) 1mg in 20ml, 4mg in 20ml

Dosage: **PREMEDICATION AND ANALGESIA FOR MODERATE TO SEVERE PAIN**
These indications are unlicensed for use in children via the parenteral route. **See notes below.**

Oral/Rectal.

1 month -1 year, 80 - 200microgram/kg/dose up to 4 hourly.

Over 1 year, 200 - 500microgram/kg/dose up to 4 hourly.

Maximum of 2.5mg/kg/day.

OR

1 - 5 years 2.5-5mg every 4 hours

6 - 12 years 5-10mg every 4 hours

Over 12 years 10-20mg every 4 hours

Slow or controlled release products are given as the total daily dose in 2 divided doses. The dose is usually, *orally*, 200-800microgram/kg every 12 hours.

SC injection.

Neonate: Initially, 100 micrograms/kg every 6 hours, adjusted according to response.

Child 1 - 6 months: Initially 100 – 200 micrograms/kg every 6 hours, adjusted according to response.

Child 6 months - 2 years: Initially 100 – 200 micrograms/kg every 4 hours, adjusted according to response.

Child 2 - 12 years: Initially 200 micrograms/kg every 4 hours, adjusted according to response

Child 12 - 18 years: Initially 2.5 – 10mg every 4 hours, adjusted according to response.

SC infusion, via an indwelling butterfly needle.

Over 1 month, loading dose 100 - 200microgram/kg, then 20microgram/kg/hr.

Only suitable for 48-72 hours at any one site.

IV injection, over at least 5 - 10 minutes.

Neonates, 50 - 100microgram/kg/dose

Over 1 month, 100 - 200microgram/kg/dose

IV infusion,

Preterm loading dose 25-50microgram/kg then neonates, 5microgram/kg/hr.

Neonates, loading dose 50-100micrograms/kg then 5-10microgram/kg/hr.

Over 1 month, loading dose 100-200microgram/kg then 10-30micrograms/kg/hr.

Under 6 months the initial infusion rate is 10microgram/kg/hour

and over 6 months 20microgram/kg/hour. In non-ventilated patients maximum dose is 60microgram/kg/hour. Ventilated patients may need to exceed these doses to achieve adequate sedation and pain management.

PICU, IV infusion,

These Pre-filled syringes should be used on PICU and must be used in combination with the “smart” infusion pumps.

<3.9kg 3mg in 50ml
 4 - 19.9kg 10mg in 50ml
 >20kg 50mg in 50ml

TREATMENT OF NEONATAL OPIOID WITHDRAWAL

Initial, 40microgram/kg 4 hourly, increase by 20microgram/kg/dose until control achieved. Continue (controlling dose) for at least a week.
 Reducing, Reduce frequency of dose on a 2-7 day basis to 6, 8, 12, and 24 hourly dose. Discontinue at a dose of 40microgram/kg/daily.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dosage adjustment
10-50	75% of dose
< 10	50% of dose

Notes:

- a) Oral bioavailability of morphine is approximately 50%. To convert IV infusion to oral dose, multiply the total daily IV dose by 2 to obtain total daily oral dose and then administer in 4-6 divided doses.
- b) Neonates and infants show an increased susceptibility to respiratory depression however this should not exclude them from adequate analgesia. Above doses reflect the increased sensitivity and decreased metabolism seen in neonates and infants. All non-ventilated patients should be assessed regularly for pain, sedation and respiration.
- c) Naloxone reverses morphine induced respiratory depression.
- d) Dosage titration should be made by increasing or decreasing the previous dose by 30-50%.
- e) Conversion to MST should only be made after the total daily dose required has been established. The first dose of MST is given prior to discontinuing previous treatment.
- f) See also premedication guidelines and pain management guidelines.
- g) Part doses of the dissolved controlled release granules appear to be fairly inaccurate.
- h) Pre-filled syringes should be used on PICU and NICU and must be used in combination with the “smart” infusion pumps.

MOVICOL

Preparations: MOVICOL ORAL POWDER SACHET containing Macrogol 3350 13.125g.
MOVICOL PAEDIATRIC PLAIN ORAL POWDER SACHET containing Macrogol 3350 6.563g.

Dosage: **CONSTIPATION (MOVICOL)**
1 sachet Movicol = 2 sachets of Movicol Paediatric Plain
This indication is unlicensed for use in children.
Orally, initially, 1 - 6 years 1 sachet daily Movicol Paediatric (max 4 daily)
6 - 12 years 2 sachets daily Movicol Paediatric (max 4 daily)
>12 years 1-3 sachets daily Movicol

Doses usually given once as a single dose each week and titrated according to response (see constipation guidelines).

FAECAL IMPACTION

Daily dosage regimen up to 7 days

Age (years)	Day 1	Days 2&3	Days 4&5	Days 6&7
1 – 5 years Movicol Paediatric	2 sachets	4 sachets	6 sachets	8 sachets
5 – 12 years Movicol Paediatric	4 sachets	6-8 sachets	10-12 sachets	12 sachets
> 12 years Movicol	8 sachets	8 sachets	-	-

The daily number of sachets should be taken in divided doses all consumed within a 12 hour period.

The above dosage regimen should be stopped once disimpaction has occurred.

Administration: Each Movicol sachet should be dissolved in 125ml of water. Each Movicol Paediatric Plain should be dissolved in 62.5ml of water and contains half the electrolytes of Movicol. Solution may be stored in the refrigerator (2-8°C) for up to 6 hours.

Notes:

- On reconstitution in 125ml of water each Movicol (adult) sachet provides 65mmol/L sodium, 53mmol/L chloride, 5.4mmol/L potassium and 17mmol/L bicarbonate.
- For use in faecal impaction the correct number of sachets can be reconstituted in advance and kept covered and refrigerated. Adult Movicol[®] sachets can be stored in the fridge for 6 hours following reconstitution. Movicol Paediatric Plain[®] can be stored in the fridge for up to 24 hours following reconstitution.
- Abdominal distension, pain and nausea can occur.

MULTIVITAMIN (see as listed below)

a) ABIDEC®

Preparations: ABIDEC® DROPS: 0.6ml contains vitamin A 1333 units, ergocalciferol 400 units, vitamin C 40mg, thiamine 0.4mg, riboflavine 800microgram, nicotinamide 8mg, pyridoxine 800microgram.

Dosage: **MULTIVITAMIN SUPPLEMENT**
Orally,
Premature babies, 0.6ml once a day continue for 6-12 months.
Infants, 0.3ml once a day.
Children over 1 year, 0.6ml once a day.

Notes:

- a) Abidec drops contain 45mg of sucrose in 0.6ml.
- b) In cystic fibrosis doses are doubled.
- c) In the absence of Abidec, Dalivit may be substituted at the same doses bearing in mind it has nearly four times the concentration of Vitamin A.
- d) Abidec contains Arachis oil (peanut oil) and should not be taken by patients known to be allergic to peanut. As there is a possible relationship between allergy to peanut and allergy to Soya, patients with Soya allergy should also avoid Abidec Multivitamin Drops.

b) KETOVITE®

Preparations: TABLETS containing ascorbic acid 16.6mg, riboflavine 1mg, thiamine 1mg, pyridoxine 330microgram, nicotinamide 3.3mg, calcium pantothenate 1.16mg, alphatocopheryl acetate 5mg, inositol 50mg, biotin 170microgram, folic acid 250microgram, acetomenaphthone 500microgram.

LIQUID each 5ml contains: vitamin A 2500 units (750microgram), ergocalciferol 400 units, choline chloride 150mg, cyanocobalamin 12.5microgram.

Dosage: **MULTIVITAMIN SUPPLEMENT**
Orally, all ages, 5ml of liquid **and** 3 tablets per day.

Notes:

- a) Tablets **and** liquid must **both** be given for complete vitamin supplementation.
- b) These preparations do not contain sucrose, lactose, starch, sodium or artificial colouring.
- c) Ketovite liquid and tablets must be stored in fridge.

c) FORCEVAL®

Preparations: CAPSULES, vitamins (ascorbic acid 60mg, biotin 100micrograms, cyanocobalamin 3micrograms, folic acid 400micrograms, nicotinamide 18mg, pantothenic acid 4mg, pyridoxine 2mg, riboflavin 1.6mg, thiamine 1.2mg, vitamin A 2500units, vitamin D₂ 400 units, vitamin E 10mg, minerals and trace elements (calcium 100mg, chromium 200micrograms, copper 2mg, iodine 140micrograms, iron 12mg, magnesium 30mg, manganese 3mg, molybdenum 250micrograms, phosphorus 77mg, potassium 4mg, selenium 50micrograms, zinc 15mg).

SOLUBLE JUNIOR TABLETS, vitamins (ascorbic acid 375micrograms, vitamin D₂ 5micrograms, thiamine 1.5mg, riboflavin 1mg, vitamin B₆ 1mg, vitamin B₁₂ 2micrograms, vitamin C 25mg, vitamin E 5mg, biotin 50micrograms, niacin, 7.5mg, pantothenic acid 2mg, vitamin K 25micrograms, folic acid

100micrograms) mineral and trace elements (iron 5mg, copper 1000micrograms, magnesium 1mg, iodine 75micrograms, potassium 96miligrams, zinc 5mg, manganese 1.3mg, selenium 25micrograms, chromium 50micrograms, molybdenum 50micrograms)

Dosage:

VITAMIN AND MINERAL DEFICIENCY

1 year - 4 years 1 Forceval Junior tablet daily
5 years - 12 years 2 Forceval Junior tablets daily
> 12 years 1 Forceval capsule daily

Notes:

Junior capsules can be snipped open and contents squeezed out.

d) DIALYVIT[®] Paediatric Formula

Preparations:

CAPLETS, vitamin (B₁) 0.8mg, vitamin (B₂) 1mg, niacinamide 12mg, vitamin (B₆) 2mg, pantothenic acid 6mg, folic acid 1mg, vitamin (B₁₂) 1mcg, biotin 20mcg, vitamin C 40mg, vitamin E₃ I.U., Vitamin (K₁) 20mcg, copper (oxide) 0.8mg, zinc (oxide) 8mg.

Dosage:

VITAMIN AND MINERAL DEFICIENCY (DIALYSIS & CHRONIC RENAL FAILURE)

Children under 5 years old, ½ caplet daily.

Children over the age of 5, one caplet daily.

To be swallowed or chewed between meals or as directed by physician. For patients on haemodialysis, Diallyvit[®] Paediatric Formula should be taken immediately after a dialysis session, then daily between sessions.

Notes:

Caplets can be crushed and dissolved.

MUSTINE HYDROCHLORIDE (CHLORMETHINE HYDROCHLORIDE)

Preparations: INJECTION 10mg (**Import**).

Dosage: **NEPHROTIC SYNDROME**
IV injection, 100microgram/kg (Max 10mg) daily for 4 days.
In overweight or grossly oedematous patients ideal body weight must be used for calculating the dose.
Repeat the course after 4 weeks or when neutrophils >1000.

Administration: Mustine is a cytotoxic drug; therefore it will be reconstituted in the oncology pharmacy department.
Sodium Chloride 0.9% or 5% glucose should be started pre-mustine as the mustine is administered as an injection, over approximately 2 minutes, through the side port of a fast running drip (approximately 150-200ml/hour).

Notes:

- a) **CAUTION: MUSTINE IS A VESICANT.** Extravasation during injection and any contact with skin, eyes or mucosa should be avoided.
- b) Check chemotherapy extravasation policy before use. A Trust extravasation kit and spill kit must be available on the ward.
- c) If eyes contaminated, flush with copious amounts of water or 1.26% sodium bicarbonate (in polyfusor) for at least 10 minutes. Seek urgent medical advice. If skin contaminated, wash in copious amounts of water, and seek urgent medical advice.
- d) Whenever possible, mustine should be prescribed as a weekday course as it is only stable for 6 hours, if refrigerated, after reconstitution.
- e) Ensure patient is hydrated before and after mustine dose. If patient is vomiting institute intravenous fluid therapy.
- f) Mustine is highly emetogenic, give antiemetic before injection.
- g) Mustine may cause thrombophlebitis especially if concomitant infusion rate is too slow. Superficial thrombophlebitis can be treated with a heparinoid cream e.g. Lasonil®.

MYCOPHENOLATE

Preparations: MYCOPHENOLATE MOFETIL CAPSULES 250mg. TABLETS 500mg. SUSPENSION 1g in 5ml. INTRAVENOUS INFUSION 500mg VIAL MYCOPHENOLIC ACID (MYFORTIC[®]) TABLETS 180mg AND 380mg (**restricted use** see notes f-h)

Dosage: **PREVENTION OF RENAL ALLOGRAFT REJECTION, NEPHROTIC SYNDROME**

The oral preparation is unlicensed for renal allograft rejection in children under 2 years. The IV preparation is unlicensed in children. Unlicensed for use in nephrotic syndrome.

Mycophenolate mofetil, *Orally / IVI*, 600mg/m² (maximum 1g) twice a day.

PREVENTION OF LIVER TRANSPLANT REJECTION

This indication is unlicensed for use in children.

Mycophenolate mofetil, *Orally / IVI*, 10mg/kg twice a day increasing to 20mg/kg twice a day (maximum 1g twice a day).

Administration: Dilute reconstituted vial to 6mg/ml with Glucose 5% - give over 2 hours.

Notes:

- a) Monitor full blood count at least weekly during first month, twice monthly during second and third months, then monthly in the first year.
- b) Absorption is reduced by antacids and anion exchange resins.
- c) Elevated plasma concentrations of aciclovir and mycophenolate occur with concomitant administration.
- d) Prophylaxis against cytomegalovirus infection or reactivation should be considered. Discuss with Medical Virologist on call.
- e) Some children tolerate the total daily dose better if divided into 4 doses.
- f) Restricted use only: Mycophenolic acid is available for patients who can not tolerate the GI side effects of mycophenolate mofetil only.
- g) Mycophenolic acid 720mg ≈ mycophenolate mofetil 1g.
Mycophenolic acid 360mg ≈ mycophenolate mofetil 500mg.
Mycophenolic acid 180mg ≈ mycophenolate mofetil 250mg
- h) Avoid unnecessary switching between products due to potential pharmacokinetic differences.

NALIDIXIC ACID

Preparations: LIQUID 300mg in 5ml.

Dosage:

URINARY TRACT INFECTION TREATMENT

Over 3 months 12.5mg/kg four times a day, reduce dose to 7.25mg/kg four times a day for long term therapy.

PROPHYLAXIS OF URINARY TRACT INFECTION

Over 3 months 12.5mg/kg once a day.

IN RENAL FAILURE

If creatinine clearance is less than 20ml/min/1.73m² give half the normal dose.

Notes:

- a) Do not use in children under 3 months, due to risk of increased intracranial pressure and acidosis.
- b) Nalidixic Acid should not be used in patients with a history of convulsions (increased risk with NSAID's).
- c) Nalidixic Acid and nitrofurantoin are mutually antagonistic in vitro.
- d) Nalidixic Acid may potentiate the effects of Warfarin, and increased chance of nephrotoxicity when given with cicosporin.
- e) Nalidixic Acid may precipitate haemolytic reactions in G6PDH deficient individuals.

NALOXONE

- Preparations:** INJECTION 400microgram in 1ml.
PRE-FILLED SYRINGE (Minijet) 400microgram in 1ml.
- Dosage:** **REVERSAL OF OPIOID INDUCED RESPIRATORY DEPRESSION**
Neonates: *IV injection*, 10microgram/kg, repeated every 2-3 minutes as necessary. Doses up to 100microgram/kg have been used. In neonates with respiration depressed by maternal opioids, it is generally preferred to give an *IM injection* of 200microgram (60microgram/kg) for a prolonged effect within 4 hours of delivery.
Children: *IV injection*, 4-10microgram/kg. If respiratory improvement is not achieved, a larger dose of 100microgram/kg (maximum 2mg) may be administered. If there is still no response, other causes may be responsible.
IV infusion, 5-20micrograms/kg/hr.
SEVERE OPIOID INDUCED ITCHING
Unlicensed indication – Second line
IV infusion, 1microgram/kg/hour.
IV bolus, 0.5microgram/kg - repeat at 10min intervals (max 4 doses).
- Administration:** Dilute if required with sodium chloride 0.9% or glucose 5%.
Infusion – make up to 4micrograms/ml (in fluid restriction may increase to 24micrograms/ml). Any solution not used within 12 hours should be discarded.
- Notes:**
- a) **CAUTION:** The half-life of an opioid may be longer than that of naloxone. A second dose of naloxone may be required to prevent respiratory depression recurring.
 - b) Naloxone can be given by IM or SC injection, however the IV route is preferred **except** for neonates with respiration depressed by maternal opioids. Given by IM injection, onset of action of naloxone is approximately 3-4 minutes and duration is 18 hours. The onset is approximately 2 minutes if given IV, but duration is only 3-4 hours.

NAPROXEN

Preparations: ENTERIC COATED TABLETS 250mg. TABLETS 250mg and 500mg.
LIQUID 125mg in 5ml (**Special Manufacture**).

Dosage: **JUVENILE RHEUMATOID ARTHRITIS, NON-STEROIDAL ANTI-INFLAMMATORY ANALGESIC**
Naproxen is unlicensed for use in children under 5 years.
Orally, 5mg/kg twice a day.

IN RENAL FAILURE

Use with caution, avoid if creatinine clearance is less than 20ml/minute/1.73m², unless dialysis patient.

Notes:

- a) Naproxen is contraindicated in patients with a history of hypersensitivity (including asthma, angioedema, urticaria or rhinitis) to aspirin or any other non-steroidal anti-inflammatory drug or with a coagulation defect.
- b) CAUTION, use in renal, cardiac or hepatic failure may cause a deterioration in renal function; the dose should be kept as low as possible and renal function monitored.

NASEPTIN

Preparations: CREAM containing chlorhexidine hydrochloride 0.1% and neomycin sulphate 0.5%.

Dosage: **ERADICATION OF NASAL STAPHYLOCOCCI**
Apply to inside of each nostril 4 times a day for 10 days.

PROPHYLAXIS
Apply to inside of each nostril twice a day.

Notes:

- a) Prolonged use can lead to skin sensitisation.
- b) **Note:** Naseptin[®] cream contains arachis (peanut) oil.

NEOSTIGMINE

Preparations: TABLETS 15mg. INJECTION 2.5mg in 1ml.
LIQUID (**Extemporaneously Prepared**).

Dosage: **MYASTHENIA GRAVIS**
Neonates
Orally, initially, 1-2mg followed by 1-5mg every 4 hours.
IM injection, initially, 100microgram followed by 50-250microgram *IV, IM or SC injection* every 4 hours (see note a).
Neostigmine should be given at least 30 minutes before feed.
Over 1 month
Orally, initially,
Under 6 years 7.5mg then at suitable intervals during the day.
6 - 12 years 15mg then at suitable intervals during the day.
Adjust according to response, range usually 15-90mg per day.
Neostigmine usually produces a therapeutic effect for 4 hours.
Maximum dose is 300mg/day although most patients can only tolerate a dose of 180mg/day.
IV, IM or SC injection, 200-500microgram as required.
Test dose for Myasthenia Gravis: 0.05mg/kg IV/IM.

REVERSAL OF NON-DEPOLARISING MUSCLE RELAXANTS

Slow *IV injection* 50-80microgram/kg in combination with a slow *IV injection* of atropine 10-20microgram/kg (maximum of 600mcg) over 1 minute.

Administration: Oral neostigmine should be administered at least 30 minutes before food.

Notes:

- a) 1microgram *IV* is equivalent to 2-3microgram given by *IM* or *SC injection* or to 30microgram orally.
- b) When used in a conscious child e.g. in myasthenia gravis, neostigmine may cause severe gastro-intestinal pain. Simultaneous administration of atropine may prevent the muscarinic side effects.
- c) In neonates with myasthenia gravis, treatment beyond 8 weeks is only required in the rare condition of congenital and familial infantile myasthenia.

NIFEDIPINE

Preparations: CAPSULES 5mg and 10mg. Modified release (MR) TABLETS 10mg and 20mg. SLOW RELEASE TABLETS (Adalat LA[®]) 30mg and 60mg.
LIQUID 2% (20mg in 1ml) (**Import**).

Dosage: These indications are unlicensed for use in children.

HYPERTENSIVE CRISIS

All ages, *orally*, 250-500microgram/kg (see note a).

HYPERTENSION

All ages, *orally*, 200-300microgram/kg 3 times a day **or** 5-10mg 3 times a day. Maximum 3mg/kg/day.

Modified release tablets, 10-20mg twice a day. Transplant patients may require three times a day dosing (see note b).

Slow release tablets, once a day.

Notes:

- a) **For rapid effect**, bite the capsule releasing the contents into the mouth and then **swallow**. If neither 5mg or 10mg are the appropriate dose use the liquid.
- b) Only in the event of liquid being unavailable, the content of the capsules may be syringed out:-
10mg Bayer capsules contain 10mg nifedipine in 0.34ml
10mg Norton capsules contain 10mg nifedipine in 0.45ml
- c) Nifedipine is **very** light sensitive. Cover required dose of liquid from capsules in foil and administer immediately. Capsule contents may also be diluted with water to aid administration. Use immediately. Discard any remainder.
- d) Tablets may be crushed to aid administration; however this may alter the modified release characteristic of the tablet and therefore administration might be needed more often (i.e. three times a day). Crushed tablets should also be administered within 30-60 seconds of crushing to avoid significant loss in potency of drug.
- e) Nifedipine should be prescribed by generic name, strength, form and trade name to ensure continuity of the same preparation for the patient as NOT ALL PRODUCTS ARE BIOEQUIVALENT.
- f) Liquid 2% contains 20 drops in 1ml (1 drop = 1mg).
- g) Avoid grapefruit juice.

NIMODIPINE

Preparations: INJECTION 10mg in 50ml. TABLETS 30mg.

Dosage: These indications are unlicensed for use in children.

**SEEK EXPERT ADVICE FROM NEUROLOGIST OR
NEUROSURGEON BEFORE PRESCRIBING**

TREATMENT OF VASOSPASM FOLLOWING SUBARACHNOID HAEMORRHAGE

IV infusion, 15microgram/kg/hr increasing after 2 hours to 30microgram/kg/hr provided no severe decrease in blood pressure is observed. If blood pressure is unstable starting dose is 7.5microgram/kg/hr.

Treatment should start as soon as possible and continue for at least 5 days to a maximum of 14 days.

PREVENTION OF VASOSPASM FOLLOWING SUBARACHNOID HAEMORRHAGE

Orally, 0.9-1.2mg/kg every 4 hours (max. 60mg) for 21 days.

OR

1 - 4 years 15mg every 4 hours

5 - 11 years 30mg every 4 hours

12 - 16 years 45mg every 4 hours

Over 16 years 60mg every 4 hours

Administration: Infuse neat via a central catheter. Nimodipine reacts with polyvinyl chloride (PVC) and should be avoided. Use polyethylene or polypropylene plastic infusion materials. Protect infusions from light.

If infused peripherally – must be administered with a co-infusion running at 40ml/hr of sodium chloride 0.9% or glucose 5%.

Notes:

- a) Tablets may be crushed or halved but are light sensitive therefore administer immediately and discard any remaining drug.
- b) Infusion contains 20% ethanol and 17% polyethylene glycol-400.

NITISINONE (NTBC)

Preparations: CAPSULES 2mg, 5mg, and 10mg. (Fridge). Only 2mg capsules are kept at ECH.

Dosage: **TREATMENT OF TYROSINAEMIA TYPE 1**
Orally, all ages, initially 0.5mg/kg twice a day at least 1 hour before food (maximum dose 2mg/kg/day).

Notes:

- a) Aim to maintain plasma tyrosine levels below 600micromol/L.
- b) NTBC treatment has been associated with some ophthalmological and haematological problems. All adverse effects must be reported.
- c) Capsules can be opened and the content dispersed in water.

NITRAZEPAM

Preparations: TABLETS 5mg. LIQUID 2.5mg in 5ml.

Dosage: **EPILEPSY, DYSTONIA**
This is an unlicensed indication.

Orally, initially,

Up to 1 year	250-500microgram/kg	twice a day
1 - 4 years	2.5mg	twice a day
5 - 12 years	2.5-5mg	twice a day
>12 years	2.5-15mg	twice a day

Notes:

- a) Nitrazepam liquid (Somnite[®]) is cherry flavoured and contains 2g of sucrose in 5ml.
- b) Nitrazepam is rarely used for epilepsy. If a benzodiazepine is indicated clobazam or clonazepam are preferred.

NITROFURANTOIN

Preparations: CAPSULES 50mg and 100mg. LIQUID 25mg in 5ml.

Dosage: **URINARY TRACT INFECTION**
Orally, over 3 months, 3mg/kg/day in 4 divided doses.
In severe infections the above dose can be doubled.

PROPHYLAXIS
Orally, over 3 months, 1mg/kg at night.

IN RENAL FAILURE
Nitrofurantoin should not be used if creatinine clearance is less than 60ml/minute/1.73m².

Notes:

- a) Nitrofurantoin is not usually used in infants less than 3 months due to the theoretical risk of haemolytic anaemia.
- b) Acute, subacute and chronic pulmonary reactions and peripheral neuropathy have been observed. If these occur treatment should be stopped immediately.
- c) Nitrofurantoin may cause haemolysis in patients with glucose-6-phosphate dehydrogenase (G-6-PD) deficiency.
- d) Nitrofurantoin and the quinolones are mutually antagonistic in vitro.

NORADRENALINE (NOREPINEPHRINE)

Preparations: INJECTION noradrenaline 1:1000 1ml = 1mg Noradrenaline Base (2mg Noradrenaline Tartrate) (4mg in 4ml and 20mg in 20ml).

Dosage: **VASOPRESSOR**
This indication is unlicensed for use in children.
IV infusion, 20-100nanogram/kg/minute (0.02-0.1microgram/kg/minute) of noradrenaline **base**. Increase to a maximum of 1microgram/kg/minute of noradrenaline **base**.

Administration: IV infusion, dilute in glucose 5% or glucose/saline and administer via a central line.

Notes:

- a) Local extravasation into tissue will cause necrosis.
- b) Noradrenaline is incompatible with alkaline solutions.

NORFLOXACIN

Preparations: TABLETS 400mg.

Dosage: **URINARY TRACT INFECTIONS**

This indication is unlicensed for use in children.

Orally, 5 years and over, 6mg/kg twice a day for 7-10 days (3 days in uncomplicated lower urinary tract infections).

IN RENAL FAILURE

If CrCl <30ml/minute/1.73m² reduce to once a day dose.

Notes:

- a) **CSM Warning:** At the first sign of pain or inflammation, discontinue treatment, rest the affected limb until tendon symptoms have resolved.
- b) Theophylline levels, the anticoagulant effect of warfarin and the nephrotoxic effect and plasma levels of ciclosporin may be increased.
- c) Sucralfate, antacids and iron should not be administered concomitantly.
- d) Tablets may be crushed or halved but are light sensitive therefore administer immediately and discard any remaining drug.

NYSTATIN

- Preparations:* LIQUID 100,000 units in 1ml.
Nystaform (Nystatin 100,000 units/g + chlorhexidine 1%) CREAM.
- Dosage:* **OROPHARYNGEAL CANDIDA**
Oropharangeally, 1ml of liquid dropped into the mouth and retained for one minute before swallowing, or 1 pastille dissolved in the mouth, 4 times a day, after meals or feeds.
- TREATMENT IN THE NEWBORN**
Orally, 1ml of liquid applied round the mouth after each feed.
- POST RENAL TRANSPLANT** See *transplant protocol*.
Orally, 1ml of liquid 4 times a day for 5 days.
- TOPICAL CANDIDA**
>1 month apply Nystaform cream 2-3 times a day. Continue for 7 days after lesions have healed.
- Notes:*
- a) Nystatin liquid (Rosemont) is sugar free.
 - b) All children on peritoneal dialysis prescribed systemic broad spectrum antibiotics should receive concomitant nystatin.
 - c) Nystaform may not be suitable on premature skin, due to the chlorhexidine. Consider Clotrimazole cream as an alternative.

OCTREOTIDE

Preparations: INJECTION 50microgram in 1ml, 100microgram in 1ml and 500microgram in 1ml (Fridge).

Dosage: **HYPERINSULINAEMIA**
IV/SC infusion, 5-20micrograms/kg/day.

SECRETORY DIARRHOEA

IV/SC, start at 0.7micrograms/kg twice a day increasing by 0.3micrograms/kg/dose every 3 days up to a maximum of 2micrograms/kg three times a day.

CHYLOTHORAX

IV Infusion, 1-4micrograms/kg/hr.
S/C bolus, 10microgram/kg three times a day.

BLEEDING GASTRO-OESOPHAGEAL VARICES

This is an unlicensed indication.

IV infusion, all ages, loading dose, 1microgram/kg then 1microgram/kg/hour for 2-5 days. Doses up to 3micrograms/kg/hr have been used to control bleeding.

Administration: IV: Dilute with Sodium Chloride 0.9% to not less than 1:1 and not more 1:9 by volume (this applies to any size vial).
Change syringes every 8 hours. (This applies to any size vial).

Notes: Octreotide should be withdrawn slowly. Halve rate every 6 to 12 hours.

OESTROGENS (TOPICAL)

Preparations: CREAM containing conjugated oestrogens (equine) 0.625mg in 1gram (Premarin[®]).

Dosage: **FUSED LABIA MINORA**
Topically, infants, once a day for two weeks.

Administration: Apply firmly to the line of fusion a small amount on a cotton bud with a gentle pressure.
Apply sparingly initially to avoid irritation and apply more if no irritation occurs. If irritation continues with sparring use stop treatment.

OLOPATADINE

Preparations: EYE DROPS 1mg/ml (Opatanol®).
SEASONAL ALLERGIC CONJUNCTIVITIS
For children over 3 years:
Eye drops: 1 drop in each eye twice a day. Maximum 4 months duration of treatment.

Notes:

- a) Olopatadine eye drops are the only antihistamine eye drops approved for the Paediatric Formulary.
- b) In case of concomitant therapy with other topical ocular medicines, an interval of five to ten minutes should be allowed between successive applications.
- c) Patients should be instructed to wait 10-15 minutes after instillation of Olopatadine before inserting contact lenses. Olopatadine should not be administered while wearing contact lenses.

OMALIZUMAB

Preparations: INJECTION 150mg (Fridge)

Pharmacy Approval Required – NICE does not support the use of Omalizumab in Children <12 years.

Dosage:

PROPHYLAXIS OF SEVERE PERSISTENT ALLERGIC ASTHMA

Over 6 years: *SC injection*, according to immunoglobulin E concentration and body weight, consult product literature.

75-375mg of omalizumab in 1 to 3 injections may be needed for each administration.

Maximum recommended dose is 375mg omalizumab every 2 weeks

Administration:

For Subcutaneous administration only. Do not administer by the intravenous or intramuscular route.

The deltoid region of the arm or thigh is the best injection site.

Consult product literature for instructions on how to reconstitute the powder in each 150mg vial (see note e).

Notes:

- a) Omalizumab is recommended for children who cannot be controlled adequately with high-dose corticosteroids and long-acting beta₂ agonists in addition to leukotriene receptor antagonists, theophylline, oral corticosteroids, oral beta₂ agonists and smoking cessation where clinically appropriate. The following conditions apply:
 - confirmation of IgE-mediated allergy to a perennial allergen by clinical history and allergy testing.
 - either 2 or more severe exacerbations of asthma requiring hospital admission within the previous year, or 3 or more severe exacerbations of asthma within the previous year, at least one of which required hospital admission, and a further 2 which required treatment or monitoring in excess of the patient's usual regimen, in an accident and emergency unit.
- b) Omalizumab should be discontinued at 16 weeks in patients who have not shown an adequate response to therapy.
- c) Churg-Strauss syndrome has occurred rarely in patients given omalizumab – the reaction is usually associated with the reduction or withdrawal of oral corticosteroid therapy. Corticosteroids should not be discontinued abruptly once omalizumab therapy has been started – they may be withdrawn slowly under clinical supervision.
- d) Hypersensitivity reactions can also occur immediately following treatment with omalizumab or sometimes more than 24 hours after the first injection. Medication for severe hypersensitivity should be available.
- e) Solution should be used within 4 hours of preparation.

OMEPRAZOLE

Preparations: TABLETS (MUPS) 10mg and 20mg.
SOLUTION 10mg in 5ml (**Manufactured Special**) (Fridge).

Dosage: **SEVERE REFLUX OESOPHAGITIS**
This indication is unlicensed for use in children under 2 years.

<i>Orally,</i>	Once Daily Dose	Maximum Daily Dose
<2.5kg	0.7-1.4mg/kg	3mg/kg/day
2.5 – 7kg	5mg	3mg/kg/day (max10mg)
7 - 15kg	10mg	20mg daily
>15kg	20mg	40mg daily

HELICOBACTER PYLORI ERADICATION

This indication is unlicensed for use in children.

The above doses should be used for 7 days in conjunction with treatment doses of amoxicillin (see amoxicillin) and clarithromycin (see clarithromycin).

Administration: MUPS[®] tablets may be dispersed in water (do not crush the tablet) for oral liquid administration. Halve the tablet before dispersing for the 5mg dose.

Notes:

- a) Omeprazole should only be used in the treatment of severe oesophagitis refractory to H₂ receptor antagonists. It is not recommended as first line therapy administration. MUPS[®] tablets may be administered via gastrostomy.
- b) Omeprazole may increase levels of phenytoin, digoxin, diazepam and tacrolimus and increase the anticoagulant effect of warfarin.
- c) A liquid is available as a manufactured special. However there is only limited evidence of their efficacy and MUPS[®] should be used where possible.

ONDANSETRON

Preparations: INJECTION 4mg in 2ml and 8mg in 4ml. TABLETS 4mg and 8mg.
SOLUTION 4mg in 5ml.

Dosage: **EMESIS**
Orally, 100 - 150micrograms/kg 8-12 hourly.
IV injection, 100 – 150 micrograms/kg 8-12 hourly (see note c).
Over 12 years old maximum dose is 8mg.

Administration: Slow IV bolus over 2-5 minutes, dilute if necessary with sodium chloride 0.9% or glucose 5%.

Notes:

- a) Injection can be given orally.
- b) Ondansetron liquid is sugar free.
- c) 4mg is the maximum licensed dose for postoperative nausea and vomiting, but up to 8mg has been used. In chemotherapy doses of $5\text{mg}/\text{m}^2$ are usually used.
- d) May increase QT interval – use with caution in patients with congestive heart failure, bradyarrhythmias, hypokalaemia or hypomagnesaemia or on other medications that prolong QT interval. Avoid in patients with congenital long QT syndrome.

ORAL REHYDRATION SOLUTION

Preparations: DIORALYTE[®] NATURAL SACHETS containing Na 60mmol/L, K 20mmol/L, Cl 60mmol/L, citrate 10mmol/L and glucose 90mmol/L.

ELECTROLADE[®] Blackcurrant SACHETS containing Na 50mmol/L, K 20mmol/L, Cl 40mmol/L, bicarbonate 30mmol/L and dextrose 111mmol/L.

Dosage: **ORAL REHYDRATION**
Infants, 150ml/kg/day, **OR** 1-1.5 times the usual feed volume.
Children and adults, 20-40ml/kg/day, **OR** 1 sachet after each loose motion.

Once rehydrated, reintroduce the normal diet. Breast feeding can continue to be offered between oral rehydration drinks.

Notes:

- a) Treat mild to moderate diarrhoea with oral rehydration solutions, however if severe, intravenous therapy is indicated. Anti-diarrhoeals and antibiotics are not generally indicated as infections are usually viral and will resolve quickly.
- b) Following reconstitution with 200ml of water, solution can be stored for up to 24 hours in a fridge, used within one hour out of the fridge.
- c) Only add to feeds at the recommendation of the dietitian.

OSELTAMIVIR

Preparations: CAPSULES 30mg, 45mg, 75mg. SUSPENSION 6mg in 1ml.

VIROLOGY APPROVAL REQUIRED

**UNLESS INFLUENZA ANNOUNCED TO BE CIRCULATING IN THE COMMUNITY –
SEE OSELTAMIVIR GUIDELINES ON TRUST INTRANET**

Dosage:

TREATMENT OF INFLUENZA IN AT RISK CHILDREN (SEE NOTE A)

0 – 1 month	2mg/kg	twice a day
1 month - 3 months	2.5mg/kg	twice a day
3 months -12 months	3mg/kg	twice a day
1 year - 3 years	30mg	twice a day
3 years - 7 years	45mg	twice a day
7 years - 12 years	60mg	twice a day
> 12 years	75mg	twice a day

Treatment should be commenced within 48 hours of first symptoms and given for 5 days. Immunocompromised children require a longer course and should be discussed with Virology.

POST EXPOSURE PROPHYLAXIS (SEE NOTE B)

Dose as for treatment, but only once a day for 10 days. Duration depends on individual circumstances.

This indication is licensed for prophylaxis in children >1 year and always requires Virology approval.

Notes:

- a) At risk children = chronic respiratory disease, significant cardiovascular disease, chronic renal disease, immunocompromised, diabetes mellitus.
- b) Prophylaxis in at risk children, who are not effectively protected by influenza vaccine and who can commence oseltamivir within 48 hours of exposure to influenza.
- c) During a pandemic other suspensions may be available from the Department of Health which vary in taste, storage and strength.

OXYBUTYNIN HYDROCHLORIDE

Preparations: TABLETS 2.5mg and 5mg.
MODIFIED RELEASE TABLETS 5mg and 10mg.
LIQUID 2.5mg in 5ml.

Dosage: **NEUROGENIC BLADDER DISORDERS, BLADDER SPASM, DAYTIME WETTING, HYPOSPADIUS**

These indications are unlicensed for use in children under 5 years. The use in bladder spasm is unlicensed for use in children. Doses are usually started low (once a day) and titrated upwards on a weekly basis.

Orally,

Age	Initial Dose TAB, LIQUID	Max. dose
<2 years	0.1-0.2mg/kg 2-3 times daily	1.25mg three times daily
2 - 5 years	1.25-2.5mg twice daily	2.5mg three times daily
5 - 12 years	2.5mg-5mg twice daily	5mg three times daily
>12 years	2.5mg-5mg 2-3 times daily	5mg four times daily
	Initial Dose MR. TABS	
>6 years	5mg once a day	15mg once a day
>12 years	5mg once a day	20mg once a day

Notes:

- a) Ensure patient is able to empty bladder particularly if large doses prescribed.
- b) The side effects of oxybutynin are mostly anticholinergic and include dry mouth, blurred vision, constipation and facial flushing.
- c) Oxybutynin elixir (Ditropan[®]) contains 1.3g of sucrose in 5ml.
- d) Oxybutynin Modified-Release (Lyrinel XL[®]) must be swallowed whole with the aid of liquid, and must not be chewed, divided, or crushed.
- e) Patients should be advised that the tablet membrane of Lyrinel XL[®] (modified-release tablet) may pass through the gastrointestinal tract unchanged. This has no bearing on the efficacy of the product.

PALIVIZUMAB

Preparations: INJECTION 50mg and 100mg (Fridge).

Dosage: **RSV PROPHYLAXIS (RESTRICTED USE – SEE NOTE A)**
IM, 15mg/kg monthly during the RSV season. Maximum of 5 doses in one season.

Administration: IM only – volumes > 1ml should be administered in different site. Anterolateral aspect of the thigh is the best injection site.

Notes:

- a) Babies <2 years with severe chronic lung disease on home oxygen or who have had prolonged use of oxygen during the RSV season should receive Palivizumab.
Infants <6 months of age who have left to right shunt haemodynamically significant congenital heart disease (CHD) and/or pulmonary hypertension and other babies <2 years with chronic lung disease, congenital abnormalities or severe immunodeficiency may be considered (speak to pharmacy), but funding must be in place before discussing with parents.
Chronic lung disease defined as oxygen dependency for at least 28 days from birth. Palivizumab is not currently licensed for use in children with immunodeficiency.
- b) Medication for severe hypersensitivity should be available.
- c) Solution should be used within 3 hours of preparation.

PANCREATIN PREPARATIONS

Preparations:

Preparations	Protease (units)	Lipase (units)	Amylase (units)
CREON 10000 CAPSULES (enteric coated beads)	600	10,000	8,000
CREON 25000 CAPSULES (enteric coated beads)	1000	25,000	18,000
PANCREX V POWDER	1400	25,000	30,000
CREON MICRO (PER 100MG)	200	5000	3600

Note contents of Pancrease capsules are expressed in USP units on the container from the manufacturer. In the above table the contents are expressed as PhEur units.

Dosage:

PANCREASE, CREON, PANCREX V POWDER

Dose varies considerably according to the child's needs but initial doses are:

Orally, (Capsule doses are based on using Creon 10000).

Neonates, 1/4 capsule with feeds increasing in 1/4 capsule increments to 1 capsule (or 250-500mg of Pancrex V powder).

Children, 1 capsule with snacks and 1-2 before each meal. The beads must not be chewed, but can be emptied out of the capsule and mixed with a small amount of liquid or soft food e.g. jam or apple juice. Do not add to hot food.

Increase slowly according to response. Total dose of pancreatin should not exceed 10,000 units of lipase/kg/day (see note a).

Development of new abdominal symptoms (or any change in existing abdominal symptoms) should be reviewed to exclude the possibility of colonic damage.

Notes:

- a) Due to reported fibrotic strictures in the large bowel of cystic fibrosis children, aged between 3-13 years, the use of high dose products (i.e. Creon 25000) should be avoided unless the benefits outweigh the risks.
- b) Contact of the beads in the capsules with food of pH greater than 5.5 can dissolve the protective coat.
- c) The use of a barrier cream (e.g. Metanium) will help prevent excoriation in neonates and infants.
- d) High concentrations of pancreatin may burn the buccal mucosa and skin round the mouth and anus. If this occurs the dose should be reduced.
- e) Creon capsules may be opened and the beads mixed with milk to administer down a nasogastric tube (at least an 8 French Gauge in size). With smaller tubes use the pancrease powder.
- f) Creon Micro is available on a named patient basis for use in neonates and infants as an alternative to the Pancrex V powder.

PANCURONIUM

Preparations: INJECTION 4mg in 2ml (Fridge).

Dosage: **NEUROMUSCULAR BLOCKADE FOR VENTILATION AND SURGICAL PROCEDURES**

IV injection,

All ages, initially 50-100mcg/kg then 10-20mcg/kg, adjust interval as required.

RENAL AND LIVER FAILURE

Use with caution in severe renal impairment or liver failure as duration is prolonged.

Administration: Dilute if required with sodium chloride 0.9% or glucose 5%.

Notes:

- a) Pancuronium is only used in patients with assisted ventilation.
- b) Dose is reduced in neonates as they have an increased sensitivity to non-depolarising muscle relaxants.
- c) Although pancuronium lacks a histamine releasing effect, vagolytic and sympathomimetic effects can cause hypertension and tachycardia.

PANTOPRAZOLE

Preparations: INFUSION 40MG.

Dosage: **SEVERE REFLUX OESOPHAGITIS**

This indication is unlicensed for use in children.

IV Infusion, 0.5-2mg/kg once a day, up to 40mg/day.

Administration: Reconstitute 40mg with 10ml sodium chloride 0.9%. Give required dose as a slow bolus. Alternatively dilute to 100ml with sodium chloride 0.9% or glucose 5% and draw up proportional volume containing required dose and give over 30 minutes.

Notes:

- a) IV Pantoprazole should only be used in the treatment of severe oesophagitis refractory to H₂ receptor antagonists and when the oral route for proton pump inhibitors is not clinically appropriate.
- b) Pantoprazole may increase levels of phenytoin, digoxin, diazepam and tacrolimus and increase the anticoagulant effect of warfarin.

PARACETAMOL

Preparations: TABLETS 500mg. SOLUBLE TABLETS 500mg.
LIQUIDS 120mg in 5ml and 250mg in 5ml.
SUPPOSITORIES 15mg, 30mg, 60mg, 125mg, 240mg and 500mg.
INJECTION 1g in 100ml and 500mg in 50ml.

Dosage: **ANTIPYRETIC AND ANALGESIA FOR MILD TO MODERATE PAIN.**
These indications are licensed in children over 3 months of age.
Over 2 months of age, licensed for post immunisation pyrexia.
Orally/Rectal,

< 32 weeks	15mg/kg	12 hourly (max 30mg/kg/day)
32 weeks - 1month	15mg/kg	6-8 hourly (max 60mg/kg/day)
1month - 12 years	20mg/kg	6-8 hourly (max 90mg/kg/day)

A loading or stat dose of 30-40mg/kg may be used.

OR

The following doses are the manufacturers recommendation and to avoid confusion should be prescribed for outpatient and TTAs.

Orally.

3 - 6 months	60mg
6 - 24 months	120mg
2 - 4 years	180mg
4 - 6 years	240mg
6 - 8 years	250mg
8 - 10 years	375mg
10 - 12 years	500mg
12 - 16 years	500 - 750mg

Repeat dose every 4-6 hrs as necessary. (Max. 4 doses/24 hrs)

Rectally,

1 - 3 months	30 - 60mg
3 - 12 months	60 - 125mg
1 - 5 years	125 - 250mg
6 - 12 years	250 - 500mg
12 - 18 years	500mg - 1g

Repeat dose every 4-6 hrs as necessary. (Max. 4 doses/24 hrs)

IV,

< 10kg	7.5mg/kg/dose	4-6 hourly (max 30mg/kg/day)
10 - 50kg	15mg/kg/dose	4-6 hours (max 60mg/kg/day)
> 50 kg	1g	6 hours (max 4g /day)

Administration: Slow IV injection over 15 minutes. 10mg/ml may be diluted to a minimum of 1mg/ml with sodium chloride 0.9% and used within 30 minutes.

The 500mg vial should be used for all children <33kg.

Notes:

- a) Paracetamol is the drug of choice for mild analgesia in children under 16 years, as aspirin is contraindicated in this age group.
- b) Soluble tablets contain 18.5mmol of sodium per 500mg.

PARALDEHYDE

Preparations: PARALDEHYDE AND OLIVE OIL (50:50) ENEMA 30ml
(**Manufactured Special**).

Dosage: **STATUS EPILEPTICUS**
Rectally, 0.4ml/kg of undiluted paraldehyde.
Thus the volume to be used for the current 50:50 mix enema is
0.8ml/kg. (Max 20ml)

Notes:

- a) Plastic syringes can be used if the dose is administered immediately, otherwise use a glass syringe.
- b) Do not use if it has a brownish colour or smells of acetic acid.

PENICILLAMINE

Preparations: TABLETS 125mg and 250mg.

Dosage: **CYSTINURIA**
Orally, all ages, 10mg/kg twice a day up to 30mg/kg/day. Adjust dose to maintain urinary cystine below 200mg/L.

WILSON'S DISEASE

Orally, all ages, initially 5mg/kg 1-2 times a day increasing at 2 week intervals, if tolerated, up to 10mg/kg twice a day.

JUVENILE RHEUMATOID ARTHRITIS

Orally, initially 2.5-5mg/kg once a day for 1 month, then increase at 4 week intervals to 15-20mg/kg/day.

Notes:

- a) Pyridoxine 10mg a day may be given concurrently in Wilson's Disease.
- b) Thrombocytopenia occurs commonly, neutropenia less often. A full blood count must be performed every week for the first 2 months of treatment, or after any dosage increase, and monthly thereafter. If platelet count is less than 120,000/mm³ or WBC below 2500/mm³ or if three successive falls are noted within normal range then stop drug, restarting at lower doses when recovery occurs. If thrombocytopenia or neutropenia recurs treatment should be withdrawn permanently.
- c) Counsel patients or their carers to report any fever, sore throat, mouth ulcers, bruising or any other symptoms of blood or skin disorders.
- d) Persistent heavy proteinuria should lead to withdrawal of the drug, however transient proteinuria is not an indication to stop the drug. Test urine every week for 2 months and then monthly.

PEPPERMINT WATER

Preparations: PEPPERMINT WATER BP.

Dosage: **COLIC**
Unlicensed under 12 years old.
3 - 6 months 2.5ml 20 minutes before feeds
6 months - 2 years 5ml 20 minutes before feeds
Over 2 years 10-40ml before food
Maximum 4 doses in 24 hours for all age groups.

Notes:

- a) Not to be used in children with biliary disorders.
- b) Dilute well with water.

PERMETHRIN

Preparation: DERMAL CREAM 5%.

Dosage:

SCABIES

This indication is unlicensed for use in children under 2 months.

Only use under medical supervision in children under 2 years.

Apply dermal cream 5%

2 months to 1 year up to 1/8 tube (3.8g)

1 - 5 years up to 1/4 tube (7.5g)

5 - 12 years up to 1/2 tube (15g)

Over 12 years up to 1 tube (30g)

Apply over whole body including face, neck, scalp and ears.

The cream should be rubbed gently into the skin. Wash off after 8-24 hours. Repeat after 7 days if necessary.

Notes:

- a) Refer to scabies guidelines.
- b) If hands are washed with soap and water during the treatment period reapply dermal cream.
- c) It is often advisable, to repeat application after 7 days, to cover any areas that may have been missed.

PETHIDINE - (CD)

Preparations: INJECTIONS 50mg in 1ml and 100mg in 2ml. TABLETS 50mg.

Dosage:

ANALGESIA FOR MODERATE TO SEVERE PAIN

Orally, SC or IV injection:

Neonates 500microgram - 1mg/kg/dose.

Over 1 month 500microgram - 2mg/kg/dose, usual dose is 1mg/kg.

Doses may be repeated every 4-6 hours (neonates every 12 hours).

Notes:

- a) Neonates and infants under 1 year show an increased susceptibility to respiratory depression, however this should not exclude them from adequate analgesia. Non-ventilated patients should be assessed regularly for pain, sedation and respiration.
- b) Avoid in patients with renal impairment as accumulation of metabolite, norpethidine, may induce seizures. Accumulation of this metabolite may also occur, thus infusions are not recommended.
- c) Pethidine has antispasmodic properties
- d) Injection can be given orally.

PHENOBARBITAL (PHENOBARBITONE) - (CD)

Preparations: TABLETS 15mg, 30mg and 60mg.
INJECTION 60mg (sodium salt) in 1ml.
LIQUID 15mg (base) in 5ml.
LIQUID "Alcohol Free" 50mg in 5ml (**Manufactured Special**).

Dosage: **EPILEPSY**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Loading dose, slow IV injection,

All ages, 20mg/kg (max. 1gram)(See note c).

Maintenance dose, slow IV injection or orally,

All ages, 5mg/kg/day in 1-2 divided doses.

Increase by 2mg/kg/day as necessary. Maximum dose 10mg/kg/day (300mg twice daily).

IMPROVEMENT IN BILE FLOW

This is an unlicensed indication.

Orally, all ages, 5mg/kg/day, for 5 days prior to scintigraphy scan and continued depending upon result.

In biliary atresia, all ages, 45mg once a day.

Administration: Slow IV injection, dilute to 20mg in 1ml with water for injection and give at a maximum rate of 1mg/kg/minute.

Notes:

- a) Therapeutic drug monitoring:
 - i) Approx. time to steady state: 10-14 days. (Prolonged in neonates).
 - ii) Therapeutic plasma levels:

Epilepsy	9-25mg/L
Febrile convulsions	15-25mg/L

Some patients may tolerate levels up to 40mg/L. (>100mg/L if ventilated on PICU)
 - iii) Take trough sample, immediately prior to next dose.
- b) Phenobarbitone reduces blood levels of carbamazepine, clonazepam, lamotrigine and sodium valproate and may reduce ethosuximide levels. The effect of phenobarbitone on phenytoin levels is unpredictable therefore blood levels should be checked if this drug combination is initiated. Reduced blood levels and/or increased elimination of chloramphenicol, theophylline, ciclosporin and warfarin also occur if phenobarbitone is given concomitantly.
- c) If the initial loading dose is ineffective after 20 minutes an additional half loading dose (10mg/kg) can be administered up to a maximum total dose of 40mg/kg (ie 2 half loads can be administered in addition to the initial full loading dose)
- d) Phenobarbitone liquid B.P. is sucrose free but contains 38% alcohol, and is very bitter. Not to be used in children.
- e) Injection contains 90% propylene glycol.
- f) If alcohol free liquid is unavailable tablets can be crushed and dissolved.
- g) Injection can be administered rectally, undiluted, at the same total oral daily dose.

PHENOTHRIN

Preparation: LOTION 0.2% w/v in an alcoholic base.

Dosage: **PEDICULOSIS (HEAD LICE)**

Use only under medical supervision in children under 6 months.
Apply and rub gently into dry hair until entire scalp is moistened.
Comb hair whilst still wet and then allow hair to dry naturally. DO NOT use heat to dry hair. Hair may be shampooed 2 hours after application.

Repeat after 7 days only if live lice are found again.

Notes:

- a) Rotation of preparations is now outmoded. A mosaic pattern of use should be employed, i.e. an alternative preparation used if after repeat application there are still live lice.
- b) Household contacts should **NOT** routinely be treated, only treat if infestation has occurred.
- c) Lotion contains 69.3% isopropyl alcohol. Avoid contact with eyes and in asthmatics.

PHENOXYBENZAMINE HYDROCHLORIDE

Preparations: CAPSULES 10mg. INJECTION 100mg in 2ml.

Dosage:

SEEK EXPERT ADVICE BEFORE PRESCRIBING

PHAEOCHROMOCYTOMA

This indication is unlicensed for use in children.

Orally, 1-2mg/kg once a day.

IV infusion, 0.5-1mg/kg twice daily, titrating the dose according to response. Concomitant beta-adrenergic blockade may be required to prevent tachycardia and arrhythmias.

CARDIAC SURGERY

This is an unlicensed indication.

IV infusion, 1mg/kg, just prior to the institution of cardiopulmonary bypass.

HYPERTENSION DURING ECMO

This is an unlicensed indication.

IV infusion, initially 1mg/kg, then 0.5mg/kg every 8 to 12 hours.

Administration: IV infusion, dilute in sodium chloride 0.9% immediately before use and give over at least 2 hours or by continuous infusion (one third of the dose in the first hour and two thirds in the second hour).

Notes:

- a) Continuous intra-arterial blood pressure monitoring is recommended during an IV infusion. If severe hypotension occurs and is not correctable with intravenous fluids then a noradrenaline infusion may be required.
- b) Phenoxybenzamine is no longer recommended for urinary conditions as it has been shown to have carcinogenic effects in rats. For phaeochromocytoma it should only be used in children for whom alternative treatment is inappropriate.
- c) Avoid contact with skin/hands as risk of contact sensitisation. Phenoxybenzamine is also irritant to tissues, avoid extravasation.

PHENOXYMETHYLPENICILLIN (PENICILLIN V)

Preparations: TABLETS 250mg. LIQUIDS 125mg in 5ml and 250mg in 5ml.

Dosage: **TREATMENT OF INFECTION**
All ages, 6-12.5mg/kg 4 times a day (use 12.5mg/kg in severe infection),

OR

Up to 1 year	62.5mg)	
1 - 6 years	125mg)	4 times a day
6 - 12 years	250mg)	
Over 12 years	500mg)	

PROPHYLAXIS

1 month - 6 years	125mg)	twice a day
> 6 years	250mg)	

Dose may be doubled for >12 years if thought at greater risk

Notes:

- a) In confirmed penicillin allergy, cephalosporins may be an alternative treatment although approximately 10% of these patients will also be allergic to cephalosporins. Where severe allergy symptoms have occurred previously or the extent of the allergy is unknown an alternative antibiotic should be given. Contact the microbiology department for further information.
- b) Give 1 hour before food or on an empty stomach.

PHENTOLAMINE MESYLATE (PHENTOLAMINE MESILATE)

Preparations: INJECTION 10mg in 1ml.

Dosage: **PAROXYSMAL HYPERTENSION**

This indication is unlicensed.

IV infusion, 20-100microgram/kg loading dose then 5 to 50microgram/kg/min.

Administration: IV infusion dilute in 5% glucose, sodium chloride 0.9% or glucose/saline.

Notes:

- a) Phentolamine should only be administered by an anaesthetist or in an intensive care unit.
- b) Presence of sulphites in ampoule may lead to hypersensitivity with bronchospasm and shock, especially in asthmatic patients.
- c) Occasionally used for treatment of dermal necrosis after extravasation of drugs with alpha-adrenergic effects (dobutamine, dopamine, adrenaline, metaraminol, noradrenaline and phenylephrine).

PHENYLEPHRINE

Preparations: INJECTION 10mg/ml (1%).

Dosage:

ACUTE HYPOTENSION

By *subcutaneous* or *intramuscular injection* (but intravenous injection preferred, see below).

1 - 12 years	100 micrograms/kg every 1–2 hours as needed (max. 5 mg)
12 - 18 years	2–5 mg, followed if necessary by further doses of 1–10 mg (max. initial dose 5 mg)

By *slow intravenous injection*,

1 - 12 years	5–20 micrograms/kg (max. 500 micrograms) repeated as necessary after at least 15 minutes
12 - 18 years	100–500 micrograms repeated as necessary after at least 15 minutes

By *intravenous infusion*,

1 - 16 years	100–500 nanograms/kg/minute, adjusted according to response
16 - 18 years	initially up to 180 micrograms/minute reduced to 30–60 micrograms/minute according to response

Administration:

- a) Administration for intravenous injection dilute to a concentration of 1 mg/mL with Water for Injections and administer slowly.
- b) For intravenous infusion dilute to a concentration of 20 micrograms/mL with Glucose 5% or Sodium Chloride 0.9% and administer as a continuous infusion via a central venous catheter.

PHENYTOIN

Preparations: CHEWABLE TABLETS (Infatabs®) **phenytoin** 50mg.
LIQUID 30mg **phenytoin** in 5ml.
CAPSULES **phenytoin sodium** 25mg, 50mg and 100mg.
INJECTION 250mg **phenytoin sodium** in 5ml.

NOTE: PHENYTOIN 90MG IS EQUIVALENT TO PHENYTOIN SODIUM 100MG. THEREFORE 45MG AND 7.5ML OF 30MG/5ML SUSPENSION IS EQUIVALENT TO A 50MG CAPSULE.

Dosage: **STATUS EPILEPTICUS**
See note a).
All ages, *slow IV injection*, 18-20mg/kg given over 20 minutes.
Followed by a further 10mg/kg given over 20 minutes if necessary.
A further dose may be necessary, after reviewing blood levels at 12 to 24 hours post dose, before initiating maintenance doses.

EPILEPSY

See note a).

Loading dose, *slow IV injection*,

All ages 18-20mg/kg

Maintenance dose, *slow IV injection* or *orally*, (see note d).

Neonates 2.5-5mg/kg (max. 7.5mg/kg) twice a day

Metabolism increases over first 5-7 weeks then stabilises, dosage increases will be required over this time. Monitor levels.

1 mth - 12 yrs 2.5-7.5mg/kg (max. 150mg) twice a day

>12 years 75-150mg (max. 300mg) twice a day

Usual maintenance dose is 5mg/kg twice a day. Measure blood levels after 2 weeks and adjust the dose accordingly. Oral dosage increments should not exceed 1mg/kg/day. For difficult to control fits, higher doses are often required, check blood levels regularly.

Administration: Slow IV injection, at maximum rate of 1mg/kg/minute. The ready-mixed injection solution (Epanutin®) does not need to be diluted. Dilute, if required, only with sodium chloride 0.9% to a maximum concentration of 10mg in 1ml. Use infusion within one hour. Flush with sodium chloride 0.9% before and after administration. Only give IV with concurrent ECG monitoring. Monitor B.P. Infuse centrally if possible. A 0.22 to 0.5 micron filter should be used as a final filter in the IV line, for diluted phenytoin.

Notes:

- a) Oral administration is not effective for loading the patient with phenytoin if they are in status or fitting.
- b) Do not give by IM injection. If essential, IM dose should be 50% greater than established oral dose (unlicensed).
- c) Administration of intravenous phenytoin to patients receiving thyroid hormones may induce supraventricular tachycardia.
- d) Therapeutic drug monitoring:
 - i) Approx. time to steady state: 1-2 weeks (highly variable)
 - ii) Therapeutic plasma levels:

Neonates	6-15mg/L.
Infants/children	10-20mg/L. ❶

❶ Caution above 16mg/L.
 - iii) Take a trough sample, immediately prior to next dose.
- e) If phenytoin plasma concentration is 10-20mg/L 2 hours after loading dose completed, start maintenance dose 12 hours after loading dose complete. If phenytoin plasma concentration is <10mg/L 2 hours after

loading dose is completed, give a further loading dose of 5mg/kg over 20 minutes and commence maintenance dose after 8 hours.
Full loading dose required on commencement of treatment and if blood level <2.5mg/L.

- f) Phenytoin levels must be monitored in hypothermia
- g) Phenytoin toxicity can produce persistent cerebellar syndrome.
- h) The bioavailability of oral phenytoin is very good therefore the same daily dose of phenytoin can be given by IV injection if oral route becomes impossible. **However** as the infatabs and suspension are in the form of phenytoin and the injection is the sodium salt multiply oral dose by 1.1 to calculate equivalent IV dose.
- i) **Enteral feeds** inhibit the absorption of phenytoin resulting in low plasma levels. **STOP** feed for at least 30 minutes prior to and post administration of oral phenytoin. Dose should be given with water to enhance absorption.
- j) Phenytoin is highly protein bound; 90% bound to serum albumin. In states of low serum albumin or altered protein binding (e.g. renal failure) adjust the plasma level or measure free drug level from a saliva sample (therapeutic range of free drug = 1- 2mg/L).
- k) Phenytoin can affect the metabolism of many hepatically metabolised drugs due to enzyme induction. Also phenytoin blood levels may be increased or decreased by drugs which alter its absorption or metabolism.
- l) Counsel patient/carer to report the onset of fever, sore throats, mouth ulcers, bruising, rashes or any other indicators of skin or blood disorders.
- m) Injection contains propylene glycol and ethanol.

PHOSPHATES

Preparations: **Phosphate-Sandoz®:** EFFERVESCENT TABLETS each containing 16.1mmol phosphate, 20.4mmol sodium and 3.1mmol potassium.
Potassium acid phosphate 13.6% (CD): INJECTION containing 10mmol potassium and 10mmol acid phosphate in 10ml.
Neutral sodium phosphate: INJECTION (1ml) containing 1.5mmol sodium and 0.8mmol phosphate in 1ml (**GSTT Special**).
Phosphate LIQUID: (20ml) containing 1mmol phosphate and 1.8mmol sodium in 1ml (**GSTT Special**).
Polyfusor phosphates: INFUSION containing 50mmol phosphate, 81mmol sodium and 9.5mmol potassium in 500ml.
Phosphate Enema: 118ml.

Dosage: **HYPERCALCAEMIA**
See note c).
Orally, neonates, initially 1mmol/kg/day in 1-2 divided doses. Adjust dose according to serum phosphate levels.
Under 5 years up to 3 tablets (Phosphate-Sandoz®)/day.
Over 5 years up to 6 tablets/day.

HYPOPHOSPHATAEMIA, INCLUDING RICKETS AND OSTEOMALACIA
Orally, premature neonates, initially 1mmol/kg/day in 1-2 divided doses.
Under 5 years 2-3 tablets (Phosphate-Sandoz®)/day.
Over 5 years 4-6 tablets/day.
Adjust the dose according to response.

PARENTERAL PHOSPHATES

SEEK EXPERT ADVICE BEFORE PRESCRIBING

IV infusion, 0.3mmol/kg, up to 1mmol/kg/day of phosphate. This is repeated to maintain appropriate blood levels of phosphate.

CONSTIPATION

Rectally, (see notes e and f).

Under 3 years not recommended.
3 - 6 years 50ml as required.
Over 6 years 1 enema as required.

Administration: *IV infusion*, dilute to 0.1mmol of phosphate in 1ml with sodium chloride 0.9% or glucose 5%. Administer at a rate of 0.05mmol/kg/hour.
In an emergency **and** in intensive care rate can be increased to 0.5mmol/kg/hour via a central line.

Notes:

- Use with great caution in renal failure.
- Phosphate infusion may cause hypotension, tachycardia, pulmonary oedema, fever, hypocalcaemia and tetany. It can also cause thrombophlebitis and calcification at infusion site.
- Phosphate infusion is not the first line treatment for hypercalcaemia because of the risk of precipitation of calcium phosphate in tissues especially the kidneys. A high fluid throughput is essential and electrolyte load must be monitored. Seek expert advice.
- CAUTION:** monitor acid-base balance when infusing potassium acid phosphate as it may potentiate/cause acidosis.

- e) Phosphate enema is not recommended in small children and renal impairment as absorption of phosphate results in electrolyte imbalance.
- f) Many small children who experience pain or fear during defecation find rectally administered treatment very distressing and alternatives should be considered.
- g) Neutral sodium phosphate injection can be given orally.
- h) Phosphate-Sandoz[®] tablets contain 136mg of sucrose.

PHYTOMENADIONE

- Preparations:** INJECTION (Konakion MM[®]) 10mg in 1ml.
AMPOULES oral/IV/IM 2mg/0.2ml (Konakion[®] MM Paediatric).
- Dosage:** **PROPHYLAXIS AGAINST HAEMORRHAGIC DISEASE OF THE NEWBORN**
IM injection, a single dose at birth (<36 weeks gestation)
- | | |
|-----------------------------|----------|
| <2.5kg | 0.4mg/kg |
| >2.5kg | 1mg |
| Term babies at special risk | 1mg |
- If IV is given at birth, 2 further oral (or IV) doses should be given at one week and 4-6 weeks. IM is recommended.
Orally, (only if concerns over parenteral route or on parents/carers request) 2mg dose at birth and on day 7-14. Breast-fed babies and babies on mixed feeding with <2/3 formula require a further oral dose of 2mg at 4-6 weeks.
- NEONATAL HYPOPROTHROMBINAEMIA**
IV injection, 1mg, repeated at 8 hourly intervals if necessary.
- ANTIDOTE TO COUMARIN ANTICOAGULANTS WHERE CONTINUED ANTICOAGULATION IS REQUIRED.**
Initially, *IV injection*, 25microgram/kg, maximum 1mg if no major bleeding and INR >8. Repeat if INR still too high after 24 hours. Restart warfarin when INR <5. Higher doses may be used if no more anticoagulation is needed: 250micrograms/kg, max. 10mg.
- BILLIARY OBSTRUCTION**
1mg/day and watch INR.
- OTHER INDICATIONS**
- | | | |
|-----------------|-----------|--|
| <i>Orally</i> , | Infants, | 1mg a day |
| | Children, | 5-10mg a day (Menadiol tablets should be used) |
- IV or IM injection*,
- | | |
|---------------------|------|
| 4 weeks - 12 months | 1mg |
| 1 - 4 years | 3mg |
| 5 - 12 years | 5mg |
| Over 12 years | 10mg |
- Repeat at intervals according to clotting time.
- Administration:** *IV injection*, Konakion MM[®] injection solution may be diluted if required with glucose 5% or sodium chloride 0.9%. Give over 5-10 minutes.
- Notes:** *IV injection* may cause peripheral vascular collapse, cyanosis, sweating and flushing if given too rapidly.

PIMOZIDE

Preparations: TABLETS 2mg and 4mg.

Dosage:

GILLES DE LA TOURETTE SYNDROME

This indication is unlicensed for use in children.

Orally, 1-2mg once a day, **OR** 200microgram/kg/day. Maximum dose 10mg/day.

SCHIZOPHRENIA

There is no recommended dose for children under 12 years.

Children over 12 years, initially 2mg/day. Adjust in increments of 2-4mg/day at weekly intervals. Maximum dose 20mg/day.

PARANOID STATES & PSYCHOSIS

There is no recommended dose for children under 12 years.

Over 12 years, 4mg/day increasing to a maximum of 16mg/day.

Notes:

- a) **CSM Warning:** Pimozide should be used with extreme caution in patients with cardiovascular disorders, liver disease, renal failure or epilepsy. An E.C.G. should be performed before initiating treatment and periodically where doses exceed 16mg/day.
- b) Doses >20mg/day have been associated with rare sudden deaths.
- c) Pimozide should **not** be given with other antipsychotic drugs, tricyclic antidepressants, other drugs which prolong the QT intervals, i.e. antimalarials (e.g. quinine), antiarrhythmics or drugs which cause electrolyte imbalance e.g. diuretics.

PIPERACILLIN – with TAZOBACTAM (PIPTAZOBACTAM)

Preparations: INJECTION 2.25g (2g piperacillin with 0.25g tazobactam) and 4.5g (4g piperacillin with 0.5g tazobactam).

AVOID IN PATIENTS WITH PENICILLIN ALLERGY

Dosage: **SEVERE SEPSIS**
IV injection or infusion, 90mg/kg every 6 hours. (Maximum 4.5g 4 times a day).

IN RENAL FAILURE

CrCl (ml/min/1.73m ²)	Dose	Frequency (times daily)
> 40	No adjustment	
20 - 40	90m/kg (Max 4.5g)	3
< 20	90mg/kg (Max 4.5g)	2

HAEMODIALYSIS

Children, <50kg, *IV injection or infusion*, 45mg/kg every 8 hours.
Ensure dose is given post dialysis.

Administration: *IV*: displacement valve may be significant.
For *IV bolus* reconstitute to 225mg/ml with water for injections or 0.9% sodium chloride, and give over 3-5 minutes.

Notes:

- a) Do **not** mix with aminoglycosides or sodium bicarbonate; do not administer through same line without adequate flushing in-between.
- b) Use with caution in children with cystic fibrosis as they may demonstrate increased sensitivity to piperacillin.
- c) Piperacillin can prolong the neuromuscular blockade effect of muscle relaxants.

PIRACETAM

Preparations: LIQUID 333.3mg in 1ml (33%).

Dosage: **MYOCLONUS**
This indication is unlicensed for use in children.
Orally, initially 150mg/kg/day (in 2-3 divided doses).
Increasing depending on clinical response to a maximum of 300mg/kg/day.

Notes: The solution has a bitter taste and should be given undiluted followed by a glass of water or soft drink.

PORACTANT (CUROSURF[®]) NATURAL SURFACTANT

- Preparations:* INJECTION 120mg in 1.5ml and 240mg in 3ml (Fridge).
- Dosage:* **TREATMENT OF RESPIRATORY DISTRESS SYNDROME (RDS) OR HYALINE MEMBRANE DISEASE**
Newborns
Intra-tracheal injection, Initial dose 200mg/kg (2.5ml/kg).
Followed by two further doses of 100mg/kg after 12 and 24 hours if necessary. Maximum total dose of 300-400mg/kg.
- PROPHYLAXIS (EARLY SELECTIVE) IN PREMATURE INFANTS <30 WEEKS AT RISK OF RDS OR WITH EVIDENCE OF SURFACTANT DEFICIENCY**
Intra-tracheal injection, 100-200mg/kg as soon as possible after birth (preferably within 15 minutes). Further doses of 100mg/kg can be given 6-12 hours after the first dose and then 12 hours later in babies with persistent signs of RDS and remain ventilator-dependent. Maximum total dose 300-400mg/kg.
- Administration:* **Disconnecting the baby from the ventilator:** Disconnect the baby momentarily from the ventilator and administer the dose as single bolus, directly into the lower trachea via ETT. Perform approximately 1 minute of handbagging and then reconnect the baby to the ventilator at the same settings as before administration. After administration pulmonary compliance can improve rapidly thus requiring prompt adjustment of the ventilator settings.
- Without disconnecting the baby from the ventilator:** Administer the dose as a single bolus directly into the lower trachea by passing a catheter through the suction port and into the ETT.
- Notes:* Therapy with Curosurf starting more than 48 hours after diagnosing RDS has not been investigated.

POTASSIUM CANRENOATE

Preparations: INJECTION 200mg in 10ml (**Import**).

Dosage: **OEDEMA, ASCITES**
These indications are unlicensed for use in children.
Slow *IV injection*, 1-2mg/kg twice a day,

Administration: **IN RENAL FAILURE**
Avoid if creatinine clearance is less than 30ml/minute/1.73m².
IV injection, dilute to 1mg in 1ml in sodium chloride 0.9% or glucose 5% or give undiluted slowly over 2-3 minutes. The injection is very irritant and should be given via a central line whenever possible.

Notes:

- a) Long term use should be avoided due to the association of prolonged use with neoplastic changes in rats.
- b) Transient confusion may occur during treatment with high doses.
- c) For oral equivalent, see spironolactone. To convert to oral spironolactone, multiply intravenous dose by 0.7.

POTASSIUM CHLORIDE

Preparations: SLOW RELEASE TABLETS potassium chloride 600mg, providing 8mmol each of potassium and chloride (Slow K[®]).
SOLUBLE TABLETS containing potassium bicarbonate and chloride, equivalent to 12mmol potassium and 8mmol chloride (Sando-K[®]).
LIQUID containing 1mmol each of potassium and chloride in 1ml (Kay-Cee-L[®] 7.5%w/v)
INJECTION containing 1.5g (20mmol) potassium and 20mmol chloride in 10ml. [Stored in CD cupboard].

Dosage: **POTASSIUM SUPPLEMENT**
All ages, *orally*, 1mmol/kg twice a day.
IV infusion, add 2mmol/kg/day to the infusion fluid, according to serum levels. See note b).

ACUTE DEPLETION (PICU ONLY)

If patient symptomatic or plasma potassium less than 3mmol/L
All ages, *IV infusion* 0.5-1mmol/kg infused at a rate of 0.2mmol/kg/hr (maximum rate 0.5mmol/kg/hr, centrally)
IV infusion, 1mmol/kg infused at a rate of 0.2mmol/kg/hr.
Recheck potassium level after 3 hours. **Caution** is required in patients with renal failure.

Administration: **Dilute injection before use.** Ensure thoroughly mixed before administration. Max. concentration peripherally of potassium is 40mmol/L. Max. infusion rate 0.5mmol/kg/hour of potassium.
If patient is fluid restricted and being monitored by ECG, higher concentrations of potassium have been infused centrally (see note g)

Notes:

- a) Potassium requirement in healthy individuals is 1- 2mmol/kg/day.
- b) Intravenous fluids with added potassium are available on the wards. These pre-mixed bags should always be used in preference to using strong potassium ampoules. See fluid guidance.
- c) Injection can be given orally.
- d) Slow release tablets (Slow K[®]) should **not** be crushed.
- e) Potassium chloride liquid (Kay-Cee L[®]) is cherry flavoured and sucrose free but does contain sorbitol. It has an 8 week expiry once the bottle has been opened.
- f) Sando-K[®] effervescent tablets contain 0.5g of sucrose (approximately 4kcal) and 0.1mmol of sodium in each tablet.
- g) Maximum concentration of potassium via a central line is considered to be 0.5mmol/ml

POTASSIUM IODATE

Preparations: CAPSULE 170mg.

Dosage: **MIBG SCAN**
One capsule orally once a day. Commence 2 days prior to the injection for 5 consecutive days.

Administration: For babies the dose may be crushed and mixed with milk or juice before administration. For children the dose may be crushed and mixed with e.g. Jam, honey or yoghurt.

Notes:

- a) Potassium iodate is contra-indicated in patients with known iodine sensitivity and renal failure
- b) Care should be exercised if potassium salts are given concomitantly with potassium-sparing diuretics, as hyperkalaemia may result.
- c) For a liquid formulation see 'Iodine'.

PRAZOSIN

Preparations: TABLETS 500microgram, 1mg and 2mg.
LIQUID (**Extemporaneously Prepared**).

Dosage: **HYPERTENSION**
This indication is unlicensed for use in children.
Orally, initially, 10-15microgram/kg 2-4 times a day, increasing to a maximum of 500microgram/kg/day (maximum 20mg/day).

CONGESTIVE HEART FAILURE

This indication is unlicensed for use in children.
Orally, initially, 5microgram/kg twice a day increasing to a maximum of 100microgram/kg/day (>12 years 20mg/day).

Notes:

- a) The patient's blood pressure should be monitored closely after the **first** dose since prazosin can cause a precipitous fall in blood pressure. It may be preferable to give first dose at bedtime.
- b) Patients in chronic renal failure are more sensitive to effects of prazosin.

PREDNISOLONE

- Preparations:* TABLETS 1mg, 5mg and 25mg.
ENTERIC COATED TABLETS 2.5mg and 5mg.
SOLUBLE TABLETS 5mg.
SUPPOSITORIES 5mg. ENEMA 20mg.
- Dosage:* **CAUTION: SEVERE CHICKENPOX ASSOCIATED WITH SYSTEMIC CORTICOSTEROIDS**
See immunisation guidelines.
- ULCERATIVE COLITIS AND CROHN'S DISEASE**
Orally, 2mg/kg/once a day.
Rectally,
Enema, 20mg at night, initially for 2-4 weeks.
Suppository, 5mg at night and morning after bowel movement.
- ASTHMA**
Orally, 1-2mg/kg/day, max. 40mg, for 3-5 days then stop. If treatment is required for 7 days or more, reduce dose gradually.
- CROUP REQUIRING INTUBATION**
Orally, 1mg/kg every 12 hours for 48 hours or until extubated.
- IDIOPATHIC NEPHROTIC SYNDROME (First presentation)**
Prednisolone 60mg/m²/day for 28 days (irrespective of whether the child goes into remission earlier than 28 days). Maximum dose: 80mg/day.
Followed by 40mg/m² on alternative days for 28 day.
Followed by 30mg/m² on alternate days for 28 day
Followed by 20mg/m² on alternate days for 28 day
Followed by 10mg/m² on alternate days for 28 day
Followed by 5mg/m² on alternate days for 28 day
Then stop.
- RENAL GRAFT REJECTION**
Orally, 3mg/kg/day for 3 days.
- INFANTILE SPASM**
Orally, initially 10mg four times a day (all ages >1 month and weight) for two weeks. If seizure is not controlled by the end of 1st week increase dose to 20mg three times a day. Wean off over 15 days.
Patients on 40mg/day reduce to 30mg for 5 days; then 20mg for 5 days; then 10mg for 5 days. Then stop.
Patients on 60mg/day reduce to 40mg for 5 days; then 20mg for 5 days; then 10mg for 5 days. Then stop.
- EPILEPSY WITH ELECTRICAL STATUS IN SLEEP (ESES)**
Orally, 2mg/kg/day for 2 weeks then 4mg/kg once a week in steroid responsive patients. Treatment for this indication, including Landau Kleffner syndrome should be discussed with regional epilepsy service.

Notes:

- a) If therapy is long term, consider maintenance treatment on alternate days as steroids suppress growth in children.
- b) When long term treatment is to be discontinued, the dose should be reduced gradually over several weeks or months depending on the dosage and duration of the therapy.
- c) The absorption of enteric coated prednisolone is not always reliable in children. They are therefore not used in renal transplant children.
- d) For relative potencies see Hydrocortisone.
- e) To convert from oral prednisolone to IV hydrocortisone give four times the prednisolone dose 3-4 times daily. (For example 20mg OD of prednisolone would be converted to 80mg QDS of hydrocortisone)

PROCHLORPERAZINE

Preparations: TABLETS 5mg. LIQUID 5mg in 5ml. INJECTION 12.5mg in 1ml.

Dosage:

ANTIEMETIC

This indication is unlicensed for use in children under 10kg or for the rectal or parenteral routes.

Orally, 100-250microgram/kg 2-3 times a day

OR

1 - 4 years (over 10kg)	1.25-2.5mg	2-3 times a day
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5 - 12 years	2.5-5mg	2-3 times a day
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Over 12 years	5-10mg	2-3 times a day
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IM injection,

1 - 4 years (over 10kg)	1.25-2.5mg	Up to
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5 - 12 years	5-6.25mg	3 times
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Over 12 years	12.5mg	a day
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Notes:

- a) There is an increased possibility of extrapyramidal side effects, especially in very ill children and children under 10kg. Prochlorperazine may, rarely, cause neuroleptic malignant syndrome.
- b) The IV route is unlicensed and not recommended, however the above IM injection doses have been given as a slow IV injection, diluted 1 in 10 with sodium chloride 0.9%, over at least 10 minutes.

PROCYCLIDINE

Preparations: TABLETS 5mg. INJECTION 10mg in 2ml. LIQUID 5mg in 5ml.

Dosage: **ACUTE DYSTONIA**

**IF IN ANY DOUBT CONTACT THE MEDICAL TOXICOLOGY UNIT
☎ 020 7188 0600 ☎**

This indication is unlicensed for use in children.

Orally,

7 - 12 years 1.25mg 3 times a day

Over 12 years 2.5mg 3 times a day

IM or IV injection (over at least 2 minutes),

Under 2 years 500microgram-2mg as a single dose

2 - 10 years 2-5mg as a single dose

Over 10 years 5-10mg as a single dose

Repeat if necessary after 20 minutes.

Notes:

- a) Procyclidine liquid (Arpicolin[®]) is sugar free.
- b) May cause elation (potential for abuse).

PROGUANIL

Preparations: TABLETS 100mg.

Dosage: **PROPHYLAXIS OF MALARIA**
Orally,

Up to 12 weeks (6kg)	25mg (¼ tablet)	once a day
12 weeks - 11 months (6-10kg)	50mg (½ tablet)	once a day
1 - 3 years (10-16kg)	75mg (¾ tablet)	once a day
4 - 7 years (16-25 kg)	100mg (1 tablet)	once a day
8 -12 years (25-45kg)	150mg (1½ tablet)	once a day
12 years and over (40kg)	200mg (2 tablets)	once a day

Notes:

- a) Tablets are scored and do break into fairly accurate quarters. Precise accuracy is not essential. The dose may be crushed and mixed with milk, jam or honey.
- b) Proguanil should be started 1 week before arriving in endemic area and should be continued for 4 weeks after return.

Advice on **PROPHYLAXIS** and **TREATMENT** can be obtained from:

Medicines Information Centre

or

The Hospital for Tropical Disease

☎ 020-7387 4411 (all hours) ☎

PROMETHAZINE HYDROCHLORIDE

Preparations: TABLETS 10mg and 25mg. LIQUID 5mg in 5ml. INJECTION 25mg in 1ml.

Dosage: These indications are unlicensed for use in children under 2 years of age.

ALLERGIC DISORDERS

Orally, 125 microgram/kg 3 times a day and 500 microgram/kg at night.

OR

6 months - 2 year	2.5mg	twice a day or 2.5-10mg as single dose. Max. 10mg/day.
2 - 5 years	5mg	twice a day or 5-15mg as single dose. Max. 15mg/day.
5 - 10 years	5-10mg	twice a day or 10-25mg as single dose. Max. 25mg/day.
Over 10 years	10-20mg	2-3 times a day or 25mg as single dose. Max. 60mg/day.

SEDATION

Orally,

6 months - 2 year	5-10mg	at bedtime
2 - 5 years	10-20mg	at bedtime
5 - 10 years	20-25mg	at bedtime
Over 10 years	25-50mg	at bedtime

OR, for daytime sedation, give once or twice a day using the lower dose.

PREMEDICATION, SEDATION ON INTENSIVE CARE UNITS

Deep IM injection or slow IV injection over at least 5 minutes, 500microgram/kg/dose.

Orally, 500microgram-1mg/kg/dose to a maximum of 50mg.

Notes:

- a) **Caution:** in infants under 2 years because of the possible association with 'cot deaths'.
- b) Paradoxical hyperexcitability may be seen in some children.
- c) Promethazine liquid (Rosemont) contains 1.7g of sucrose in 5ml. Promethazine liquid (Phenergan[®]) is sugar free.

PROPANTHELINE

Preparations: TABLETS 15mg.

Dosage: **ANTISPASMODIC, DAY TIME WETTING AND UNSTABLE BLADDER**
Unlicensed for use in children.
Orally, all ages, 300microgram/kg 3-4 times a day. Maximum dose 2mg/kg/day. (Do not exceed 15mg three times daily and 30mg at night).

Notes:

- a) The side effects are anticholinergic and include dry mouth, blurred vision and constipation.
- b) Give at least an hour before food.

PROPOFOL

Preparations: INJECTION 200mg in 20ml (1%).
PREFILLED SYRINGE 500mg in 50ml (1%), 1g in 50ml (2%).

Dosage:

THE CSM DOES NOT RECOMMEND THE USE IN CHILDREN FOR SEDATION.

ANAESTHESIA

Induction; over 1 month, *IV injection* 2.5mg/kg, adjust dose according to response. Larger doses are often required for children under 8 years. Lower dosage is recommended for children of ASA grades 3 and 4.

Maintenance; over 1 month, repeat injections as required or *IV infusion*, 9-15mg/kg/hour adjusting dose according to response. (Theatre doses only).

SEDATION AND ICP CONTROL IN SEVERE HEAD INJURY

These indications are unlicensed for use in children.

IV injection, 2-2.5mg/kg

IV infusion, 2-3mg/kg/hour adjust dose according to response. Infusion should not continue for more than 2 days or exceed 4mg/kg/hr.

Administration: Inject slowly or infuse, neat. If required propofol 1% can be diluted in glucose 5% only. Minimum concentration is 2mg in 1ml. Discard any diluted solution after 6 hours. Administer using PVC giving sets. Propofol 2% should not be diluted.

Notes:

- a) Monitor blood lipid levels of all patients at risk of not clearing the fat contained in propofol injection emulsion.
- b) Discolouration of the urine has been reported with prolonged infusions and implies toxicity.
- c) The 2% infusion contains half the amount of fat per mg of propofol as the 1% infusion. 1ml of propofol = 1ml intralipid 10% \cong 1Kcal.
- d) High doses and/or long duration increases the risk of the "propofol syndrome" with lactic acidosis and increased heart rate.
- e) Use strict aseptic technique when using propofol as it is a very good culture medium for bacteria.
- f) Caution in patients with a history of egg, soya or peanut allergy or sensitivity.

PROPRANOLOL

Preparations: CAPSULES MR 80mg. TABLETS 10mg, 40mg and 80mg.
INJECTION 1mg in 1ml. LIQUID 50mg in 5ml.

Dosage: **FALLOT'S TETRALOGY AND ARRHYTHMIAS**
Orally,
Neonates; 0.25mg-1mg/kg 2-3 times a day (max 2mg/kg three times a day)
>1 month: 0.25mg-1mg 3-4 times a day (max 5mg/kg/day).
IV injection, initially, 15-20microgram/kg (may need 50microgram/kg for arrhythmias), then increasing to a dose of 100microgram/kg, given slowly under ECG control. May be repeated 3-4 times each day.

PHAECHROMOCYTOMA, THYROTOXICOSIS

Orally, 250-500microgram/kg 3-4 times a day. Start at low dose and increase to 1mg/kg 3 times a day or until response. Maximum 8mg/kg/day (160mg/day).
IV injection, 10-50microgram/kg slowly under ECG control. Repeat 3-4 times a day if necessary.

PORTAL HYPERTENSION

Orally, initially,
Neonates: 250microgram/kg 3 times a day (max 2mg/kg 3 times a day).
1 month – 12 years: 500microgram/kg 3 times a day (max 2mg/kg 3 times a day).
12 - 18 years: 80mg twice daily, maintenance 160-320mg daily.
Doses are usually increased at weekly intervals.

MIGRAINE PROPHYLAXIS

Orally,

2 - 12 years	250-500microgram/kg	2-3 times a day (max 4mg/kg/day)
Over 12 years	20-40mg	2-3 times a day (max 160mg/day)

HAEMANGINOMA

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Week 1	1mg/kg/day	Divide into 3 doses
Week 2	2mg/kg/day	Divide into 3 doses

Increase dose with weight each month until 9 months old. Continue on that dose until 1 year old and then taper dose off over 2-3 weeks.

Administration: Give by slow IV bolus over 3-5minutes – rate should not exceed 1mg/min. May be diluted with sodium chloride 0.9% or Glucose 5%.

Notes:

- Contra-indicated in asthmatics due to increased bronchospasm.
- Cardiac failure and heart block may be exacerbated by propranolol.
- Administration of IV, propranolol is contraindicated in patients on concomitant verapamil.
- Cimetidine potentiates the effects of propranolol and chlorpromazine concentrations are increased by propranolol.
- Excessive bradycardia can be countered by intravenous atropine.
- Start with a smaller dose in renal impairment. May reduce renal blood flow and adversely affect renal function in severe renal impairment.

PROTAMINE SULPHATE

Preparations: INJECTION 50mg in 5ml.

Dosage: **HEPARIN ANTIDOTE**

Time since heparin given (minutes)	Protamine dose per 100units of heparin (or LMWH)
<30	1mg
30-60	0.5-0.75mg
60-120	0.375-0.5mg
>120	0.25-0.375mg

Maximum 50mg (5ml)/dose. Monitor APTT and INR.

Administration: *IV injection* over 10 minutes undiluted, dilute if required with sodium chloride 0.9%.

Notes:

- a) May cause hypotension.
- b) In excess, protamine has an anticoagulant effect.
- c) Not suitable for reversal of oral anticoagulants.
- d) Increased risk of allergic reactions if patient has had previous protamine, protamine insulin or an allergy to fish.

PROTIRELIN (THYROTROPHIN RELEASING HORMONE)

Preparations: INJECTION 200microgram in 2ml.

Dosage: ***TO ELUCIDATE BORDERLINE THYROTOXICOSIS OR HYPOTHYROIDISM BY EXAMINATION OF TSH RESPONSE***

Undiluted *IV injection* 1microgram/kg as a single dose (over 30 seconds). Doses up to 20microgram/kg have been required.

Notes:

- a) Take blood sample before the dose as a control, then again 20 minutes after injection, for peak TSH assay. If necessary take a further blood sample 60 minutes after the dose to detect a delayed TSH response.
- b) IM injection should be avoided as no peak in blood levels occurs.
- c) The response to thyrotrophin may be modified in patients taking thyroid hormones, antithyroid drugs, corticosteroids, theophylline, phenothiazines, metoclopramide, bromocriptine, salicylates, benzodiazepines, amiodarone, carbamazepine or spironolactone.

PYRAZINAMIDE

Preparations: TABLETS 500mg (**Import**). LIQUID 500mg in 5ml (**GSTT Special**) (Fridge).

Dosage: **TUBERCULOSIS THERAPY (UNSUPERVISED REGIMEN)**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

This indication is unlicensed for use in children.

Orally, all ages, 35mg/kg/day, rounded to the nearest 125mg. Maximum dose is 2g/day. Give for first 2 months of treatment only. If not given, rifampicin and isoniazid should be administered for 9 months.

Notes:

Hepatitis has been reported with pyrazinamide. Base line liver function tests should be performed before commencing treatment. Frequent checks in the first 2 months are then required in those with pre-existing liver disease. Patients/carer should be warned to seek medical advice immediately if there are any signs of liver disorder e.g. persistent nausea, vomiting, malaise, fever or jaundice.

PYRIDOSTIGMINE BROMIDE

Preparations: TABLETS 60mg. SUSTAINED RELEASE TABLETS 180mg (**Import**).
SUSPENSION 60mg in 5ml (**Extemporaneously Prepared**).

Dosage: **MYASTHENIA GRAVIS**
Orally, initially,
Neonates, 1mg/kg daily increased gradually to max 10mg
1 month - 5 years 30mg daily
5 years - 12 years 60mg daily
>12 years 60-120mg daily
Increase daily by 30-60mg given as extra doses at suitable intervals throughout the day.
Total daily dose is usually 30-360mg (under 12 years) and 300mg-1.2g/day (over 12 years).

Notes:

- a) Pyridostigmine is usually first line as it is longer acting and has a smoother onset of action than neostigmine. It is weaker than neostigmine and the decreased muscarinic action results in better gastrointestinal tolerability.
- b) Tablets are scored.
- c) Use with extreme caution in asthmatic children.
- d) Renal Impairment – reduce dose to 35% in moderate and 20% in severe renal impairment.
- e) In neonates give doses 30-60minutes before feeds.

PYRIDOXINE (Vitamin B6)

- Preparations:* TABLETS 50mg. INJECTION 50mg/2ml (**Specials Manufacturer**).
LIQUID 50mg in 5ml (**Extemporaneously Prepared**).
- Dosage:* **CONVULSIONS**
Neonates, *orally*, 200mg a day as a therapeutic trial for up to 7 days. Maintenance dose – 50-100mg daily.
IV injection (see notes a and b) 100mg as a therapeutic trial for up to 7 days. For maintenance, convert to oral therapy.
Children, *orally*, 50-100mg a day, but up to 1g may be required (see note c).
SUPPLEMENTATION ON DIALYSIS AND ISONIAZID PROPHYLAXIS
Neurological side effects of isoniazid are less common in children (see note d)
Orally, neonates and infants 5mg once a day and children 12.5mg once a day.
- Administration:* Slow IV injection over at least 5 minutes, dilute with sodium chloride 0.9%.
- Notes:*
- a) Resuscitation facilities **must** be readily available when IV pyridoxine is administered due to the risk of cardiovascular collapse.
 - b) Initial IV therapeutic trial dose should be given, if possible, during concurrent EEG monitoring.
 - c) Ideal maintenance dose is not necessarily one that stops seizures but that allows best intellectual performance.
 - d) Risk factors for developing peripheral neuritis whilst on isoniazid are breast fed infants, malnutrition, diabetes and chronic renal failure.
 - e) Tablets can be halved and quartered or crushed and dissolved in water.

PYRIDOXAL 5 PHOSPHATE

Preparations: TABLETS 50mg (**Specials Manufacturer**).

Dosage: **NEONATAL SEIZURE DISORDER (UNLICENSED USE)**

Neonates: 10mg/kg three times a day (max. 5 times a day).

>3 months: 5mg/kg three times a day.

Notes:

- a) Sudden respiratory arrest and profound hypotension may occur with the use of Pyridoxal 5 Phosphate.
- b) It is advisable that any trial of Pyridoxal 5 Phosphate be started during working hours.
- c) Resuscitation facilities must be close at hand and intensive care facilities must be available. Ideally, it should be initiated in PICU, HDU or in the HDU area of the ward.
- d) Tablets can be halved and quartered or crushed and dissolved in water. Drug can be difficult to dissolve and so large amounts of water (i.e. 10mls) may be needed.
- e) Initial patient monitoring required including baseline observations and continuous cardiac and saturation monitoring. Blood pressure, pulse, respirations and oxygen saturation should be monitored and recorded every 15 minutes for 2 – 3 hours following administration of Pyridoxal 5 Phosphate dose.

QUININE

Preparations: TABLETS quinine sulphate 200mg and 300mg.
INJECTION quinine dihydrochloride 300mg in 1ml (**Specials Manufacturer**).

Dosage: **TREATMENT OF CHLOROQUINE RESISTANT MALARIA (P.FALCIPARUM)**
See note e).

Advice on **PROPHYLAXIS** and **TREATMENT** can be obtained from:

Medicines Information Centre

or

The London Malaria Reference Laboratory

☎ 020-7636 3924 ☎

The Hospital for Tropical Disease

☎ 020-7387 4411 (all hours) ☎

QUININE SULPHATE

Orally, 10mg/kg (of sulphate) 3 times a day, for 7 days (maximum dose 600mg).

Doses may need to be rounded to the nearest tablet size or given less frequently, to achieve a suitable total daily dose.

QUININE DIHYDROCHLORIDE

IV infusion, 20mg/kg (of dihydrochloride) as loading dose, maximum 1.4g (**See note a**). Then after 8-12 hours, 10mg/kg (of dihydrochloride)(maximum 700mg) every 8 hours. Change to oral therapy as soon as practically possible. If IV treatment is required for more than 48 hours, reduce maintenance dose to 5-7mg/kg every 8 hours. A 7 day course of quinine should be completed.

Administration: IV infusion; (administer over at least 4 hours) dilute to 2mg in 1ml with sodium chloride 0.9% or Glucose 5%. In fluid restricted patients dilute to a maximum concentration of 30mg in 1ml.

Notes:

- a) **Do not** give loading dose if patient has received quinine, quinidine or mefloquine during the previous 24 hours.
- b) Monitor blood glucose levels as quinine and malaria may cause hypoglycaemia.
- c) Consider monitoring blood levels of quinine if IV used for >48 hours. To avoid toxicity, trough blood levels should remain below 8mg/L.
- d) For IV injection or IM administration, **seek expert advice**, due to risk of hypoglycaemia or arrhythmias.
- e) Quinine base 100mg is equivalent to quinine dihydrochloride 122mg or quinine sulphate 121mg.

RANITIDINE

Preparations: TABLETS 150mg and 300mg. LIQUID 150mg in 10ml.
INJECTION 50mg in 2ml.

Dosage: **ULCER THERAPY, REFLUX OESOPHAGITIS**
The parenteral route is unlicensed for use in children.
IV injection, all ages, 1mg/kg 3-4 times a day (max dose is 50mg four times a day).
The treatment of peptic ulcers is the only licensed indication for use in children.

Orally,

Neonates	1-2mg/kg	3 times a day
1 month - 6 months	1mg/kg	3 times a day (max 3mg/kg three times a day)
6 months - 12 years	2 - 4mg/kg	twice a day (max 150mg twice daily)
Over 12 years	150mg	twice a day (max 300mg twice daily)

Doses as high as 5mg/kg twice a day, can be used for treatment of peptic ulcer.

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dosage
10-50	75% normal dose
<10	50% normal dose

Administration: IV injection, dilute to 2.5mg in 1ml with sodium chloride 0.9% or glucose 5% and administer over at least 2 minutes.

Notes:

- a) Interactions due to blocking of cytochrome P450 mediated hepatic drug metabolism are less common with ranitidine compared with cimetidine.
- b) Ranitidine effervescent tablets are sucrose and alcohol free but contain aspartame and 14.3mmol of sodium per 150mg tablet; the liquid (Rosemont) is sucrose free but contains 8% w/v alcohol.

RIBAVIRIN (TRIBAVIRIN)

Preparations: INJECTION 1.2g in 12ml (Import). POWDER FOR INHALATION 6g.
CAPSULES 200mg.

VIROLOGY APPROVAL ONLY

SEEK SPECIALIST ADVICE

Dosage: **NEBULISED - RESPIRATORY SYNCYTIAL VIRUS (RSV) BRONCHIOLITIS**

Use is usually restricted to immunocompromised or cardiac compromised patients who are infected with RSV or Parainfluenza virus.

All ages,

6g nebulised over 12-18 hours, once a day for 3-5 days.

Maximum duration is 7 days.

INTRAVENOUS - RESPIRATORY SYNCYTIAL VIRUS (RSV) OR PARAINFLUENZA VIRUS, BRONCHIOLITIS OR PNEUMONITIS

Unlicensed.

Occasionally used in at risk patients who are severely unwell.

IV,

All ages,

33mg/kg as a loading dose, then 16mg/kg four times a day for 4 days, then 8mg/kg three times a day for 3-10 days.

TREATMENT OF ADENOVIRUS

Unlicensed Use.

IV,

All ages,

25mg/kg/day (in 3 divided doses) for 1 day then 15mg/kg/day for 9 days to give a total of 10 days treatment.

TREATMENT OF CHRONIC HEPATITIS C

Unlicensed

In combination with interferon alfa-2b for chronic hepatitis C.

All ages, *orally* 15mg/kg/day in two divided doses rounded to the nearest 200mg capsule.

If adverse reactions occur the dose can be reduced to 7.5mg/kg/day in two divided doses.

Maximum dose is 1g per day.

Ribavirin capsules should be swallowed whole with or after food.

Administration: **Nebulised:** Reconstitute each vial with 300mls water for injection. Nebulise via a small particle aerosol generator (SPAG 6000).

Intravenous: All doses should be diluted to a total of 15mls with 0.9% sodium chloride or 5% glucose, administered at a rate of 1 ml/min over 15 minutes.

Notes:

- Ribavirin is potentially teratogenic and therefore is contra-indicated in women who are or who may become pregnant. Healthcare workers and others (including visitors) who are pregnant or at a risk of becoming pregnant, should not be exposed to ribavirin.
- Efficacy is increased if ribavirin is started early in the course of the infection.
- Precipitation of nebulised ribavirin in tubing has caused difficulties during assisted ventilation. Consult manufacturer directly for current advice.

- d) Ribavirin has been associated with reticulocytosis, worsening respiration, bacterial pneumonia and pneumothorax. Ribavirin has been associated with haemolysis, anaemia, psychiatric disorders, suicidal ideation, thyroid disorders (in combination with interferon alfa-2a), and hyperuricaemia.
- e) Ribavirin interacts with Nucleoside Reverse Transcriptase Inhibitors.
- f) Use with caution in cardiac disease, assessment including ECG is recommended before and during treatment, discontinue if deterioration occurs. Monitor full blood count, platelets, electrolytes, serum creatinine, liver function tests and uric acid on a regular basis.

RIBOFLAVIN (Vitamin B2)

Preparations: CAPSULES 50mg (**Specials Manufacturer**).

Dosage: ***INHERITED METABOLIC DISEASE***

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Orally, all ages, initially 10-20mg once a day. Maintenance, 50mg once a day. Doses up to 400mg/day have been used.

Notes:

- a) Riboflavin is a co-enzyme in a number of different enzyme systems.
- b) Large doses may interfere with some laboratory tests.

RIFAMPICIN

Preparations: CAPSULES 150mg and 300mg. LIQUID 100mg in 5ml.
 INJECTION 600mg.
Combined Products:
 Rifinah 150[®] = Rifampicin 150mg + Isoniazid 100mg
 Rifinah 300[®] = Rifampicin 300mg + Isoniazid 150mg
 Rifater[®] = Rifampicin 120mg + Pyrazinamide 300mg + Isoniazid 50mg

Dosage: **TUBERCULOSIS THERAPY (UNSUPERVISED REGIMEN)**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Orally or IV infusion,
 Premature and newborn neonates, 10mg/kg once a day.
 Over 1 month, 10mg/kg up to 20mg/kg once a day (<50kg maximum dose 450mg and >50g maximum dose 600mg).

TUBERCULOSIS MENINGITIS

IV infusion 20mg/kg once a day.

IN LIVER FAILURE

Avoid in liver failure or reduce dose to a max. of 8mg/kg daily.

PROPHYLAXIS OF MENINGITIS

MENINGOCOCCAL

Orally,

Less than 1 year	5mg/kg	twice a day	} for
1 - 12 years	10mg/kg	twice a day	} 2
Over 12 years	10mg/kg (max. 600mg)	twice a day	} days

HAEMOPHILUS INFLUENZAE TYPE B

Orally,

Under 3 mths	10mg/kg	once a day	} for
3 mths - 12 years	20mg/kg	once a day	} 4
Over 12 years	600mg	once a day	} days

PRURITUS DUE TO CHOLESTASIS

Orally, all ages, 5-10mg/kg once a day (maximum dose 600mg).
 On reconstitution 600mg (Rifadin[®]) displaces 0.48ml. Add 4.52ml of the solvent provided to each vial to give 600mg in 5ml. Further dilute to a concentration of 1mg in 1ml with glucose 5%. Administer over 2-3 hours.

Administration:

Notes:

- a) Hepatitis has been reported with rifampicin. Base line liver function tests should be performed before commencing treatment. Frequent checks in the first 2 months are then required in those with pre-existing liver disease. Further routine checks are not required if there is no evidence of liver disease or dysfunction. Patients/carer should be warned to seek medical advice immediately if there are any signs of liver disorder e.g. persistent nausea, vomiting, malaise, fever or jaundice.
- b) Renal dysfunction and haematological abnormalities have been noted, particularly with intermittent, interrupted or prolonged treatment.
- c) Rifampicin enhances the metabolism of many drugs thus reducing blood levels and efficacy. Some of the drugs affected are warfarin, ciclosporin, phenytoin, corticosteroids, theophylline, oral contraceptive pills and some antifungals and antiarrhythmics.
- d) Rifampicin stains urine, sweat and tears (including soft contact lenses).

RISPERIDONE

Preparations: TABLETS 500micrograms, 1mg, 2mg, 3mg, 4mg and 6mg.
LIQUID 1mg in 1ml.

Dosage: **CHILDHOOD SCHIZOPHRENIA, BEHAVIOURAL DISORDERS**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Unlicensed for use in children under 15 years.

	4 - 8 years	8 - 15 years	≥ 15 years	
Day 1	0.25mg	0.5mg	1mg	} TWICE
Day 2	0.5mg	1mg	2mg	} A
Day 3	0.75mg	1.5mg	3mg	} DAY

Increase dose according to response. Usual maintenance dose in adolescents and adults is 4-8mg/day. Maximum 16mg/day however doses above 10mg/day have not been shown to be more effective and side effects are more likely.

IN RENAL AND HEPATIC FAILURE

Initial starting dose should be reduced by 50%.

Notes:

- a) Risperidone can cause postural hypotension. A baseline blood pressure should be performed. Blood pressure should be monitored whilst dose is being established and after any dosage increments.
- b) Patient should be monitored at least weekly for side effects whilst dose is being established. Weight gain needs close monitoring.
- c) Beware of Neuroleptic Malignant Syndrome.
- d) The liquid can be mixed with mineral water or orange juice or black coffee and taken immediately. The liquid should not be mixed with tea.

RITUXIMAB

Preparations: INJECTION 100mg in 10ml and 500mg in 50ml (**Non-formulary**) (Fridge).

Dosage: **TREATMENT OF LUPUS NEPHRITIS AND POST-TRANSPLANT LYMPHOPROLIFERATIVE DISEASE**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Unlicensed Use.

LUPUS NEPHRITIS

Dose: 750mg/m²/dose every two weeks for a total of two doses. (Maximum dose is 1g).

POST-TRANSPLANT PROLIFERATIVE DISEASE

Dose: 375mg/m²/dose at WEEKLY intervals for 4 weeks. (Maximum dose is 500mg).

Administration: For intravenous infusion, dilute to a concentration of 1 – 4 mg/ml with Glucose 5% or Sodium Chloride 0.9%; gently inverting vial to avoid foaming. The initial rate for the infusion is 25mg/hr, increasing every 30 minutes by 25mg/hr if tolerated to a maximum of 200mg/hr (400mg/hr for children over 12).

Notes:

- a) Rituximab should be used with caution in children receiving cardiotoxic chemotherapy or with a history of cardiovascular disease.
- b) Transient hypotension occurs frequently during infusion and antihypertensives may need to be withheld for 12 hours before infusion.
- c) Infusion-related side-effects are frequently reported, predominantly during the first infusion. These include fever and chills, nausea and vomiting, allergic reactions (rash, pruritis, angioedema, bronchospasm and dyspnoea) and flushing. Children should be given an analgesic and an antihistamine before each dose of Rituximab to minimise these effects. Premedication with a corticosteroid should also be considered. Mild or moderate infusion-related reactions usually respond to a reduction in the rate of infusion.
- d) Patients who develop evidence of severe reactions, especially severe dyspnoea, bronchospasm or hypoxia should have the infusion stopped.
- e) Rituximab infusions should be administered in an environment where full resuscitation facilities are immediately available, and under the close supervision of an experienced physician.

ROCURONIUM

Preparations: INJECTION 50mg in 5ml and 100mg in 10ml (Fridge).

Dosage: **NEUROMUSCULAR BLOCKADE FOR VENTILATION AND SURGERY**

Over 1 month: *IV bolus* 0.6mg-1mg/kg.

IV infusion (avoid if possible): 5-10microgram/kg/min.

Administration: *IV bolus* or it can be diluted in 0.9% sodium chloride, glucose 5%/sodium chloride 0.9% for continuous administration.

Notes:

- a) Prolonged duration neuromuscular blockade if patient is on halogenated volatile anaesthetics, high doses of thiopental, ketamine, fentanyl, etomidate and propofol. Also with other muscle relaxants, antibiotics (aminoglycoside, metronidazole, etc), diuretics, lithium salts.
- b) Reduced duration of neuromuscular blockade by: chronic steroid use, neostigmine, edrophonium, phenytoin, carbamazepine, noradrenaline, azathioprine, calcium chloride, potassium chloride.
- c) Rocuronium is excreted in urine and bile.

RUFINAMIDE

Preparations: TABLETS 100mg, 200mg and 400mg

Dosage: **ADJUNCTIVE TREATMENT OF SEIZURES IN LENNOX-GASTAUT SYNDROME**

Orally, Over 4 years:

Under 30kg: initially 100mg once daily, increased after 2 weeks to 100mg twice daily; increased every 1-2 weeks in steps of 100mg up to maximum 500mg twice daily.

Over 30kg: initially 100mg twice daily, increased after 2 weeks to 200mg twice daily; increased every 1-2 weeks in steps of 100mg up to:

30-50kg: max 900mg twice daily

50-70kg: max 1.2g twice daily

Over 70kg: max 1.6g twice daily

Administration: Tablets may be crushed and given in water.

Notes:

- a) **Caution:** hypersensitivity syndrome has developed in children and upon treatment initiation. Warn children and carers to seek immediate medical attention if signs and symptoms of hypersensitivity syndrome occur – including rash, fever, lymphadenopathy, hepatic dysfunction, haematuria.
- b) Avoid abrupt withdrawal.

SALBUTAMOL

Preparations: LIQUID 2mg in 5ml.
INJECTION 500microgram in 1ml and 5mg in 5ml (for continuous infusion).
NEBULES (Preservative free) 2.5mg in 2.5ml and 5mg in 2.5ml.
INHALER 100microgram/metered inhalation.
BREATH ACTIVATED INHALER 100microgram/metered inhalation.
ACCUHALER® 200microgram per blister.

Dosage: **ASTHMA THERAPY**
Inhaled, initially, 100-200microgram up to 4 times a day. In severe attacks higher doses (up to 10 puffs – one puff every 15-30seconds) may be necessary.

Nebulised,

Under 5 years 2.5mg) every 4 hours as required
5 years and over 5mg)

Nebulisers may be administered more frequently in hospital with close monitoring (i.e. every 20 minutes).

Orally, see note a).

All ages, 100microgram/kg 3-4 times a day,

OR

Liquid,

2 - 6 years 1-2mg)
6 - 12 years 2mg) 3-4 times a day.
Over 12 years 2-4mg (max 8mg))

Controlled release tablets,

3 - 12 years 4mg twice a day
Over 12 years 8mg twice a day

PARENTERAL THERAPY FOR ACUTE SEVERE ASTHMA

This indication is unlicensed for use in children.

IV injection, 15microgram/kg (usually 5-10mcg/kg if <2 years) as a single dose in status asthmaticus. Maximum intravenous bolus dose is 250 microgram.

IV infusion, 0.6-1microgram/kg/minute. Doses as high as 5microgram/kg/minute have been used in intensive care.

RENAL HYPERKALAEMIA

This indication is unlicensed.

All ages, *IV injection*, 4microgram/kg, preferred route in neonates.

Nebulised, 2.5-5mg as a single dose, repeat as necessary.

CONGENITAL MYOPATHY, SPINAL MUSCULAR ATROPHY

Orally,

< 12 years 2mg three times a day
> 12 years 4mg three times a day

Administration: Slow IV injection over 5 minutes or IV infusion, dilute with sodium chloride 0.9% or glucose 5%. Ideally dilute to 10micrograms/ml. In fluid restricted patients 10mg in 50ml (200mcg/ml) may be used peripherally or give neat centrally.

Notes:

- a) Inhaled therapy is the preferred method of administration and should be used whenever possible. Oral salbutamol is much less effective and has more systemic side effects.
- b) Children under 10 years are usually incapable of using metered dose aerosol inhalers effectively and children under 4 years are usually incapable of using accuhalers.
- c) An Aerochamber or Volumatic[®] spacer is available for use with the aerosol inhaler. If this is not available, for emergency use only, a hole just large enough for the inhaler mouthpiece can be cut in the bottom of a polystyrene cup. The inhaler is fitted into this and the cup can then be placed over the child's nose and mouth.
- d) Always be aware of the risk of hypokalaemia, especially with high doses and IV therapy.
- e) The use of spacers is at least as effective as that of nebulisers in emergency situations.

SALMETEROL

Preparations: INHALER 25microgram per metered inhalation.
ACCUHALER 50microgram per blister.

Dosage: **ASTHMA THERAPY**

ON CONSULTANT ADVICE ONLY

This indication is unlicensed for use in children under 4 years.

Inhaled,

Under 4 years 25 microgram twice a day

Over 4 years 50 microgram twice a day

Increase dose according to response up to 100microgram twice a day.

Notes:

- a) **Note:** Salmeterol is not for immediate relief of acute attacks and existing corticosteroid therapy should not be withdrawn or reduced.
- b) Children under 10 years are usually incapable of using metered dose aerosol inhalers effectively. If a dry powder device is required an accuhaler should be prescribed for children over 4 years.
- c) An Aerochamber or Volumatic[®] spacer (and mask) is available for use with the aerosol inhaler.
- d) See chronic asthma management guidelines.

SENNA

Preparations: TABLETS containing sennoside B 7.5mg.
LIQUID containing sennoside B 7.5mg in 5ml.

Dosage: **CONSTIPATION**
Orally,
2 - 6 years 2.5-5ml at night
Over 6 years 5-10ml or 1-2 tablets at night
In severe constipation much higher doses may be necessary.

BOWEL PREP PRE-COLONOSCOPY

Orally, one dose, usually taken at noon on day before procedure.

0-1yrs	1-2yrs	2-5yrs	5-8yrs	8-12yrs	>12yrs
10ml	20ml	30ml	40ml	50ml	60ml

Notes:

Senna (Senokot[®]) liquid contains 3.3g of sucrose in 5ml and 7% v/v alcohol and is fruit flavoured.

SERTRALINE

Preparations: TABLETS 50mg and 100mg.

Dosage: **OBSESSIVE COMPULSIVE DISORDER, ANXIETY DISORDERS, SELF INJURY BEHAVIOUR**

SEEK EXPERT ADVICE BEFORE PRESCRIBING
CSM WARNING – NOT RECOMMENDED FOR DEPRESSIVE ILLNESS
IN THOSE <18 YEARS

This indication is unlicensed for use in children.

Orally, initially, 0.5-1mg/kg/day rounded to the nearest half tablet (25mg). Increase dose according to response to 1-2mg/kg/day. Maximum 200mg/day. Some children may respond to 12.5mg daily.

Doses of **150mg/day** and above are not recommended to continue for more than 8 weeks.

OR

initially,

6 - 12 years 25mg once a day (max. dose 200mg/day)

12 years and over 50mg once a day (max. dose 200mg/day)

Notes:

- a) Patients should be monitored weekly for side effects whilst dose is being established. At the maximum dose of 200mg/day there is an increased risk of elevated transaminases which decreases on discontinuation.
- b) Sertraline tablets taste bitter but can be dispersed in water, orange juice or blackcurrant squash for ease of administration. They can also be crushed and mixed with soft food.
- c) Avoid abrupt withdrawal. Sertraline should be withdrawn over approximately 4 weeks.
- d) Irritability may be a problem (even hypomanic symptoms).

SEVELAMER

Preparations: TABLETS 800mg.

Dosage: ***HYPERPHOSPHATAEMIA IN RENAL PATIENTS***
Orally,
Child 12–18 years initially 0.8–1.6 g 3 times daily with meals, then adjusted according to plasma-phosphate concentration. Part doses have been used and titrated in children as young as 2 years old (no evidence base).

Administration: There is no evidence for crushing and dissolving the tablets, but some centres do crush and disperse in 5ml of sodium bicarbonate.

Notes: Contra-indicated in bowel obstruction.

SILDENAFIL

Preparations: TABLETS 25mg, 50mg and 100mg. LIQUID 50mg in 5ml
(**Extemporaneously Prepared**).

Dosage: **PULMONARY HYPERTENSION (CONFIRM USE WITH PHARMACY)**
This is an unlicensed indication.
Orally, all ages, initially 0.5mg/kg every 4-6 hours, increasing according to response to a maximum of 2mg/kg every four hours.

Notes:

- a) Gentle shaking of suspension is required prior to administration however vigorous shaking may lead to frothing.
- b) Caution if using it with nitrates (GTN or sodium nitroprusside).
- c) Stored as a Controlled Drug.

SIMPLE LINCTUS B.P (ADULT AND PAEDIATRIC)

Preparations: Simple LINCTUS – Sugar Free LINCTUS. The paediatric preparation is one quarter the strength of the adult preparation (**Extemporaneously Prepared**).

Dosage: **COUGH**
Under 12 years 5-10ml of the paediatric preparation.
Over 12 years 5-10ml of the adult preparation.
Give the above doses 3-4 times a day as necessary.

Notes: Simple linctus (Adult) contains 3g of sugar in 5ml.

SIMVASTATIN

Preparations: TABLETS 10mg, 20mg and 40mg.

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Dosage:

FAMILIAL HYPERCHOLESTEROLAEMIA

This indication is unlicensed for use in children.

Under 10 years 5mg up to 20mg daily (at night)

Over 10 years 10mg up to 40mg daily (at night)

Doses adjusted not less than 4 weeks between increments according to response.

Notes:

- a) Monitor liver function and CK. Patients should be advised to report any muscle pain.
- b) Teratogenic, therefore give clear warnings as to the importance of avoiding pregnancy in girls whilst taking Simvastatin.
- c) If pre-pubertal, monitor puberty as theoretical risk of interference.
- d) Simvastatin is metabolised by cytochrome P450 (CYP3AG) and co-administration of potent inhibitors of this enzyme (such as macrolide antibiotics, "azole" antifungal agents, protease inhibitors, ciclosporin and fibrates) may increase the statin levels and therefore increasing the risk of dose-related side effects especially Rhabdomyolysis and serious myopathy. Grapefruit juice intake should be avoided. Effect of warfarin is enhanced.

SIROLIMUS

Preparation: TABLETS 1mg and 2mg. LIQUID 1mg in 1ml (Fridge).

Dosage: **REFRACTORY RENAL ALLOGRAFT REJECTION, CALCINEURIN MINIMISATION / WITHDRAWAL (DUE TO UNACCEPTABLE SIDE EFFECTS), CHRONIC ALLOGRAFT NEPHROPATHY**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Oral loading dose of 3mg/m² twice a day for three days, then 3mg/m² daily adjusting according to trough levels. Children less than 7 years may need twice a day dosing, consult with a specialist.

Administration: Mix solution with water or orange juice immediately before taking – Do not mix with any other liquids.

Sirolimus should be given 4 hours after ciclosporin.

If switching between tablets and liquids, measurements of the serum trough concentration after 1-2 weeks is recommended.

Notes:

- a) Sirolimus is extensively metabolised with the CYP3A4 isoenzyme. Care and expert advice should be sought if in doubt when prescribing medicines that may be metabolised by this route. Monitor levels
Sirolimus levels increase by: fluconazole, itraconazole, ketoconazole, clarithromycin, erythromycin, metoclopramide, cimetidine, grapefruit juice, voriconazole
Sirolimus levels decreased by: rifampicin, carbamazepine, phenobarbitone, phenytoin.
- b) Therapeutic Drug Monitoring:
 - i) Approximate time to steady state 5-7 days
 - ii) Therapeutic whole blood levels 5-15ng/ml
 - iii) Take trough sample immediately before next dose
- c) Patients of black origin may require different dosage regimens. Seek expert advice.
- d) To minimise variability in absorption, Sirolimus should be taken consistently with or without food. Grapefruit or grapefruit containing products should be avoided as it affects the CYP3A4 enzyme system.
- e) Patients should be monitored for hyperlipidaemia, abnormal results should be treated appropriately.
- f) Sirolimus can increase levels of Mycophenolic acid, leading to Anaemia.
- g) Abnormal healing has been reported. Consider drug substitution prior to elective surgery.
- h) Liquid preparation is light sensitive.

SODIUM BENZOATE

Preparation: LIQUID 500mg in 5ml (**Specials Manufacturer**).
INJECTION 1g in 5ml and 2g in 10ml (**Specials Manufacturer**).
TABLETS 500mg (**Specials Manufacturer**).

Dosage: **MAINTENANCE TREATMENT OF UREA CYCLE DEFECTS AND NON KETOTIC HYPERGLYCINAEMIA**

SEEK SPECIALIST ADVICE FROM METABOLIC TEAM BEFORE PRESCRIBING

Orally, all ages, initially, 62.5mg/kg four times daily with food. (Max. 150mg/kg four times daily).

IV injection, total daily dose as a continuous infusion over 24 hours.

ACUTE HYPERAMMONAEMIA

IV infusion, all ages 250mg/kg over 90minutes followed by 20mg/kg/hour.

Adjust according to response.

Administration: Dilute to 20mg in 1ml with glucose 5% or 10% (maximum concentration is 50mg/ml) and administer as a continuous infusion.

Notes:

- a) **Caution:** in neonates, due to increased risk of kernicterus.
- b) Sodium benzoate and sodium phenylbutyrate may be administered together as an intravenous infusion. Can be infused at Y-site with arginine, carnitine, and sodium phenylbutyrate.
- c) Aim to maintain plasma concentration of ammonia below 60micromol/L and glutamine below 800micromol/L.
- d) 1mmol of nitrogen is theoretically cleared by 1mmol of sodium benzoate (500mg contains 3.5mmol of sodium).
- e) Give with food to reduce nausea and vomiting. Can be mixed with milk, fruit juice or feeds.
- f) Injection can be given orally.
- g) 1g contains 7mmol of sodium.

SODIUM BICARBONATE

Preparations: TABLETS 600mg (7.14mmol of sodium and bicarbonate).
CAPSULES 500mg (6mmol sodium and bicarbonate).
INJECTION 4.2% (0.5mmol of sodium and bicarbonate in 1ml), 10ml; 8.4% (1mmol of sodium and bicarbonate in 1ml), 10ml.
PREFILLED SYRINGE 8.4% (Minijet), 50ml. INFUSION POLYFUSOR 8.4% 1.26% (0.15mmol of sodium and bicarbonate in 1ml), 500ml.

Dosage:

TO CORRECT ACIDOSIS

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Check blood gases, repeat every 15 minutes or as required.
Emergency: 1mmol/kg over 20minutes using 4.2% solution
OR

Total number of mmol of bicarbonate required can be calculated by:

$$F \times \text{base deficit (mmol/L)} \times \text{weight (kg)}.$$

F represents the extracellular fluid: weight ratio. This is 0.5-0.6 in prem neonates, 0.4 in neonates and 0.3 in infants and children. Only **half** the base deficit should be corrected initially by slow IV infusion and blood glucose, pH and electrolytes analysed before full correction.

RENAL ACIDOSIS

Orally/IV,

All ages 1-2mmol/kg/day.

Older children may use 70mmol/m²/day.

RENAL HYPERKALAEMIA

Slow IV, all ages, 1mmol/kg (1ml/kg of 8.4%) as a single dose, over 30 minutes.

RESUSCITATION

Slow IV injection, 1ml/kg of 8.4% initially, followed by 0.5ml/kg if necessary. See resuscitation guidelines.

Administration: Injection may be diluted with water to make a different strength ie. 1:1 to convert 8.4% into 4.2%.

Dilute with glucose 5% or 10% or sodium chloride 0.9% for infusions.

For peripheral administration dilute to 1 in 10 or use 1.26% infusion. However 4.2% may be given over a short period for emergency peripheral administration.

Ideally dilute 1 in 5 for centrally administered infusions, but may be given neat. Caution in renal patients: DO NOT dilute with sodium chloride 0.9% due to the potential for hypernatraemia.

Notes:

- If serum sodium or bicarbonate levels are high THAM may be considered.
- The 1.26% infusion is isotonic.
- Bicarbonate preparations suitable for dialysis are available as a special.
- Injection can be given orally.
- Polyfusor 8.4% (1mMol/ml), 200 ml can be given orally. Once decanted solution has a 7 day expiry at room temperature.

SODIUM CALCIUM EDETATE

Preparations: INJECTION 5% (10ml amps) (**Unlicensed**).

Dosage: **TREATMENT OF LEAD POISONING**

IF IN ANY DOUBT CONTACT THE MEDICAL TOXICOLOGY UNIT
☎ 020 7188 0600 ☎

IV injection, all ages, 30-40mg/kg twice a day for 5 days, repeated if necessary after 7 days. Any further courses should not be repeated for at least another 7 days.

Administration: IV infusion over 1 hour diluted with sodium chloride 0.9% or glucose 5% to 2-4mg in 1ml. In fluid restricted patients, maximum concentration is 30mg in 1ml.

Notes: Sodium calcium edetate is renally cleared and therefore adequate urinary output must be established and maintained during treatment.

SODIUM CHLORIDE

Preparations: SUSTAINED RELEASE TABLETS 600mg (10mmol of sodium).
LIQUID 5mmol in 1ml (**GSTT Specials**).
INJECTION 0.9% (0.15mmol of sodium in 1ml) 10ml.
INJECTION 30% (5mmol of sodium in 1ml) 10ml.
INFUSION 0.45% (0.075mmol of sodium in 1ml) 500ml.
INFUSION 0.9% 100ml, 250ml, 500ml and 1L.
POLYFUSORS 2.7% (0.46mmol of sodium in 1ml) 500ml.
UROTAINER 0.9% 50ml and 100ml.
EYE/NOSE DROPS sodium chloride 0.9%.
NEBULISER SOLUTION 3%

Dosage: **SODIUM SUPPLEMENTATION**
Adjust the dose according to serum levels. It is usual to do a half correction over 24 hours. As a guide the additional sodium (in mmol of sodium) to add to the previous intake is calculated via:
 $(138 - \text{serum Sodium}) \times 0.3 \times \text{weight (kg)}$.

SYMPTOMATIC HYPONATRAEMIC SEIZURES, RAISED INTRACRANIAL PRESSURE

Give 2-3ml/kg of 3% (or 2.7%) sodium chloride over 20 minutes preferably via central line.

CHRONIC RENAL LOSS

Orally, 1-2mmol sodium/kg/day.

NASAL CONGESTION

Instil, 1-2 drops of 0.9% sodium chloride into each nostril before feeds.

BRONCHIOLITIS

Nebulise, 4ml of sodium chloride 3% nebuliser solution three times a day (see note e).

Notes:

- a) Injection can be given orally.
- b) A 3% solution contains 0.5mmol of sodium/ml.
- c) 3ml/kg of 3% saline increases plasma sodium by approx. 2-3mmol/L.
- d) Liquid 5mmol/ml has a 7 day expiry after opening.
- e) A dose of ipratropium nebuliser solution should be administered before each sodium chloride 3% nebule dose.

SODIUM CROMOGLYCATE

Preparations: EYE DROPS 2% (Opticrom[®]). NASAL SPRAY 4% (Rynacrom[®]).

Dosage:

ALLERGIC RHINITIS

Nasal spray 4%: Over 1 year, one spray into each nostril 2-4 times a day.

ALLERGIC CONJUNCTIVITIS

Eye drops 2%: 1-2 drops in each eye 4 times a day.

SODIUM FUSIDATE

Preparations: TABLETS (E.C.) 250mg. LIQUID (Fusidic Acid) 250mg in 5ml.
INJECTION 500mg.
VISCIOUS EYE DROPS 1% fusidic acid (Fucithalmic®).

Dosage: **EYE PREPARATIONS**
Instil, into the affected eye/s TWICE a day. See note a).

TREATMENT OF STAPHYLOCOCCAL INFECTION

Use in combination with another anti-staphylococcal agent because resistance may develop rapidly if used alone.

Orally,

Under 1 year	0.3ml/kg	3 times a day
1 - 5 years	5ml	3 times a day
5 - 12 years	10ml	3 times a day
Over 12 years	15ml or 2 tablets	3 times a day

Intravenous infusion,

Neonates and Children less than 50kg, 6-7mg/kg of sodium fusidate three times a day.

Children over 50kg, 500mg of sodium fusidate 3 times a day.

Doses may be doubled in SEVERE infections.

Administration: Reconstitute vial with the 10ml phosphate-citrate buffer provided. Displacement volume is negligible. Further dilute to 1mg in 1ml with sodium chloride 0.9%, and infuse slowly over at least 6 hours. Can administer over 2 hours if via central line.

Notes:

- a) Fusidic acid 1% viscous eye drops are recommended for initial treatment. Chloramphenicol eye preparations are only indicated for neonates (in NICU/SCBU) and when sensitivities show that fusidic acid is not appropriate.
- b) Sodium fusidate absorption is good, use oral route when practicable.
- c) No modification of dosage is necessary in renal failure, however 10ml of phosphate-citrate buffer contains 1.1mmol of phosphate. Sodium content is 3.1mmol when reconstituted.
- d) Jaundice may occur, particularly with high doses and/or when intravenous infusions are infused at too high a concentration or too rapidly. This usually resolves if sodium fusidate is stopped.
- e) Doses in excess of the recommended IV dose may result in hypocalcaemia due to the large amount of phosphate/citrate buffer administered.
- f) Sodium fusidate displaces bilirubin from its albumin binding sites, however the clinical significance is uncertain. Caution in premature, jaundiced, acidotic, or seriously ill neonates due to risk of kernicterus.
- g) 250mg of fusidic acid liquid is *therapeutically* equivalent to 175mg sodium fusidate due to its lower oral bioavailability.

SODIUM NITROPRUSSIDE

Preparations: INJECTION 50mg in 2ml (**Import**).

Dosage: **VASODILATION**

This indication is unlicensed for use in children.

Initially IV infusion 0.5microgram/kg/minute increasing in increments of 0.2microgram/kg/minute as necessary to a maximum of 8microgram/kg/minute. If treatment for more than 24 hours, maximum of 4microgram/kg/minute. Wean dose slowly over 30 minutes on withdrawal to avoid rebound effects.

Administration: Reconstitute contents of each vial with 2ml **glucose 5%**, then further dilute to a concentration of 200microgram in 1ml with glucose 5% or sodium chloride 0.9%. If fluid restricted, maximum concentration is 1mg in 1ml. Protect infusion from light and use an amber giving set. **Discard after 24 hours**. Discard if the solution changes from pale orange to dark brown or blue.

Notes:

- a) If treatment continues for more than 72 hours, measure serum thiocyanate levels which should be less than 100mcg/ml (1.7mmol/L).
- b) In hypertensive encephalopathy a rapid reduction in blood pressure to normotensive levels can result in water shed cerebral infarction, blindness or death.
- c) Use with caution in severe liver or renal impairment, impaired cerebral circulation and hypothyroidism.
- d) Lactic acidosis may be the first presentation of cyanide toxicity.
- e) There is an increased risk of toxicity if the patient receives >3.5mg/kg of sodium nitroprusside in any course.

SODIUM PHENYLBUTYRATE

Preparations: TABLETS 500mg. GRANULES 940mg per g.
INJECTION 2g in 10ml (**Specials Manufacturer**).
LIQUID 250mg in 1ml (**Specials Manufacturer**).

Dosage: **MAINTENANCE TREATMENT OF UREA CYCLE DEFECTS AND NON KETOTIC HYPERGLYCINAEMIA**

SEEK SPECIALIST ADVICE FROM METABOLIC TEAM BEFORE PRESCRIBING

Orally, all ages, initially, 62.5mg/kg four times daily with food. (Max. 150mg/kg four times daily).

IV injection, total daily dose as a continuous infusion over 24 hours.

ACUTE HYPERAMMONAEMIA

IV infusion, all ages 250mg/kg over 90minutes followed by 20mg/kg/hour.

Adjust according to response.

Administration: Dilute to 20mg in 1ml with glucose 5% or 10% (maximum concentration is 50mg/ml) and administer as a continuous infusion.

Notes:

- a) Sodium benzoate and sodium phenylbutyrate may be administered together as an intravenous infusion.
- b) Aim to maintain plasma concentration of ammonia below 60micromol/L and glutamine below 800micromol/L.
- c) 2mmol of Nitrogen is theoretically cleared by 1mmol of sodium phenylbutyrate (500mg contains 2.7mmol sodium).
- e) Injection can be given orally.
- d) Give with food to reduce nausea and vomiting and increase palatability.
- f) Liquid (Ambutyrate[®]) contains aspartame.
- g) Hyperammonaemia may be induced by valproate, haloperidol or corticosteroids.
- h) The granules may be mixed with a small amount of food or dissolved in water flavoured with juice.

SODIUM PICOSULFATE

Preparations: SACHETS = Sodium Picosulfate 10mg + Magnesium Oxide + Citric Acid.
LIQUID 5mg in 5ml.

Dosage: **BOWEL EVACUATION BEFORE ABDOMINAL PROCEDURES, CONSTIPATION**

Orally,

Sachets:

1 - 2 years	0.25 sachet	twice a day
2 - 4 years	0.5 sachet	twice a day
4 - 9 years	1 sachet 0.5 sachet	am and evening
Over 9 years	1 sachet	twice a day

Give the above dose in the morning and then again in the early evening, on the day prior to procedure.

For treatment of constipation use above dose only **once** a day.

Pre-Colonoscopy: doses may vary in combination with senna (see guideline).

Liquid:

For constipation,

2 - 5 years 2.5ml at night

5 - 10 years 2.5-5ml at night

Over 10 years 5-15ml at night

Notes:

- a) Initially powder should be mixed with 30ml of water, followed by approximately 120ml after 5 minutes once the heat generated in the solution cools off.
- b) Sachets are sugar free, lemon flavour and contain 5mmol of potassium per sachet.
- c) Sodium picosulphate liquid is sugar and aspartame free but contains 5.9% alcohol.

SODIUM VALPROATE

Preparations: CRUSHABLE TABLETS 100mg. ENTERIC COATED TABLETS 200mg and 500mg.
CONTROLLED RELEASE TABLETS (Epilim Chrono®) 200mg, 300mg and 500mg.
MODIFIED RELEASE GRANULES 50mg, 250mg, and 500mg (Epilim Chronosphere).
LIQUID 200mg/5ml. INJECTION 400mg.

Dosage: **EPILEPSY**
Orally,
Under 20kg Initially 20mg/kg/day in divided doses, increasing if necessary by increments of 5mg/kg at weekly intervals.
Over 20kg Initially 400mg a day in divided doses, increasing if necessary until control is achieved. Maintenance dose is usually within the range of 20- 30mg/kg/day in divided doses.
Higher doses have been used, if above 40mg/kg/day, regularly monitor biochemistry and FBC.
Modified release tablets / granules may be useful if peak level effects are a problem. Total daily dose may be administered as a single dose.
Slow IV injection,
All ages, 10mg/kg twice a day. For patients on satisfactory oral maintenance doses, give the same dose IV.

Administration: Reconstitute each vial with 4ml of diluent provided to give a solution of 95mg in 1ml. Give slowly over 3-5 minutes.

Notes:

- a) Therapeutic drug monitoring: Dosage is determined by seizure control rather than plasma levels, may be of value when poor compliance and/or side-effects are suspected. Therapeutic range 40-100mg/L.
- b) Liver dysfunction (including fatal hepatic failure) has occurred in association with valproate (especially in children under 3 years of age, those with metabolic/degenerative disorders, and severe seizure disorders associated with mental retardation) usually in the first 6 months of therapy and often involving multiple antiepileptic therapy. Raised liver enzymes are common during valproate treatment and are usually transient. Patients should be assessed clinically and liver function monitored until return to normal.
- c) During concomitant administration of phenobarbitone and sodium valproate, blood levels of phenobarbitone may be increased and sedation may occur. During concomitant administration with phenytoin or carbamazepine blood levels of sodium valproate may be reduced. Dosage of sodium valproate may need to be increased by 5-10mg/kg/day. Concomitant administration with lamotrigine requires a reduction in dosage of lamotrigine.
- d) Sodium valproate has been associated with thrombocytopenia and inhibition of platelet aggregation. A full blood count should be considered prior to surgery.
- e) Anecdotally, the sodium valproate liquid has been used rectally. It should be retained for at least 15 minutes. Suppositories (100mg and 300mg) can be imported on a "named patient basis" and should be bioequivalent to oral dosing
- f) Caution is needed when changing brands of sodium valproate preparations as some patients may experience changes in control.
- g) Granules may be mixed with cold food or drink and swallowed immediately without chewing.

SOLIFENACIN

Preparations: TABLETS 5mg and 10mg.

Dosage: **NEUROGENIC BLADDER DISORDERS, BLADDER SPASM, DAYTIME WETTING**

Solifenacin is not licensed in children and adolescents.

Orally,

Over 4 years: initially 5mg once a day.

If needed, the dose may be increased to 10mg once a day.

Notes:

- a) The tablets can be crushed and dispersed in water immediately before taking, although the taste is very bitter.
- b) Oxybutynin and tolterodine should be used as first-line treatments and only replaced with solifenacin if the first two have failed. Solifenacin is occasionally used as a first-line treatment in teenagers.
- c) Maximum dose should be 5mg once daily in patients with moderate hepatic impairment. It is contraindicated in patients with severe hepatic impairment.
- d) Maximum dose should be 5mg once daily in patients with severe renal impairment (eGFR <30ml/min/1.73m²). It is contraindicated in patients receiving haemodialysis.
- e) Maximum dose should be 5mg once daily in patients who are also taking itraconazole, ketoconazole, nelfinavir or ritonavir.

SOMATROPIN

- Preparations:* GENOTROPIN[®] CARTRIDGES 5.3mg (16 unit) and 12mg (36 unit) (Fridge) (**Purchased on request**).
ZOMACTON[®] 4mg (12 units) vials (Fridge) (**Purchased on request**).
NORDITROPIN[®] 5mg (15 units) vials, 10mg (30 units) vials and 15mg (45 units) cartridge (Fridge) (**Purchased on request**).
- Dosage:* **CHRONIC RENAL INSUFFICIENCY**
Subcutaneously, 1 unit/kg/week in 7 divided doses; adjustment may be required after 6 months.
- INSUFFICIENT SECRETION OF GROWTH HORMONE**
Subcutaneously, 0.5 to 0.7 units/kg/week in 5 to 7 divided doses.
- GONADAL DYSGENESIS (TURNER SYNDROME)**
Subcutaneously, 0.6 to 1 unit/kg/week in 5 to 7 divided doses.
- Administration:* Reconstitute each vial as directed. Do not shake vigorously as this may denature the growth hormone. Once reconstituted, the vial can be stored in a fridge for up to 2 weeks.
- Notes:* This preparation is only available on prescription by consultants in paediatrics or endocrinology. The indications are usually limited to children covered under NICE guidance. Any new starter should be discussed with pharmacy to confirm funding and any shared care arrangements

SOTALOL

Preparations: TABLETS 40mg and 80mg.
LIQUID 40mg in 5ml (**Extemporaneously Prepared**).

Dosage: **ANTIARRHYTHMIC**
This indication is unlicensed for use in children.
0 - 12years, *orally*, 1mg/kg twice a day increase every 3-4 days to a max of 4mg/kg twice daily (max. dose 80mg twice daily).
> 12 years, 40mg twice daily up to 160mg twice a day.
Doses as high as 640mg daily have been used.

IN RENAL FAILURE

CrCl (ml/min/1.73m ²)	Dosage
30 - 60	½ dose
10 - 30	¼ dose
<10	Not recommended

ANTENATAL ARRHYTHMIAS

Maternally administered:
80mg twice daily, increasing to 160mg twice daily after 48 hours and up to 240mg twice daily if arrhythmia unresponsive after 5 days.

Notes:

- a) QT interval must be documented before and with any change in dosage. Caution should be used if the QT_c exceeds 500msec, dose should be reduced or therapy discontinued if QT_c exceeds 550msec.
- b) Therapeutic drug monitoring:
 - i) Approx. time to steady state: 2-3 days.
 - ii) Therapeutic range: 0.04 - 2.0mg/l.
 - iii) Take trough blood sample immediately prior next dose.
- c) Concomitant administration of cisapride, phenothiazines, terfenadine, any drugs lengthening QT intervals may precipitate arrhythmias.
- d) As bioavailability may vary by 20% depending on whether sotalol is administered in a fasting or non-fasting state give with food/feed.
- e) Tablets may be crushed and dissolved in water while preparing an extemporaneous liquid
- f) Excessive bradycardia can be countered with intravenous atropine

SPIRONOLACTONE

Preparations: TABLETS 25mg and 100mg.
LIQUID 50mg in 5ml (**Specials Manufacturer**).

Dosage: **DIURESIS, ASCITES**
Orally, all ages, initially, 0.5-1mg/kg up to 3 times a day (see note b).
Doses up to 9mg/kg/day have been used with careful monitoring in resistant ascites.

Notes:

- a) Spironolactone has been shown to be carcinogenic **in rats** when high doses are given over prolonged periods of time. The clinical significance of this remains uncertain.
- b) Cardiac children being treated with frusemide are usually prescribed concomitant spironolactone at the same dose and frequency, on a mg/kg basis, to maintain potassium levels.
- c) Spironolactone may increase digoxin levels.
- d) Spironolactone liquid is sugar-free.
- e) Watch for hyperkalaemia with concomitant use of other potassium sparing drugs (especially ACE inhibitors).

STIRIPENTOL

Preparations: CAPSULES 250mg and 500mg. SACHET 250mg and 500mg.

Dosage: **ADJUNCTIVE THERAPY OF REFRACTORY GENERALIZED TONIC-CLONIC SEIZURES IN PATIENTS WITH DRAVET'S SYNDROME**
Orally, 10mg/kg/day in 2-3 divided doses, increasing over 3 days to reach recommended dose of 50mg/kg/day in 2 or 3 divided doses.

Administration: Powder should be mixed with water immediately before use.

Notes:

- a) Stiripentol must always be taken with food as it degrades rapidly in an acidic environment.
- b) Stiripentol should not be taken with milk or dairy products, carbonated drinks, fruit juice or food and drinks that contain caffeine or theophylline.
- c) Each 250mg sachet contains 2.5mg aspartame, 500mg glucose and 2.4mg sorbitol.
- d) Carbamazepine, phenytoin and phenobarbital should not be used in conjunction with Stiripentol in the management of Dravet's syndrome. The daily dosage of clobazam and/or valproate should be reduced according to the onset of side effects.
- e) Stiripentol interacts with drugs metabolised by the cytochrome P450 system therefore may increase plasma concentrations of drugs and/or increase the risk of adverse effects.
- f) Sachet and capsule formulations are not bioequivalent.

STREPTOKINASE

Preparations: INJECTION containing 1,500,000 I.U.

Dosage: **FEMORAL ARTERY THROMBOSIS POST CARDIAC CATHETERISATION**
All ages, **IF** fibrinogen > 1.0g/L then, *IV injection* 1,000 international units/kg over 30 minutes followed by 1,000 international units/kg/hr (stop heparin), for up to 72 hours (Maximum of 6 days). Check fibrinogen levels at 2 hours and then 4 hours thereafter. **IF** level <1g/L, stop infusion for 1 hour and start at 750 international units/kg/hr.

If after 6 hours pulses are still absent increase infusion by 500 international units/kg/hr every 4 hours if fibrinogen level is still > 1.4g/L. Continue until the pulses return and recommence the heparin. If after stopping the streptokinase infusions, the pulses disappear again, then restart streptokinase for a few hours more.

Administration: Reconstitute vial with 10ml of water for injection. Further dilute with glucose 5% or sodium chloride 0.9%; this solution should be used within 12 hours.

Notes:

- a) Haemorrhage is the most common complication. Allergic reactions including chills, bronchospasm and urticaria which may be unresponsive to steroids are not uncommon. Pyrexia which may be related to degradation products of the thrombus is commonly seen.
- b) Puncture site haemorrhage commonly occurs in cannulisation and should be managed by local pressure and stopping the infusion.
- c) Streptokinase should be used with caution if a surgical or invasive procedure has been performed within the last 10 days.
- d) Streptokinase should not be given to patients who have received streptokinase before or who have had a proven streptococcal infection within the last 12 months due to the formation of antibodies.

STREPTOMYCIN

Preparations: INJECTION 1g (**Manufactured Special**).

Dosage: **TUBERCULOSIS THERAPY**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

IM injection, 15mg/kg once a day (maximum dose 1g). Change the injection site for each dose. Reduce the dose in renal failure, adjusting according to blood levels. Only include if ethambutol is contraindicated and there is a high risk of resistant infection.

Administration: Reconstitution (taking displacement values into account) with water for injection to give 1g in 5ml.

Notes:

- a) Higher doses can be used initially but are ototoxic and nephrotoxic if continued.
- b) Therapeutic drug monitoring:

Approx. time to steady state:	24 hrs.
Therapeutic plasma levels:	trough < 3mg/L
	peak 20-40mg/L

Take trough sample immediately prior to next dose and peak sample 1 hour after dose.
- c) In renal failure give first dose as above, then give further doses when plasma levels are <3mg/L. If the trough level exceeds 3mg/L, the dosage should be reduced.

SUCRALFATE

Preparations: TABLETS 1g. LIQUID 1g in 5ml.

Dosage:

STRESS ULCER PROPHYLAXIS

This indication is unlicensed for use in children.

0 - 2 years	250mg	4 times a day
2 - 12 years	500mg	4 times a day
Over 12 years	1g	4 times a day

Maximum 8g/day.

PHOSPHATE BINDING IN RENAL PATIENTS

Unlicensed

Orally, initially

4 weeks - 12 months	1.25 - 2.5mls	3-4 times a day
1 - 4 years	2.5 - 5mls	3-4 times a day
5 - 12 years	5 - 10mls	3-4 times a day

Dose is adjusted according to phosphate levels.

Notes:

- a) Tablets may be dispersed in 10-15ml of water immediately prior to administration.
- b) Sucralfate may reduce the bioavailability of tetracycline, phenytoin, ciprofloxacin, cimetidine, digoxin and warfarin. Concurrent administration with any of these drugs should be separated by 2 hours.
- c) Sucralfate, although a complex of aluminium hydroxide and sulphated sucrose, has very little antacid properties. If an antacid is required it should be given half an hour before or after Sucralfate.
- d) Use with caution in renal failure as small amounts of aluminium may be absorbed.
- e) Sucralfate liquid is sugar-free.
- f) Intestinal obstruction has been seen with use in critically ill patients, especially those receiving concomitant feeds or with delayed gastric emptying. Sucralfate is not recommended for premature infants.
- g) Administration of Sucralfate and enteral feeds should be separated by 1 hour to avoid Bezoar formation. See Trust Intra-gastric/Intra-junal Guidelines.
- h) For patients who can take capsules and who cannot have calcium salts, Aluminium Hydroxide capsules should be used.
- i) When converting from Calcium Carbonate for phosphate binding, use 2.5mls of Sucralfate in place of 5mls of 600mg in 5mls Calcium Carbonate Suspension.
- j) For phosphate binding Sucralfate should be taken with food, or if on nasogastric feeds, mix well with feed before administering to avoid precipitation.

SUCROSE SOLUTION

Preparations: 24% SUCROSE SOLUTION.

Dosage: **PROCEDURAL PAIN AND BLOOD SAMPLING IN NEONATES**
Upper volume limits based on gestational age in weeks – given in 0.2ml dose increments.
32 - 36 weeks 1 ml maximum per procedure
> 37 weeks 2 ml maximum per procedure
EACH DIP OF THE PACIFIER IS ESTIMATED TO BE 0.2ML
Administer 1-2 minutes before a painful stimulus.
Each 0.2ml dose may be repeated every 2 minutes during the painful procedure if necessary up to the recommended maximum dose per procedure as indicated above.
Number of applications will depend on infant's response up to the maximum dose per procedure as indicated above.
No maximum daily dose has been identified.
Can be administered using a pacifier or directly dripped (one drop at a time) onto the tongue, using an oral syringe.

Notes:

- a) Coughing, choking, gagging and transient oxygen desaturations have been reported. When using the syringe method the solution should be applied carefully to the tongue one drop at a time.
- b) There is some evidence that adverse effects of sucrose, including a temporary increase in "Neurobiologic Risk" score, is more frequent in premature infants, particularly those < 32 weeks gestation.
- c) Sucrose 24% should not be administered to neonates and infants who are intolerant to fructose or sucrose, paralysed, hyperglycaemic, born to diabetic mothers, have suspected or confirmed necrotising enterocolitis, or babies of opiate dependant mothers.
- d) The sucrose solution should not be stored once opened and should be discarded after each procedure.

SULFASALAZINE (SULPHASALAZINE)

Preparations: TABLETS 500mg. ENTERIC COATED TABLETS 500mg.
LIQUID 250mg in 5ml. SUPPOSITORIES 500mg.

Dosage: **ULCERATIVE COLITIS AND CROHN'S DISEASE**

Warn all patients/carers to report immediately any sore throats, fever, malaise or non-specific illness.

This indication is unlicensed for use in children under 2 years, due to increased incidence of side effects.

Orally, over 1 year, 10mg/kg (max. 1g) 4-6 hourly for an acute attack (maximum dose 60mg/kg/day). Decrease the dose by 50% when possible, for maintenance therapy.

Rectally,

2 - 4 years 1 suppository once - twice daily

5 - 8 years 1 suppository twice a day

8 - 12 years 1 suppository in the morning and 2 suppositories in the evening

> 12 years 1-2 suppositories twice a day

Notes:

- a) Sulfasalazine should be used with caution in glucose-6-phosphate dehydrogenase (G6PD) deficiency and is contra-indicated in salicylate or sulfonamide hypersensitivity or megaloblastic anaemia.
- b) Use with caution in renal and liver failure.
- c) Side effects are more common in slow acetylators and include hepatotoxicity, skin rashes, blood dyscrasias and polyarteritis nodosa.
- d) Sulfasalazine reduces serum levels of digoxin.
- e) Urine, tears and contact lenses may be stained an orange colour.
- f) Sulfasalazine liquid contains approximately 1.2g of sucrose in 5ml.
- g) Enteric coated tablets should not be crushed.

SUXAMETHONIUM

Preparations: INJECTION 100mg in 2ml (Fridge).

Dosage: **MUSCLE RELAXANT FOR INTUBATION**
IV injection,
Neonates and infants, initially 2mg/kg (provides 5-10 minutes of muscular paralysis, and a dose of 3mg/kg provides full neuromuscular blockade).
Children, initially 1-2mg/kg.
Max. dose 2.5mg/kg. (Max. adult dose in an hour is 500mg).

Notes:

- a) Suxamethonium is not recommended in severe liver disease, burns patients or Duchenne muscular dystrophy.
- b) **Caution:** may cause bradycardia, especially in children and following a second dose.
- c) Profound hyperkalaemia may occur especially in burns, trauma and renal failure patients.
- d) Can lead to prolonged paralysis due to low levels of pseudochoolinesterase e.g. liver disease, or genetically determined variants of pseudochoolinesterase.
- e) Beware for Malignant Hyperthermia; especially when used in combination with anaesthetic gases.

TACROLIMUS

Preparations: CAPSULES (PROGRAF®) 0.5mg, 1mg and 5mg.
CAPSULES MR (ADVAGRAF®) 0.5mg, 1mg, 3mg and 5mg (available on request).
GRANULES IMMEDIATE-RELEASE (MODIGRAF®) 0.2mg and 1mg
LIQUID 2.5mg in 5ml (**Specials Manufacturer**).
INJECTION 5mg in 1ml.

Dosage: **PREVENTION OF RENAL GRAFT REJECTION, STEROID RESISTANT NEPHROTIC SYNDROME**
The treatment of nephrotic syndrome is an unlicensed indication.

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Orally, initially, 100-150microgram/kg twice a day, adjusting dose according to blood levels.

For Advagraf (MR), 200-300microgram/kg daily

Notes:

- a) Give on an empty stomach (i.e. 1 hour before or 2-3 hours after food) to increase absorption.
- b) Therapeutic drug monitoring:
 - i) Approx. time to steady state: 1-2 days.
 - ii) Therapeutic whole blood levels: 5-15micrograms/L, may be up to 20micrograms/L in the early transplant period.
 - iii) Take trough sample, immediately prior to next dose.
- c) Tacrolimus is metabolised by the cytochrome P450 enzyme system and may have an inducing or inhibiting effect on these enzymes. Care should be taken with the concomitant administration of other drugs metabolised by these enzymes.
Tacrolimus is also extensively bound to plasma proteins.
- d) Monitor ciclosporin levels when converting to tacrolimus as clearance of ciclosporin may be affected.
- e) **CSM warning:** Cardiomyopathy has been reported in children given tacrolimus after transplantation. Patients should be monitored carefully by echocardiography for hypertrophic changes; dose reduction or discontinuation should be considered if these occur.
- f) If a patient is changed from ciclosporin to tacrolimus there is no need for a wash out period.
- g) Oral bioavailability is about 20%. To convert IV to oral multiply IV daily dose by 5 and give in 2 divided doses – monitor levels.
- h) Modigraf® dose adjustments should be made in increments of 0.2 or 1mg as part of a sachet can not be used. Sachets need reconstituting to a minimum concentration of 1mg/2ml. Each sachet can be made up to a maximum of 50ml. See manufacturers leaflet for instructions on preparation.
- i) Liquid is reserved for patients where Modigraf® may be unsuitable
- j) **Warning:** None of the products are interchangeable and additional monitoring is essential if changing between products. Great care must be taken to ensure patients remain on the correct product.

TAUROLIDINE, CITRATE 4% & HEPARIN 500units

Preparations: INJECTION 5ml amp (TauroLock™ Hep500)

Dosage: **LOCK FOR HAEMODIALYSIS VASCULAR ACCESS CATHETERS**
This is a Medicinal Device

ONLY TO BE USED BY TRAINED PERSONNEL

Follow the manufacturer's instructions that accompany the particular vascular access product utilised. Specific catheter lock volumes are associated with each device

Following unit guidelines for accessing vascular access.

1. Flush the device with 5 mL of 0.9% saline.
2. Withdraw TauroLock™-Hep500 from the ampoule using a 2 mL or smaller syringe (to ensure accurate volume)
3. Instill TauroLock™-Hep500 into the access device in a quantity sufficient to fill the lumen. **Consult the manufacturer's instructions for the specific fill volume.** TauroLock™-Hep500 will remain inside the access device until the next treatment.
4. Prior to initiation of the next treatment. TauroLock™-Hep500 must be withdrawn from the access device and discarded.

Notes:

- a) Caution different formulations are available with a similar name, with and without heparin.
- b) Active ingredients in TauroLock™-Hep500 are cyclo-taurolidine, citrate and heparin (mucosa, 500 IU/mL). Other components include water for injection. The pH is adjusted with citrate and/or sodium hydroxide. The product is sterile filter processed and supplied as a clear, sterile, non-pyrogenic solution.
- c) TauroLock™-Hep500 contains anticoagulant and antimicrobial substances. It is to be used with a port or a catheter-based vascular access device. It is to be instilled in the device lumens between treatments in order to make the internal flow passages resistant to clot formation and hostile to bacterial and fungal growth. The solution must be withdrawn prior to initiating the next treatment.

TEICOPLANIN

Preparations: INJECTION 200mg and 400mg.

Dosage:

SEEK ADVICE FROM MICROBIOLOGY BEFORE PRESCRIBING

MODERATE INFECTION WITH GRAM POSITIVE ORGANISMS

Over 2 months:

Slow IV injection 10mg/kg every 12 hours for **3 doses**
THEN
6mg/kg once a day.

SEVERE INFECTIONS, NEUTROPENIC PATIENTS

Premature and term neonates:

IV infusion 16mg/kg as a **single dose**
THEN 24 hours later
8mg/kg once a day.

Over 1 months:

Slow IV Injection 10mg/kg every 12 hours for **3 doses**
THEN
10mg/kg once a day.

IN RENAL FAILURE

Dosage reduction is not required until the **fourth** day of treatment then

Creatinine clearance (ml/minute/1.73m ²)	Dosage
40-60	Half normal dose
< 40 or haemodialysis	Third normal dose

Teicoplanin is **not** removed by haemodialysis.

Administration:

Reconstitute vial with the diluent provided. Roll vial gently to dissolve. If foaming occurs, allow to stand for 15 minutes. Resultant concentration of 200mg and 400mg vial is 200mg in 3ml and 400mg in 3ml respectively.

Give as slow IV injection, over 5 minutes or as an IV infusion over 30 minutes. Dilute if required with sodium chloride 0.9% or glucose 5%.

Notes:

- a) Use with caution in patients with known hypersensitivity to vancomycin.
- b) Ototoxicity and nephrotoxicity may be potentiated by concomitant administration of other drugs with these side-effects; including aminoglycosides, frusemide, cisplatin, ciclosporin and amphotericin.
- c) Therapeutic drug monitoring:
These are not routinely done as a relationship between toxicity and serum level has not been demonstrated, but may be of benefit in optimising therapy especially in renal failure.
 - i) Approx. time to steady state: after loading completed.
 - ii) Therapeutic levels: trough 10 - 50mg/L

TEMAZEPAM - (CD)

Preparations: TABLETS 10mg. LIQUID 10mg in 5ml.

Dosage: **PREMEDICATION**
Orally, all ages, 0.5-1mg/kg, 1 hour prior to procedure.
Maximum 30mg/**dose**.

Notes:

- a) Temazepam liquid (Rosemont) is sugar free.
- b) See premedication guidelines.

TERBINAFINE

Preparations: TABLETS 250mg. CREAM 1%.

Dosage:

TREATMENT OF FUNGAL INFECTIONS

These indications are unlicensed for use in children.

Orally, over 1 year old, 3 - 6 mg/kg once a day.

OR

10 - 20kg 62.5mg once a day

20 - 40kg 125mg once a day

Greater than 40kg 250mg once a day

Recommended treatment duration is 4-8 weeks for tinea capitis, 6- 12 weeks for nail onychomycosis and may be longer for toe-nail onychomycosis.

Topically, apply the cream twice a day for up to 2 weeks for tinea corporis or 1 week for tinea pedis.

IN RENAL OR HEPATIC FAILURE

If creatinine clearance is less than 50ml/minute/1.73m² or if in stable, chronic liver failure then reduce dose by 50%.

Notes:

- a) Taste disturbances have been reported. This usually resolves slowly on discontinuation of drug.
- b) Plasma levels are reduced by rifampicin and increased by cimetidine.

TERBUTALINE

Preparations: TURBOHALER 500microgram per metered inhalation.
RESPULES 5mg in 2ml.
INJECTION 500microgram in 1ml and 2.5mg in 5ml

Dosage: **ASTHMA THERAPY**
Turbohaler over 5 years, 500mcg 4 times a day.
Nebuliser solution 200-250microgram/kg 2-4 times a day, see note a).

OR

< 3 years	2mg) up to
3 - 5 years	3mg) 4 times
6 - 8 years	4mg) a day
> 25kg	5mg)

Respules

Dilute with sodium chloride 0.9% to maximum of 4ml.

Injection SC, IM or slow IV injection (preferred routes SC or IM)
2 - 15 years, 10microgram/kg up to 4 times a day. Maximum total dose of 300microgram/dose.

15 - 18 years, 250-500microgram up to 4 times daily.

Notes:

- a) May be nebulised more frequently in hospital under close supervision.
- b) Terbutaline may not be effective in children under 1 year of age.
- c) Children under 10 years are usually incapable of using metered dose aerosol inhalers, however children over 4 years may be able to use the turbohaler.
- d) The turbohaler is a breath activated device which is effective at low respiratory flow rates, 30L/minute.
- e) An Aerochamber spacer (with or without mask) is available for use with the aerosol inhaler.
- f) See management guidelines for acute/chronic asthma.

TESTOSTERONE

- Preparations:* CAPSULES 40mg (testosterone undecanoate).
INTRAMUSCULAR INJECTION (Testosterone enantate 250mg/ml).
Sustanon 100[®] and Sustanon 250[®] (mixed testosterone esters).
Virormone[®] (testosterone propionate 50mg/ml).
- Dosage:* **INDUCTION AND MAINTENANCE OF SEXUAL MATURATION IN MALES**
Orally (as testosterone undecanoate).
Child over 12 years 40 mg on alternate days increasing according to response up to 120 mg daily.
Deep intramuscular injection (testosterone enantate or propionate).
Child over 12 years 25–50 mg/m² every month increasing dose every 6 - 12 months according to response.
- Notes:*
- a) Sustanon 100[®] and Sustanon 250[®] contain arachis (peanut) oil and benzyl alcohol.
 - b) Benzyl alcohol has been associated with a fatal toxic syndrome in preterm neonates, and therefore, parenteral preparations containing the preservative should not be used in neonates. Polyoxyl castor oils, used as vehicles in intravenous injections, have been associated with severe anaphylactoid reactions.
 - c) Sustanon[®] and Virormone[®] licensed for use in children.
Andropatch[®] licensed for use in children over 15 years
 - d) Topical testosterone is applied to the penis in the treatment of microphallus; an extemporaneously prepared cream should be used because the alcohol in proprietary gel formulations causes irritation.

TETRACOSACTIDE (TETRACOSACTRIN) (ACTH 1-24)

Preparations: INJECTION 250microgram in 1ml for IM or IV injection (Fridge).
 DEPOT INJECTION 1mg in 1ml for IM injection only (Fridge).

Dosage: **STIMULATION TEST**
 (Do **not** use depot injection).

STANDARD SYNACTHEN TEST

IV/IM	< 6 months	62.5micrograms	stat dose
	6 - 24 months	125 micrograms	stat dose
	> 2 years	250 micrograms	stat dose

LOW DOSE SYNACTHEN TEST

IV 290nanograms/m² (500nanograms/1.73m²) stat dose
 Add 125micrograms to 500ml of sodium chloride 0.9%.
 290nanograms/m² = $\frac{2 \times \text{Childs S.A.}}{1.73}$ ml of above solution.

ADRENOCORTICAL INSUFFICIENCY THERAPEUTIC DOSE

(Depot IM injection):

1 month - 2 years	Initially 250microgram once a day for up to 3 days.
	Maintenance 250microgram every 2-8 days.
2 - 5 years	Initially 250-500microgram once a day for up to 3 days.
	Maintenance 250-500microgram every 2-8 days.
5 - 12 years	Initially 250microgram-1mg once a day for up to 3 days.
	Maintenance 250microgram-1mg every 2-8 days.

INFANTILE SPASMS

This is an unlicensed indication.

(Depot IM injection)

IM injection, initially, 500microgram on alternate days for the 1st week. After 1 week increase to 750microgram on alternate days if necessary.

Notes:

- a) Steroids should be discontinued at least 12 hours prior to stimulation tests.
- b) In patients with a history of allergic disorders, tetracosactide should only be administered if no ACTH preparations have previously been given.
- c) Tetracosactide depot injection is best given into the buttock.
- d) Depot injection is contraindicated in neonates as it contains Benzylalcohol.

THAM (TROMETAMOL)

Preparations: INJECTION 7.2% in 5ml (**Specials Manufacturer**).

Dosage: **TO CORRECT ACIDOSIS**

SEEK EXPERT ADVICE BEFORE PRESCRIBING

Check blood gases, repeat every 15 minutes or as required.

Total number of mmol of bicarbonate required can be calculated by:

$F \times \text{base deficit (mmol/L)} \times \text{weight (kg)}$.

F represents the extracellular fluid: weight ratio. This is 0.5-0.6 in premature neonates, 0.4 in neonates and 0.3 in infants and children.

Only **half** the base deficit should be corrected initially and blood glucose, pH and electrolytes analysed before correction of the remaining half.

As an approximate guide:

1ml of 7.2% THAM = 1mmol bicarbonate

Do not exceed a **total** dose of 15mmol/kg/24hours.

Administration: Dilute at least 1 in 2 with glucose 5% or water for injection. Can be given neat, in fluid restricted patients, via a central or long line. Do not exceed a rate of 0.5mmol/kg/minute

Notes:

- a) THAM should only be used where **sodium bicarbonate** is unsuitable e.g. when pCO₂ or sodium levels are raised.

THEOPHYLLINE

Preparations: PROLONGED RELEASE CAPSULES 125mg and 250mg (Slo-Phyllin[®]).
 PROLONGED RELEASE TABLETS 200mg and 300mg (Uniphyllin Continus[®]).
 LIQUID 60mg in 5ml (**GSTT Special**).

Dosage: **ASTHMA THERAPY**
 This indication is unlicensed for use in children under 2 years.

Oral liquid theophylline dosage:

Initially, all ages, 5mg/kg 3-4 times a day.

Oral slow release preparation dosage:

> 6 months - 2 years	12mg/kg (max 120mg)	twice a day
2 - 6 years	60-120mg	twice a day
6 - 12 years	125-250mg	twice a day
Over 12 years	250-500mg	twice a day

TAKE TROUGH BLOOD SAMPLE AT LEAST 8 HOURS AFTER SLOW RELEASE FORMULATIONS OR IMMEDIATELY PRIOR TO THE NEXT DOSE FOR THE LIQUID.

Serum concentration at steady state	Suggestion
Below 7.5mg/L	Increase dose by about 25%. ❶
7.5-10mg/L	Increase dose by about 25% if tolerated.
10-20mg/L	Maintain dose if tolerated; repeat serum assay 6-12 monthly.
20-25mg/L	Decrease dose by at least 10%. ❶
25-30mg/L	Omit next dose, decrease later ones by at least 25%. ❶
Over 30mg/L	Omit next 2 doses, halve later ones. ❶

❶ Repeat serum assay 3-7 days later.

Notes:

- a) When prescribing oral theophylline start with the lowest recommended dose. This can be adjusted at 3-7 day intervals according to clinical response or the development of unwanted effects.
- b) 80mg theophylline is equivalent to 100mg aminophylline.
- c) As a guideline, for every 1mg/kg of theophylline administered as a loading dose, serum concentrations will rise by approximately 2mg/L.
- d) Cimetidine, erythromycin and ciprofloxacin may increase blood levels of xanthine derivatives.
- e) Barbiturates, carbamazepine, phenytoin and rifampicin may reduce blood levels of xanthine derivatives.
- f) Slo-Phyllin[®] capsules contain individual slow-release granules and young children may find the loose granules (which can be sprinkled on a spoonful of soft food e.g. yoghurt) easier to swallow than capsules or tablets. However the loose granules must not be chewed.

THIAMINE (VITAMIN B₁)

Preparations: TABLETS 50mg and 100mg.

Dosage: **METABOLIC DISORDERS**
These indications are unlicensed for use in children.

SEEK EXPERT ADVICE BEFORE PRESCRIBING

MAPLE SYRUP URINE DISEASE

Orally, 5mg/kg daily.

OTHER INBORN ERRORS

Orally, all ages 100-300mg daily.

Notes:

A wide range of doses have been used, up to 2g have been reported.

THIOPENTAL SODIUM (THIOPENTONE SODIUM)

Preparations: INJECTION 500mg.

Dosage: **INDUCTION OF ANAESTHESIA**
IV injection,
Neonates 2mg/kg over 10-15 seconds
Over 1 month 4-6mg/kg over 10-15 seconds

STATUS EPILEPTICUS

This indication is unlicensed for use in children.

ENLIST THE AID OF ANAESTHETIST

IV injection, initially, 4-8mg/kg followed by a maintenance *IV infusion* of 1-8mg/kg/hour, adjusted as necessary to control convulsions.

Administration: Reconstitute with 20ml water for injection to give 25mg in 1ml. Dilute if required with sodium chloride 0.9%.

Notes:

- a) Use of doses exceeding 5mg/kg/hour may be associated with the possibility of hypothermia and cerebral shut down.
- b) Use is not generally continued for more than 48 hours, as delayed recovery of consciousness has been encountered with prolonged use.
- c) Ventilation must be available when used for status epilepticus.
- d) Sulphonamides potentiate the effects of thiopentone.
- e) Blood levels of thiopentone and pentobarbitone (active metabolite) can be measured, by the Poisons Unit. The pentobarbitone active metabolite represents 10% of the thiopentone concentration in the blood of patients receiving high dose thiopental therapy.
- f) Caution, injection is alkaline, therefore very irritant. pH = 10.6
- g) Acute intermittent porphyria is a contra-indication to use.
- h) Thiopentone sodium injection contains 2.3mmol sodium per 500mg.
- i) Highly protein bound 80-90%.
- j) Elimination half-life at birth = 20 – 30h.
Elimination half-life in children = 6h.

TINZAPARIN

Preparations: PREFILLED SYRINGES 3500 units in 0.35ml, 4500 units in 0.45ml, 10,000 units in 0.5ml, 14,000 units in 0.7ml, 18,000 units in 0.9ml.

DALTEPARIN IS FIRST LINE

Dosage: **TREATMENT OF DEEP VEIN THROMBOSIS AND PULMONARY EMBOLISM**

These indications are unlicensed for use in children.

Subcutaneous injection

0 - 2 months 275units/kg once daily

2 months – 1year 250units/kg once daily

1 - 5 years 240units/kg once daily

5 - 10 years 200units/kg once daily

>10 years 175units/kg once daily

If monitoring effect: level 3-4 hours post dose of anti-Xa should be 0.5-1units/ml.

Tinzaparin therapy does not require routine monitoring in patients with normal renal and hepatic function.

PROPHYLAXIS OF VENOUS THROMBOEMBOLISM

50units/kg daily.

Administration: If volume containing dose is too small dilute with water for injection.

Notes:

- a) Anti Xa samples need to be taken from fast flowing venous blood and packed in ice immediately. Send samples to haemostatis laboratory.
- b) Tinzaparin (Innohep®) injection contains sulphites which may lead to hypersensitivity (with bronchospasm and shock) especially in asthma patients.
- c) The multidose vial has a 14 day expiry once in use.
- d) Due to the concentrations and cost it is better to use daily syringes rather than the multidose vial for daily doses of <3500 units.
- e) Caution with use in renal impairment, seek specialist advice before prescribing.

TOBRAMYCIN

Preparations: INJECTIONS 40mg in 1ml, 80mg in 2ml.
NEBULISER SOLUTION (Bramitob[®]) 300mg in 4ml.

Dosage: **TREATMENT OF INFECTION IN CYSTIC FIBROSIS**
IV infusion,
1 month - 18 years 10mg/kg once daily
Use in combination with another antibiotic active against *Ps aeruginosa* or *S. aureus*.

NEBULISED DOSE FOR CYSTIC FIBROSIS

BRAMITOB[®]

6 - 18 years 300mg twice daily
(used in cycles of 28 days on and 28 days off).

Administration: IV infusion in sodium chloride 0.9% or glucose 5%, given over 30 minutes.

Notes:

- a) Blood levels:
 - i) Take level 6 hours before 3rd dose (6 hours before 2nd dose if renal function is unstable). Repeat daily until stable then every 3 doses.
 - ii) Therapeutic level: trough < 1mg/L (Paediatrics)
 - iii) Redose patient at 24 hours if trough level achieved. If trough is high, recheck level 12 hours after that level was taken and redose after that if level now in range. Dosing adjustment is to avoid accumulation, but do not delay at the detriment of not treating the patient – discuss with pharmacy.
- b) Tobramycin has been added to peritoneal dialysis fluids in a concentration of 4mg/L.
- c) Concurrent therapy with potent diuretics or other aminoglycosides increases the risk of ototoxicity and nephrotoxicity.
- d) Neuromuscular blockade and respiratory paralysis have occurred when aminoglycosides have been administered to patients who have received non-depolarizing muscle relaxants.
- e) Use Ideal weight for height to calculate dose.
- f) Contraindicated in Myasthenia Gravis.

TOCOPHERYL ACETATE (VITAMIN E)

Preparations: CAPSULES 200mg. LIQUID 500mg in 5ml.

Dosage: **VITAMIN E DEFICIENCY**
Orally, all ages, 2-20mg/kg once a day.

ABETALIPOPOTINAEMIA
Orally, all ages, 50-100mg/kg once a day.

VITAMIN E DEFICIENCY SECONDARY TO CHRONIC CHOLESTASIS
Orally, all ages, 150-200mg/kg once a day.

CYSTIC FIBROSIS
Orally,
Under 1 year 50mg/day
1 - 12 years 100mg/day
Over 12 years 100-200mg/day

Notes:

- a) Gastrointestinal disturbances (diarrhoea and abdominal pain) may occur with large doses.
- b) An increased risk of thrombosis has been reported.
- c) Liquid is alcohol free and contains 1g of sucrose in 5ml.
- d) 1mg of Tocopheryl Acetate \cong 1 unit.

TOLTERODINE

Preparations: TABLETS 1mg and 2mg. MODIFIED RELEASE CAPSULES 4mg.

Dosage: **NEUROGENIC BLADDER DISORDERS, BLADDER SPASM**

Use in paediatrics is unlicensed.

Orally,

3 mths - 6 yrs	0.05mg/kg (max. 1mg)	twice daily
6 yrs - 12 yrs	1mg	twice daily
> 12 yrs	1-2mg	twice daily 2mg twice a day may be changed to 4mg MR once a day

Higher doses may be used if necessary in all ages. Max 4mg per day.

Dose reductions may be required with liver impairment and/or $\text{CrCl} \leq 30\text{ml/min}/1.73\text{m}^2$.

Notes:

- a) Tablets may be crushed and dispersed in water before use.
- b) Oxybutynin should be used first-line and only replaced with tolterodine if side effects are not tolerated.
- c) Effect usually seen within 4 weeks.
- d) Avoid use with macrolide antibiotics, imidazole and triazole antifungals and antiproteases as may result in increased tolterodine concentrations.

TOPIRAMATE

Preparations: TABLETS 25mg, 50mg and 100mg. LIQUID 25mg in 5ml
(**Extemporaneously Prepared**).
SPRINKLE CAPSULES 15mg, 25mg and 50mg.

Dosage: **ADJUNCTIVE THERAPY FOR EPILEPSY**
This indication is unlicensed for use in children under 2 years.
Orally, initially, 0.5mg/kg once a day for one week, then 0.5mg/kg twice a day for one week, then 1mg/kg twice a day for one week, then 1.5mg/kg twice a day for one week, then 3mg/kg twice a day for one week, then 3.5mg/kg twice a day. Doses over 7mg/kg/day may cause unacceptable drowsiness.
Dose escalation determined by toleration of CNS side effects.

Notes:

- a) The "Sprinkles" do not dissolve in water and are only suitable for children on whole capsule doses. The "Sprinkles" may be put on a spoonful of any soft food for oral administration.
- b) Tablets may be crushed and dissolved in water, but are very bitter and should be mixed with strong tasting drink or food.
- c) Topiramate may increase blood levels of phenytoin. Topiramate may decrease digoxin blood levels.
- d) Carbamazepine and phenytoin may decrease blood level of topiramate.
- e) Topiramate may be associated with an increased risk of nephrolithiasis. Avoid concomitant administration of drugs which may cause nephrolithiasis. Ensure adequate hydration to reduce the risk.

TRAMADOL

Preparations: SOLUBLE TABLETS 50mg. CAPSULES 50mg.

Dosage: **ANALGESIA FOR MODERATE TO SEVERE PAIN**
This indication is unlicensed for use in children under 12 years.
Orally, 1mg/kg/dose repeated every 6 hours. (Maximum 2mg/kg/dose and 100mg/dose).

IN RENAL FAILURE

Reduce dose in renal failure according to creatinine clearance.

Creatinine Clearance (ml/min/1.73m ²)	Dose	Dose frequency
20-50	Normal dose	
10-20	Normal dose	twice a day
< 10	1mg/kg	twice a day

Notes:

- a) Tramadol (synthetic opioid) with opioid agonist properties and effects on noradrenergic and serotonergic neurotransmission, presents fewer of the typical opioid side effects (less respiratory depression and less constipation).
- b) Convulsions have been reported and specific care should be taken in those with a history of epilepsy or on proconvulsive drugs such as MAOIs and risk weighted against benefit.

TRANEXAMIC ACID

Preparations: TABLETS 500mg. INJECTION 500mg/5ml.
LIQUID 500mg in 5ml (10%) (**Specials Manufacturer**).
MOUTHWASH 500mg in 10ml (5%) (**Specials Manufacturer**)
(Fridge).

Dosage: **HAEMORRHAGE**
Orally, 25mg/kg 2-3 times a day.
Slow IV injection, 10mg/kg 2-3 times a day.
Mouthwash, 5-10ml 2-3 times a day.

IN RENAL FAILURE

Reduce dose in renal failure according to creatinine clearance.

Creatinine clearance (ml/minute/1.73m ²)	Dose	Dose frequency
25-50	As above	Twice a day
15-25	As above	Once a day
< 15	Half the above dose	Once a day

As tranexamic acid is removed by haemodialysis, give the dose (5-10mg/kg) post-dialysis.

Administration: Slow IV injection over 10 minutes. Dilute if required with sodium chloride 0.9% or glucose 5%.

Notes:

- a) The liquid may be used as a mouthwash for bleeding gums.
- b) Mouthwash may be swallowed as an oral liquid, but is fairly bitter.
- c) Injection can be administered orally.

TRIHEXYPHENIDYL (BENZHEXOL)

Preparations: TABLETS 2mg and 5mg. LIQUID 5mg in 5ml.

Dosage:

ANTISPASMODIC

This indication is unlicensed for use in children.

All ages >1 month: initially 1-2mg/day in 1-2 doses

1 month - 2 years maximum dose should not exceed 3mg three times a day

2 - 12 years maximum dose should not exceed 10mg three times a day

> 12 years maximum dose should not exceed 30mg three times a day

Doses should only be increased at 0.5mg-1mg per dose per week and stop increase for:

- reach maximum dose, keep on for 3 months and review
- side effects – excess constipation, urinary retention, behavioural problems – reduce dose and wait
- benefit achieved without side effects

The above maximum doses should only be used by specialists.

Notes:

Use with caution in patients with hypertension, cardiac, liver or renal failure.

TRIMETHOPRIM

Preparations: TABLETS 100mg and 200mg. LIQUID 50mg in 5ml.

Dosage: **URINARY TRACT INFECTION TREATMENT**

Orally, all ages, 4mg/kg twice a day,

OR

4 weeks - 1 year	4mg/kg	twice a day
1 - 5 years	50mg	twice a day
6 - 12 years	100mg	twice a day
Over 12 years	200mg	twice a day

LONG TERM PROPHYLAXIS

Orally, all ages, 1-2mg/kg at night.

OR

1 - 5 years	25mg	at night
5 - 12 years	50mg-75mg	at night
Over 12 years	100mg	at night

IN RENAL FAILURE

Creatinine clearance (ml/minute/1.73m ²)	Dosage
15-30	Normal dose for 3 days then reduce by half.
below 15	Reduce dose by half.

Notes:

- There is a risk of folate deficiency with long term use. Calcium folinate supplements may be needed.
- Trimethoprim appears to inhibit the hepatic metabolism of phenytoin, may decrease plasma levels of ciclosporin and has also shown synergistic nephrotoxicity with ciclosporin.
- Trimethoprim liquids (Monotrim[®], Trimopan[®]) are sucrose free.

Z

TRIPTORELIN (GONAPEPTYL DEPOT)

Preparations: PREFILLED SYRINGE (Gonapeptyl Depot) 3.75 mg (Fridge).
 INJECTION (Decapeptyl SR) 11.25mg.

Dosage: **CENTRAL PRECOCIOUS PUBERTY**
 Treatment of confirmed central precocious puberty (girls under 9 years, boys under 10 years).
 Initial Treatment
 Subcutaneous or Intramuscular injection
 < 20kg 1.875mg (half dose)
 20 - 30kg 2.5mg (2/3 dose)
 > 30kg 3.75mg (full dose)
 Give dose on days 0, 14, and 28. Thereafter one injection every 4 weeks. Should the effect be insufficient, the injections may be given every 3 weeks.
 OR
 >30kg - One intramuscular injection of Decapeptyl SR 11.25mg repeated every 3 months.

Notes:

- a) Injection may cause local irritation (erythema, pain, rarely abscess).
- b) Gastrointestinal symptoms (nausea and vomiting), hot flushes, and withdrawal bleeding in girls have been reported).
- c) Treatment should be stopped around the physiological age of puberty in boys and girls and should not be continued in girls with a bone maturation of older than 12 years. There is limited data available in boys relating to the optimum time to stop treatment based on bone age, however it is advised that treatment is stopped in boys with a bone maturation age 13-14 years.
- d) Decapeptyl SR 11.25mg injection contains an overage, and actually contains 15mg.

T

TUBERCULIN TESTS

Preparations: TUBERCULLIN PPD INJECTION 2units/0.1ml and 10units/0.1ml.

Dosage: **TUBERCULIN SKIN TEST**

Infants and Children

The dosage is 2units/0.1ml by intradermal injection.

If the first test is negative (< 6 mm in diameter) and a second retest is considered appropriate (due to false negative reaction) use 10units/0.1ml.

Interpretation

< 6 mm or less negative test
6 - 14 mm positive test
> 15 mm strong positive

Notes:

- a) Infection with non-tuberculous mycobacteria or a previous BCG vaccination can result in a false-positive reaction.
- b) Immunosuppression by disease or drugs and viral infections (including HIV) can lower tuberculin reactivity and may result in false negative.
- c) Test should be read after 48 – 72 hours.
- d) A tuberculin test is necessary prior to BCG for:
 - All individuals over the age of six.
 - Infants and children under the age of six years with a prolonged stay (>3 month) in a country with annual TB incidence of 40/100000.
 - Person who has had close contact with a known TB patient.

UBIDECARENONE (UBIQUINONE, Co-Enzyme Q10)

Preparations: CAPSULES 30mg, 120mg (**Specials Manufacturer**).

Dosage: **MITOCHONDRIAL CYTOPATHIES**
This indication is unlicensed for use in children.
10-100mg daily divided between 1-2 doses.
Doses of 5mg/kg/day (max 300mg) are often used.

Notes: Capsules can be opened and dispersed in water.

UROKINASE

Preparations: INJECTION 25,000units.

Dosage: **OCCLUDED ARTERIOVENOUS SHUNTS, PERITONEAL DIALYSIS CATHETERS AND INDWELLING CENTRAL LINES**

Instil the appropriate volume of 25,000units in 10ml solution into the catheter. The volume is dependent on the length and lumen size of the catheter. Refer to catheter manufacturer if lumen volume is unknown.

EMPHYEMA

Prepare solution to concentration of 1000 units/ml

Instil into chest drain and clamp off for at least 4 hours

Under 1 year 10,000 units in 10ml TWICE daily for 3 days

Above 1 year 40,000 units in 40ml TWICE daily for 3 days

Administration: Reconstitute vial with sodium chloride 0.9%.

Instil into the affected catheter, clamp off and retain for at least 4 hours. The lysate is then **aspirated**. DO NOT FLUSH until urokinase has been aspirated from the catheter.

URSODEOXYCHOLIC ACID

Preparations: TABLETS 150mg. LIQUID 250mg in 5ml.

Dosage: **BILIARY CIRRHOSIS, CHOLESTASIS*, CYSTIC FIBROSIS**

*This indication is unlicensed.

Orally, all ages, 5-10mg/kg 2-3 times a day.

Maximum 45mg/kg/day.

VACCINES

It is general not felt necessary to delay minor operations if recent vaccination has taken place. If felt appropriate vaccination may be conducted at the time of minor operations.

a) B.C.G. VACCINE

Preparations: INTRADERMAL INJECTION 1ml vials.

Dosage: **ACTIVE IMMUNISATION**
Intradermal, (see note a)
Neonates and infants up to 12 months, 0.05mL
Infants over 12 months and children, 0.1mL

Administration Intradermal
Reconstitute with 1ml of water for injection.
Allow to stand for 1 minute. Do **not** shake. Draw reconstituted solution into syringe once or twice to ensure homogeneity.
Should be given at insertion of deltoid muscle, i.e. not too high. Administration into the leg in neonates is associated with a higher incidence of side effects.
The vaccine should be administered by an operator competent in intradermal injection techniques.

Notes:

- a) All newborn babies are now being offered selective BCG vaccination at primary care level in LSL Health Authority. Newborn babies who are contacts of a smear positive case should receive prophylactic isoniazid chemotherapy (see Isoniazid) for 3-6 months then skin tested and vaccinated if negative.
- b) BCG vaccine is strongly recommended to those with a recent family history of tuberculosis, contacts of active respiratory tuberculosis, to those living in crowded conditions in urban communities and to all immigrants and their children from countries with a high incidence of tuberculosis (see DOH guidelines for full details). Children over 6 should be tuberculin-tested before vaccination. . Children under 6 can be vaccinated without a skin test provided that the child has not stayed for longer than 3 months in a country with high incidence of TB, has not had contact with a person with TB and there is no family history of TB in the last 5 years.
- c) BCG vaccine is a live vaccine and is contra-indicated in immunosuppressed patients (see immunisation guidelines) – usually given 3 months before administration of immunosuppressants. Do not given for four weeks after administration of another live vaccine.
- d) The injection site is best left uncovered to facilitate healing. If ulcer discharges apply a dry dressing but do not exclude air.
- e) Any portion of vial not used within 4 hours should be discarded.

b) DIPHTHERIA-TETANUS-PERTUSSIS-POLIO- (+/-Haemophilus)

Preparations: DTaP/IPV/Hib (PEDIACEL[®]): Diphtheria, tetanus, acellular pertussis, inactivated polio vaccine, Hib. (0.5ml containing purified diphtheria toxoid, purified tetanus toxoid, five purified components of the Bordetella pertussis bacteria, three strains of inactivated polio virus and a purified component of Haemophilus Influenzae type B bacteria attached to a tetanus toxoid carrier).
dTAP/IPV (REPEVAX[®]): 0.5ml contain purified diphtheria toxoid (low dose), purified tetanus toxoid, five purified components of the Bordetella pertussis bacteria and three strains of inactivated polio virus.
Td/IPV (REVAXIS[®]): 0.5ml contain purified diphtheria toxoid (low dose), purified tetanus toxoid and three strains of inactivated polio virus.

Dosage: **PRIMARY IMMUNISATION**
See immunisation guidelines.
Infants from 2 months and children under 10 years of age not immunised: 3 doses of (Pediacef[®]) 0.5mL IM with an interval of one month between each dose.
Children aged 10 years and over not immunised:
3 doses of Revaxis[®] IM 0.5mL with an interval of one month between each dose.

Administration: Give each 0.5ml pre-filled syringe by intramuscular injection.

REINFORCING IMMUNISATION

Children under 10 Years:

The first booster dose should ideally be given 3 years after completion of the primary course. Repevax[®] 0.5mL IM.

10 Years and Over:

Children who have received only 3 doses of a diphtheria containing vaccine with the last dose at least 5 years ago should receive the first booster with Revaxis[®] 0.5mL.

The second booster dose of Revaxis[®] 0.5mL should be given to all individuals ideally 10 years after the first booster dose.

IN THE EVENT OF TETANUS PRONE WOUND

Where tetanus, diphtheria or polio protection is required and the final dose of the relevant antigen was received more than ten years ago, Revaxis[®] should be given.

Notes:

- a) These are recommendations from the Department of Health and may differ from individual product Spc's.
- b) If the wound is thought to be "tetanus-prone" tetanus immunoglobulin is indicated if the child has not been previously immunised OR if there is an especially high risk of infection in fully immunised individuals.
- c) Injection may be given by subcutaneous injection if significant bleeding risk.

c) HEPATITIS B

Preparations: INJECTION 10microgram in 0.5ml (Engerix B[®] paediatric),
5microgram in 0.5ml (HBVax Pro[®] paediatric I).
20microgram in 1ml (Engerix B[®] adult).
10microgram in 1ml (HBVax Pro[®]).
[40microgram in 1ml (HBVax[®] II 40) – dialysis only].

Dosage: See immunisation guidelines.

STANDARD IMMUNISATION REGIMEN

Neonates and children under 16 years, *IM injection*, 0.5ml.

Children over 16 years, *IM injection*, 1ml.

Repeat dose, 1 and 6 months after first dose. Test for antibodies at 1-2 months after final dose and if no seroconversion has occurred give a further dose and then retest.

ACCELERATED REGIMEN

The accelerated regimen should be used for all babies born to hepatitis B surface antigen positive mothers and where accidental inoculation has occurred. Give within 48 hours of birth. First dose should be given as above and then repeated at 1, 2 and 12 months after first dose. Test for antibodies 2-4 months after final dose and if no seroconversion has occurred give a further dose and then retest.

DIALYSIS REGIMEN

This indication is unlicensed for use in children.

Dialysis or immunocompromised patients may not seroconvert with standard regimen. Test for antibodies following standard regimen, if no seroconversion has occurred give dose as follows:

IM injection,

Under 10 years 0.5ml } of 40 microgram in 1ml

Over 10 years 1ml } (HBVax II[®] 40)

OR

Under 16 years 0.5ml } of 20 microgram in 1ml

16 - 18 years 2ml } (Energix B Adult)

Repeat dose at 1 and 6 months after first dose. Test for antibodies 1-2 months after final dose and if no seroconversion has occurred give a further dose and then retest

Administration: Give IM into the deltoid muscle if over 10 years or into the anterolateral thigh in infants and children under 10 years.

If immunoglobulin is to be administered at same time, inject at different sites.

Notes:

- a) Infants born to mothers who are HBsAg and HBeAg positive **or** HBsAg positive without e markers **or** with acute hepatitis B during pregnancy should receive vaccine **and** immunoglobulin (HBIG). Infants born to mothers who are HBsAg and anti-HBe positive require vaccine only. Infants who are 1.5kg or less should receive the immunoglobulin regardless of the mother's e-antigen status.
- b) In patients with severe bleeding tendencies e.g. haemophiliacs, SC injection may be considered.
- c) The 2 paediatric Hepatitis B vaccine brands are interchangeable in terms of giving the same volume (0.5ml), despite Engerix B[®] paediatric containing 10micrograms compared to HBVax Pro[®] containing 5micrograms.

d) INFLUENZA VACCINE

Preparation: PRE-FILLED SYRINGE containing 0.5ml.

Dosage: **PROPHYLAXIS OF INFLUENZA**
IM, deep SC INJECTION,
6 months - 9 years 0.5ml, repeat at 4-6 weeks if receiving
vaccination for first time
Over 9 years 0.5ml single dose

In infants less than 6 months seroconversion cannot be assured.
Ideally vaccine should be between September and early
November.

Administration: Each prefilled syringe should be shaken well before
administration. Can be given by Intramuscular injection or deep
SC injection in those children with bleeding disorders.

Notes:

- a) Vaccination is recommended in the following conditions: chronic respiratory disease (including asthma), chronic heart disease, chronic renal failure, chronic neurological disease, diabetes mellitus and immunosuppression due to disease or treatment.
- b) Do not administer within 3 days of DTP, due to increased risk of febrile illness.
- c) Neurological disorders such as encephalomyelitis and neuritis have been reported but are rare.
- d) Influenza vaccine is contraindicated in those hypersensitive to eggs or neomycin.

e) MEASLES, MUMPS AND RUBELLA VACCINE

Preparations: Live, attenuated VACCINE, 0.5ml (PRIORIX[®] and MMRVAXPRO[®]).

Dosage: See immunisation guidelines.
First dose, 13 months old, 0.5ml by *deep subcutaneous* or *IM injection*, into outer aspect of arm.
Second dose, not less than 3 months after first dose, usually at the same time as the pre-school dTaP/IPV (Repevax[®]) (i.e. 3-5 years). 0.5ml by *deep subcutaneous* or *IM injection*, into outer aspect of arm.

Administration: Reconstitute each vial with the diluent provided.

Notes:

- a) The Department of Health can find no established causal link between MMR vaccine and bowel disease or autism and recommend the continued use of MMR vaccine.
- b) The MMR vaccine is a live vaccine and is contra-indicated in immunosuppressed patients. It is also contraindicated in patients who have received another live vaccine within 4 weeks, immunoglobulin within 3 months or who have an acute febrile illness. Try to avoid starting immunosuppression for 1 month after giving the vaccine.
- c) The vaccine is contraindicated in children with allergies to neomycin.
- d) The MMR vaccine should be given to children even when they have had an anaphylactic reaction to food containing egg. The vaccine for these children should be given in a hospital setting.
- e) Vaccination is not recommended in infants less than 12 months of age as they may fail to respond to the measles component of the vaccine due to presence of maternal antibodies. If vaccination is absolutely necessary repeat vaccination after 15 months of age and again at pre-school age.

f) MENINGOCOCCAL GROUP C CONJUGATE VACCINE

Preparations: INJECTION 0.5ml.
Menjugate kit, powder for reconstitution, capsular polysaccharide antigen of *Neisseria meningitidis* group C (conjugated to *Corynebacterium diphtheriae* protein).

Dosage: **PRIMARY IMMUNISATION**
See immunisation guidelines
Infants, 2 - 12 months 2 doses of 0.5ml at intervals of one month by IM injection. Recommended to be given at 3 and 4 months.
Children, Over 1 year 0.5ml as a single dose (see note b) by IM injection.

Administration: Reconstitute the vial with the enclosed diluent. Give the contents using the syringe provided by intramuscular injection.

REINFORCING IMMUNISATION

A booster dose should be given at 12 months if primary course was completed (usually with the the *Hib* vaccine).

Notes:

- a) Meningococcal group C conjugate vaccine protects against Group C disease only. Individuals travelling abroad should be immunised with meningococcal polysaccharide A and C vaccine, even if they have already received meningococcal group C conjugate vaccine (for more information refer to DoH immunisation guidelines).
- b) Children over 1 year who missed routine immunisation course at 2-4 months should have a single dose repeated after at least one month.
- c) Injection may be given by subcutaneous injection for children with bleeding disorders.

g) PNEUMOCOCCAL VACCINE

Preparations: 23-Valent pneumococcal polysaccharide (Pneumovax®II)
13 Valent pneumococcal conjugate (Prevenar 13®)

Dosage: **PRIMARY IMMUNISATION ALL CHILDREN**
See Immunisation guidelines.
3 doses 0.5ml (Prevenar 13®) at 2 months, 4 months and 13 months.

CHILDREN AT RISK (SEE NOTES)

Children at risk who have received primary immunisation should also receive one dose of 0.5ml Pneumovax after 2 years of age.
Children at risk who have not received primary immunisation should follow the schedule below:

2 months - 12 months 3 doses 0.5ml (Prevenar 13®) separated by 1 month and a further dose in second year of life (Pneumovax II®).

12 months - 5 years One dose 0.5ml (Prevenar 13®) (For those with asplenia or spleen dysfunction or who are immunocompromised give 2 doses at least 2 months apart) and a further dose in the second year of life (at least two months after the last vaccine) (Pneumovax II®).

> 5 years Single 0.5ml dose of Pneumovax II®.

Administration Inject 0.5ml by intramuscular injection into the anterolateral thigh of infants or upper arm of children.

Notes:

- a) Children at Risk: Asplenia or dysfunction of spleen, chronic respiratory disease including asthma, chronic heart disease, renal disease, or liver disease, diabetes, immunosuppression, individuals with cochlear implants, CSF shunts, children under 5 years of age who had invasive pneumococcal disease.
- b) Prevenar 13[®] is a black triangle drug and has replaced Prevenar 7[®] from March 2010.
- c) Injection can be given by subcutaneous injection in those with bleeding disorders.

h) VARICELLA VACCINE

Preparations: Varivax[®] LIVE, ATTENUATED OKA STRAIN OF VARICELLA-ZOSTER VIRUS. A 0.5ml dose of the reconstituted vaccine contains not less than 1350 plaque-forming units (PFU) of the varicella-zoster virus.

Dosage: **VACCINATION**
Test that patient is seronegative for VZV prior to vaccination.
12 months and older: 2 doses of 0.5ml *subcutaneous injection* 4 – 8 weeks between doses.

Administration: *Reconstitute the vial with the diluent provided and give by subcutaneous injection*

In high-risk patients, periodic measurement of varicella antibodies after immunisation may be indicated in order to identify those who may benefit from re-immunisation (measurements at one month after completion of the course and every 6 months).

Notes:

- a) Patients under immunosuppressive treatment (including corticosteroid therapy) for malignant solid tumour or for serious chronic diseases (e.g. chronic renal failure, autoimmune diseases, severe bronchial asthma) are generally immunised when they are in complete remission from the disease. The total lymphocyte count should be above $1.2 \times 10^9/L$ and there should be no other evidence of cellular immunodeficiency.
- b) When immunising patients in the acute phase of leukaemia maintenance, chemotherapy should be stopped for 1 week before and 1 week after vaccination.
- c) If organ transplantation (e.g. kidney transplant) is being considered patient should be immunised and seroconversion demonstrated prior to transplantation (at least 4 weeks before transplant).
- d) Varicella vaccine should not be administered within 3 months of varicella zoster immunoglobulin.
- e) Live vaccines may lead to short lived suppression of the cell mediated immune response, therefore an interval of at least one month should be maintained between Varicella and other live vaccines, eg MMR..
- f) Salicylates should be avoided for 6 weeks after varicella vaccination as Reye's Syndrome has been reported following the use of salicylates during natural varicella infection.
- g) The vaccine is contra-indication in those allergic to neomycin.

Z

VALACICLOVIR

Preparations: TABLETS 500mg.
SUSPENSION 250mg in 5ml (**Extemporaneously Prepared**).

VIROLOGY APPROVAL REQUIRED

Dosage: **HERPES ZOSTER IN IMMUNOCOMPROMISED**
12 – 18 years, orally, 1g three times a day for 7 days

IN RENAL FAILURE

CrCl (ml/minute/1.73m ²)	Dosage	
15 - 30	100%	Twice a day
Less than 15	100%	Once a day

TREATMENT OF HERPES SIMPLEX

12 – 18 years, orally, 500mg twice a day for 5 to 10 days

IN RENAL FAILURE (HERPES SIMPLEX)

CrCl (ml/minute/1.73m ²)	Dosage	
Less than 15	100%	Once a day

SUPPRESSION OF HERPES SIMPLEX

12 – 18 years 500mg daily in 1 to 2 doses,
Immunocompromised 500mg twice a day

IN RENAL FAILURE (HERPES SIMPLEX PREVENTION)

CrCl (ml/minute/1.73m ²)	Dosage	
< 15	50%	Once a day
< 15 immunocompromised	100%	Once a day

PREVENTION OF CYTOMEGALOVIRUS FOLLOWING RENAL TRANSPLANT

This indication is unlicensed for use in children.

3 months - 12 years, 25mg/kg four times a day.

12 - 18 years, 2g four times a day.

Discuss duration of treatment with Virology.

IN RENAL FAILURE (CMV PREVENTION)

CrCl (ml/min/1.73m ²)	Dose and Frequency	
>75	100%	Four times a day
75-51	75%	Four times a day
50-26	75%	Three times a day
25-10	75%	Twice a day
<10 ml/min	75%	Daily

HAEMODIALYSIS

Dose as for CrCl < 10ml/min.

Notes:

- a) Aciclovir is the principal metabolite of valaciclovir.
- b) As with aciclovir polyuric renal failure is possible with high doses. If renal impairment develops during treatment, a rapid response normally occurs following hydration of the patient and/or dosage reduction or withdrawal. Avoid dehydration; specific care should be taken in all patients receiving high doses to ensure they are well hydrated.
- c) Concomitant administration with mycophenolate increased plasma levels of both drugs.
- d) White cell count and platelet count should be closely monitored, especially in immunosuppressed patients.
- e) Valaciclovir should only be used in pregnancy if the potential benefits outweigh the risks.
- f) Administration of 25mg/kg four times a day equates (in terms of AUC) to IV Aciclovir 10mg/kg three times a day.

Z

VALGANCICLOVIR

Preparations: TABLETS 450mg. LIQUID 250mg in 5ml

VIROLOGY APPROVAL ONLY, SEE EXPERT ADVICE

Dosage:

TREATMENT OF CMV INFECTION

This indication is unlicensed for use in children.

Greater than 4 months, *orally*, 520mg/m² twice a day

Max 900mg twice a day

Check renal function and if less than 75ml/min/1.73 m² use renal dosing below

ROUTINE CMV PROPHYLAXIS, MAINTENANCE TREATMENT OF CMV RETINITIS INFECTION

This indication is unlicensed for use in children.

Greater than 4 months, *orally*, 520mg/m² once a day

Max 900mg once a day

Check renal function and if less than 75ml/min/1.73 m² use dosing below

RENAL FUNCTION LESS THAN 75ML/MIN/1.73 M²

Dose (mg) = (7 x BSA x CrCl)

Twice a day for treatment or once a day for prophylaxis

BSA = Body Surface Area (m²) (see note h)

CrCl = Creatinine Clearance (mls/min/1.73m²) (see note h)

Maximum dose is 900mg (max CrCl=75ml/min/1.73 m²)

HAEMODIALYSIS

Not recommended

Notes:

- a) Take with or after food.
- b) Tablets should not be broken or crushed. As valganciclovir is considered a potential teratogen or carcinogen in humans, caution should be observed in handling liquid formulations or broken tablets. In case of contact with skin, wash immediately with soap and water, eye contact rinse immediately with water.
- c) Valganciclovir is considered to have the potential to cause birth defects and cancer.
In animal studies valganciclovir has been shown to be a suppressor of female fertility. It is also considered that valganciclovir causes temporary or permanent inhibition of spermatogenesis.
- d) Severe leucopenia, neutropenia, anaemia, thrombocytopenia, pancytopenia, bone marrow depression and aplastic anaemia have been observed in patients treated with valganciclovir and ganciclovir. White cell count and platelet count should be closely monitored.
- e) Drug interactions associated with IV ganciclovir are to be expected for valganciclovir. Interactions would be expected with the following: Imipenem-cilastatin, didanosine, mycophenolate, probenecid, stavudine, zidovudine, zalcitabine, trimethoprim.
- f) Contra-indicated in patients with a hypersensitivity to ganciclovir aciclovir and valaciclovir.
- g) Valganciclovir is rapidly and extensively metabolised to ganciclovir after oral dosing.
- h) Equations for BSA and CrCl can be found in the introduction section

VALINE

Preparations: SACHETS 50mg (not from pharmacy).

Dosage: **SUPPLEMENTATION IN MAPLE SYRUP URINE DISEASE (MSUD)**
Only to be determined by Metabolic dietician and Clinician based on blood results.

Notes:

- a) Minimum valine requirements are approximately 200-250mg/day.
- b) Intake must be frequently titrated against plasma concentrations.
- c) Mix the sachet contents with the patient's usual amino acid supplement.

VANCOMYCIN

Preparations: INJECTION 1g. CAPSULES 125mg.
 PREFILLED SYRINGES 62.5mg in 1.25ml (**GSTT Special**).

Dosage: **CLOSTRIDIUM DIFFICILE DIARRHOEA**

METRONIDAZOLE IS THE FIRST LINE TREATMENT

Orally, 10mg/kg four times a day, up to 125mg four times a day.
 Dose may be doubled in severe disease.

SYSTEMIC INFECTIONS BY INTERMITTENT INFUSION

AGE	DOSE	INTERVAL
<29 weeks (corrected age)	15mg/kg	24 hourly
29 - 35 weeks (corrected age)	15mg/kg	12 hourly
>35 weeks (corrected age)	15mg/kg	8 hourly
1 month - 18 years	15mg/kg	8 hourly

SYSTEMIC INFECTION BY CONTINUOUS INFUSION

This is an unlicensed method of administration.
 Loading dose of 7mg/kg given over one hour, followed immediately by a continuous infusion with the dose calculated from the table below:

Neonates	
Corrected gestational age (weeks)	Dose in mg/kg/day
25-26	10
27-28	12
29-30	15
31-32	18
33-34	20
35-36	23
37-38	26
39-40	29
41-42	31
43-44	34
>45	40

VENTRICULITIS OR MENINGITIS

Intraventricular injection 5-20mg once a day. Adjust dose according to CSF levels after 3-4 days. Patients with enlarged ventricles require the higher doses.

PROPHYLAXIS OF NECROTISING ENTEROCOLITIS (NICU ONLY)

Orally, neonates, 15mg/kg three times daily starting 24 hours pre feeding and continuing until on full feeds.

IN RENAL FAILURE

Doses should be reduced in renal failure according to blood levels. Still give a loading dose if using a continuous infusion.

PERITONITIS IN PERITONEAL DIALYSIS

Add to dialysis fluid: 25mg/L in every bag for 5-7 days (see protocol in Paediatric Peritoneal Dialysis Unit).

Not significantly removed by haemodialysis.

Administration: Reconstitute vial with water for injection taking displacement values into consideration. For IV infusion further dilute with sodium chloride 0.9% or glucose 5% to 5mg in 1ml and infuse over **at least 1 hour**. In fluid restricted patients, maximum concentration is 10mg in 1ml, infused centrally if possible over **at least 1 hour**. (see note g)

Notes:

- a) Too rapid infusion may be associated with the 'red man' syndrome, a histamine mediated reaction. Symptoms resolve in a few hours without the need for treatment. However if treatment is necessary antihistamines and corticosteroids can be used.
- b) Vancomycin must not be given by IM injection.
- c) i) Therapeutic drug monitoring (intermittent infusion):
 - Approx. time to steady state: 1-2 days
 - Therapeutic levels: Trough 10-15mg/L
 - Take trough blood sample, immediately prior to next dose and peak blood sample, 1 hour after completion of infusion. Peaks are not usually required – although usually <35mg/L..ii) Therapeutic drug monitoring (continuous infusion):
 - Take initial level 12 hours after completion of load: >15mg/L
 - Take level after 24 hours and every 3 days: 15-25mg/L
 - If levels are <15mg/L increase dose by 10-20%.
- d) CSF levels: Take trough sample, immediately prior to next dose. Level should be less than 10mg/L.
- e) Injection can be given orally for a non-systemic effect.
- f) Pre-filled syringes can be made by manufacturing unit for peritoneal dialysis patients.
- g) There is anecdotal evidence that concentrations of up to 20mg in 1ml have been administered centrally in critical care areas.

Z

VARICELLA-ZOSTER IMMUNOGLOBULIN (VZIG)

Preparations: INJECTION 250mg (from Health Protection Agency) (Fridge).

Dosage: **PROPHYLAXIS OF CHICKENPOX OR SHINGLES INFECTION**

SEEK VIROLOGY ADVICE BEFORE PRESCRIBING

See notes below before contacting virology

Intramuscular injection,

0 - 5 years	250mg
6 - 10 years	500mg
11 - 14 years	750mg
15 years and over	1000mg

Notes:

- a) VZIG prophylaxis is only recommended for individuals who fulfil **all** of the following criteria:
 - Significant exposure to chickenpox or shingles within the past 10 days.
 - A clinical condition which increases the risk of severe varicella; this includes neonates, immunosuppressed patients (see notes below) and pregnancy.
 - Varicella-zoster virus seronegative in recent blood samples .
- b) VZIG is recommended for **neonates** whose mothers develop chickenpox (but not shingles) in the period 7 days before to 7 days after delivery. Also for VZ antibody negative infants exposed to either chickenpox or shingles in the first 28 days of life. Exposed infants born before 28 weeks gestation or weighing less than 1000g should be given VZIG as transfer of maternal IgG antibodies may be inadequate.

Neonates who develop varicella, are especially at risk of severe disease and intravenous aciclovir is recommended (see [aciclovir](#)). Prophylactic intravenous aciclovir should be considered for infants whose mothers develop varicella four days before to two days after delivery as they are at highest risk of fatal outcome despite VZIG prophylaxis.

The following infants do not require VZIG since maternal antibody will be present:

 - Infants whose mothers have a positive history of chicken pox confirmed by a positive VZ antibody result;
 - Infants whose mothers develop shingles before or after delivery.
- c) VZIG is recommended for **immunosuppressed** children, see the DoH immunisation guidelines for full criteria. This includes children who within the previous 3 months have received prednisolone at a daily dose (or its equivalent) of 2mg/kg/day (or more than 40mg/day) for at least one week or 1mg/kg/day for one month. Patients on lower doses of steroids, given in combination with other immunosuppressant drugs are also included.
- d) Varicella immunisation with the vaccine may be considered for susceptible immunosuppressed patients e.g. children with asymptomatic HIV infection, but not for post exposure prophylaxis.
- e) There may be a role for aciclovir prophylaxis where VZIG is warranted but not administered. Seek expert advice from the virologist on call.
- f) **Caution:** Currently, all immunoglobulins available in the UK are imported to reduce the theoretical risk of transmitting new variant CJD. Patient/carer should be informed of the theoretical risk.

VECURONIUM

Preparations: INJECTION 10mg.

Dosage: **NEUROMUSCULAR BLOCKADE FOR VENTILATION* AND SURGERY**
*This is an unlicensed indication.
Initially *IV injection* 80-100microgram/kg, then 20-30microgram/kg according to patient's response.
IV infusion, 50-200microgram/kg/hour.

Administration: Reconstitute vial with 5ml water for injection to give a 2mg in 1ml solution.
For IV infusion, dilute if required with sodium chloride 0.9% or glucose 5%.
If fluid restricted, reconstitute vial with 2.5ml water for injection.
Maximum concentration 4mg in 1ml.

Notes:

- a) Doses must be reduced in neonates as they have an increased sensitivity to non-depolarising muscle relaxants.
- b) The usual duration of action is 15-20 minutes in children, this is increased to 30-40 minutes in infants, so fewer supplementary doses are needed. The onset of action is quicker in infants and children compared to adults.
- c) Prolonged recovery time has been observed in patients on continuous high dose infusions with moderate renal failure and in premature neonates. This is not a problem when neuromuscular conduction is monitored with a nerve stimulator.
- d) Aminoglycoside antibiotics, metronidazole, suxamethonium and calcium antagonists may prolong the effect of vecuronium.

Z

VERAPAMIL

Preparations: TABLETS 40mg and 80mg. INJECTION 5mg in 2ml. LIQUID 40mg in 5ml (**Specials Manufacturer**).

Dosage: **SUPRAVENTRICULAR TACHYCARDIA TREATMENT**
Verapamil has been associated with fatal collapse during treatment of supraventricular tachycardia, especially under 1 year of age. Adenosine should be used first line for this condition.

CONSULT A CARDIOLOGIST BEFORE TREATMENT OF UNDER 1 YEAR OLD

IV injection,

0 - 1 year 100-200mcg/kg (maximum 2mg)

Over 1 year 100-300mcg/kg (maximum 5mg)

The dose may be repeated after 30minutes if necessary. ECG monitoring required.

Blood pressure should be monitored. Treatment should be stopped if sinus rhythm occurs. If tachycardia worsens during administration stop immediately. If the blood pressure is low use DC shock rather than verapamil.

SUPRAVENTRICULAR TACHYCARDIA PROPHYLAXIS

Orally,

Neonates & infants 1-2mg/kg 3 times a day

Up to 2 years 20mg 2-3 times a day

Over 2 years 40-120mg 2-3 times a day

HYPERTENSION

Orally, up to 5mg/kg twice a day, according to severity of disease.

Administration: Slow IV injection over 2 minutes.

Notes:

- a) **Note:** Verapamil is no longer treatment of choice in supraventricular tachycardia. ADENOSINE should be used first line, see [adenosine](#).
- b) Verapamil should not be given concomitantly with quinidine. If given concomitantly with digoxin the dose of digoxin may need to be reduced. The concomitant use of IV verapamil with IV/PO beta-blockers is contraindicated as it may cause hypotension and asystole. The concomitant use of oral verapamil and beta blockers may also be hazardous and should only be prescribed by experts and when myocardial function is well preserved. Verapamil interacts with many drugs, contact your clinical pharmacist.
- c) Injection can be given orally.
- d) A modified release preparation is available for use in adults (120mg and 240mg tablets). These preparations are not effective for prophylaxis or treatment of arrhythmias because of pre-systemic metabolism of the isomer that is active on the heart. It can be used in hypertension.

VIGABATRIN

Preparations: TABLETS 500mg. SACHETS 500mg.

Dosage: **EPILEPSY**

ON NEUROLOGIST ADVICE ONLY

Orally, initially, 20mg/kg twice a day increasing to 40-50mg/kg twice daily (max 75mg/kg (1.5g) twice daily) **OR**,

10-15kg 1-2 tablets/day

15-30kg 2-3 tablets/day

30-50kg 3-6 tablets/day

>50kg 4-6 tablets/day

INFANTILE SPASMS (WEST SYNDROME) - MONOTHERAPY

Orally, 50-100mg/kg/day. Doses up to 150mg/kg/day have been used with good tolerability. Due to problems with visual field defects (see note a) the recommended maximum dose is now 3g daily.

IN RENAL FAILURE

Dose should be reduced if creatinine clearance is less than 60ml/minute/1.73m², and patients should be monitored for adverse effects such as sedation and confusion.

Notes:

- a) Warning: Vigabatrin has been associated with persistent visual field defects. Base line perimetry should be performed before or as soon as possible after starting vigabatrin and every 6 months thereafter, in children able to co-operate (usually 9 years old and over). Patient/carer should be warned to report any new visual problems.
- b) Other adverse effects are mainly CNS related. Any drowsiness decreases with continuing treatment. However excitation and agitation may also be seen in children.
- c) Vigabatrin should only be prescribed first-line in infantile spasms associated with Tuberous Sclerosis.
- d) There is no direct correlation between blood levels and efficacy.
- e) Vigabatrin may cause a gradual reduction of about 20% in plasma phenytoin levels, however this is unlikely to be clinically significant.
- f) Sachet contents may be dissolved in water, fruit juice or milk immediately before oral administration. If sachets are not available tablets can be crushed and then dispersed in water or squash **OR** they can be crushed and mixed with soft food.
- g) Vigabatrin sachets can be administered rectally (same total daily dose as orally). Dissolve in small amount of tap water immediately prior to administration.

VINCRIStINE

Preparations: INJECTION 2mg in 2ml.

Dosage: **NEPHROTIC SYNDROME**
This is an unlicensed indication.

SEEK EXPERT ADVICE BEFORE PRESCRIBING

IV injection, 1.5mg/m² (maximum 2mg dose), once a week for 6-8 weeks. In overweight or grossly oedematous patients, ideal body weight must be used for calculating dose.

Child must have satisfactory white cell count before administering.

Administration:

**VINCRIStINE MUST ONLY BE GIVEN INTRAVENOUSLY.
INTRATHECAL INJECTION IS USUALLY FATAL.**

Vincristine is a cytotoxic drug therefore it will be prepared in the oncology pharmacy department.

Administer as an injection, over approximately 2 minutes, through the side port of a fast running (approximately 150-200ml/hour) infusion of sodium chloride 0.9% or glucose 5%.

Do not administer with any other fluid or drug as precipitation of vincristine may occur.

Notes:

- a) **CAUTION: VINCRIStINE IS A VESICANT.** Avoid extravasation during administration of injection.
- b) Check chemotherapy extravasation policy before use. The Trust extravasation kit and spill kit must be available on the ward.
- c) If accidental contamination of skin or eyes occurs wash thoroughly and immediately with water or sodium chloride 0.9% (use polyfusor). Seek urgent medical advice.
- d) Dose may need to be reduced in hepatic dysfunction.
- e) Use with caution in patients concurrently taking drugs known to inhibit the hepatic cytochrome P450 isoenzymes in the CYP 3A subfamily (i.e. itraconazole). For further advice contact paediatric pharmacist or medicines information.

VORICONAZOLE

Preparations: INJECTION 200mg.
TABLETS 50mg and 200mg.
LIQUID 40mg in 1ml (Fridge).

Dosage: **TREATMENT OF INVASIVE ASPERGILLOSIS, FLUCONAZOLE RESISTANT INVASIVE CANDIDA INFECTIONS, SERIOUS FUNGAL INFECTIONS**

MICROBIOLOGY APPROVAL ONLY

Patients 2-<12 years and 12-14 years weighing less than 50kg

	Intravenous	Oral
Loading dose regimen (first 24 hours)	9mg/kg every 12 hours for 2 doses	Not recommended
Maintenance dose (after first 24 hours)	8mg/kg twice a day	9mg/kg twice a day (max 350mg twice a day)

Patients 12-14 years ≥50kg and 15 years or older

	Intravenous	Oral	
		Under 40kg	Over 40kg
Loading dose regimen (first 24 hours)	6mg/kg every 12 hours for 2 doses	200mg every 12 hours for 2 doses	400mg every 12 hours for 2 doses
Maintenance dose (after first 24 hours)	4mg/kg twice a day	100mg twice a day	200mg twice a day

RENAL FAILURE

No dose adjustment is necessary but change to oral formulation as IV contains a vehicle (SBECD) that might accumulate and reach toxic levels.

LIVER FAILURE

Loading dose the same but half maintenance dose in mild to moderate hepatic cirrhosis. In severe liver impairment use only if benefits outweigh risks.

Administration: IV: Reconstitute with 19ml of water for injection to get a 10mg/ml concentration. Dilute further with 0.9% sodium chloride or 5% glucose to a final concentration between 0.5-5mg/ml. Administer at a maximum rate of 3mg/kg/hr.

Notes:

- Tablets to be taken one hour before or after a meal. Liquid one hour before or two hours after a meal.
- If patient is on phenytoin increase dose of voriconazole.
- Liquid is orange flavoured and contains sugar.
- It is recommended to initiate the therapy with intravenous regimen, and oral regimen should be considered only after there is a significant clinical improvement.
- It should be noted that an 8 mg/kg intravenous dose will provide voriconazole exposure approximately 2-fold higher than a 9 mg/kg oral dose.
- It is standard to dose cap intravenous doses at 400mg. If higher doses are thought necessary then plasma levels should be monitored.

WARFARIN

Preparations: TABLETS 1mg (brown), 3mg (blue) and 5mg (pink).
LIQUID 1mg in 1ml (**Specials Manufacturer**).

Dosage: **ANTICOAGULATION**
This indication is unlicensed for use in children.

Orally, loading doses:

Day 1	200microgram/kg once a day (see notes a and b). Maximum dose 10mg.
Day 2-4	Once a day according to INR. (See table below).
INR	Dose (mg)
1.1 - 1.3	Repeat Day 1 dose
1.4 - 1.9	50% of Day 1 dose
2.0 - 3.0	50% of Day 1 dose
3.1 - 3.5	25% of Day 1 dose
>3.5	Stop until INR <3.5; restart at 50% of previous dose

Maintenance doses:

Once a day (see note a) according to INR (see table below); approximately 100microgram/kg/day.

INR	Dose (mg)
1.1 - 1.4	Increase dose by 20%
1.5 - 1.9	Increase dose by 10%
2.0 - 3.0	No change
3.1 - 3.5	Decrease dose by 10%
>3.5	Stop until INR <3.5; restart at 80% of previous dose

Notes:

- a) Warfarin should be given at the same time each day and this is usually **6pm**. INR should be checked the following morning.
- b) Loading doses may need to be altered according to condition, concomitant interacting drugs and if baseline INR is greater than 1.3.
- c) The anticoagulant effect of warfarin takes 48-72 hours to have effect. Heparin infusion, if prescribed, should be continued until INR in therapeutic range for 2 consecutive days.
- d) The current INR therapeutic ranges are:
Prophylaxis of DVT: 1.5 - 2 (usually use heparin or LMWH)
Treatment of DVT and pulmonary embolism: 2.5 - 3
Recurrent DVT, pulmonary embolism; arterial grafts and mechanical cardiac prosthetic valves: 3.5 - 4.5
- e) Warfarin interacts with many drugs. The INR should be monitored whenever a drug is added to, or withdrawn from, the patient's therapeutic regimen. Check for interactions carefully, the following is not an exhaustive list.
Warfarin effect is **potentiated** by erythromycin, imidazoles, ciprofloxacin, metronidazole, co-trimoxazole, cimetidine, dipyridamole, amiodarone, thyroxine, aspirin and other non-steroidal anti-inflammatory analgesics.
Warfarin effect is **reduced** by barbiturates, rifampicin, griseofulvin, carbamazepine and phytomenadione.
Warfarin effect may be **reduced** or **potentiated** by phenytoin, corticosteroids or cholestyramine.

Z

ZINC

Preparations: EFFERVESCENT TABLETS (Solvazinc[®]) 125mg (45mg zinc).

Dosage:

ZINC DEFICIENCY

Zinc supplements should be given only when there is good evidence of deficiency (hypoproteinaemia spuriously lowers plasma-zinc concentration) or in zinc-losing conditions. A zinc supplement is given until clinical improvement occurs, but it may need to be continued in severe malabsorption, metabolic disease, or in zinc-losing states.

Orally,

Neonate 1 mg/kg elemental zinc daily

Child < 10 kg half a tablet daily in water after food

Child 10 - 30 kg half a tablet 1–3 times daily in water after food

Child > 30 kg One tablet 1–3 times daily in water after food

Parenteral nutrition regimens usually include trace amounts of zinc. If necessary, further zinc can be added to some intravenous feeding regimens.

Notes:

Accumulation may occur in acute renal failure.

TREATMENT GUIDELINES

- Asthma
 - Acute severe
 - Chronic
- Cardiac
 - Tachycardia
- Diabetes
 - Ketoacidosis (Emergency Treatment)
 - Type 1 Diabetes control
 - Type 1 Diabetes Peri-Operative Management
- Gastro
 - Antiemetics
 - Gastro-Oesophageal Reflux Disease
- Infections
 - Antibiotic Treatment
 - Antibiotic Prophylaxis
 - Antiretroviral Drugs
 - Immunisation
- Intravenous
 - Compatibility Table
 - Extravasation
 - IV Fluid Policy
 - Standard Infusions
- Metabolic
 - Metabolic Disorders (Emergency Treatment)
- Neurology
 - Dystonia
 - Ketogenic Diet Medicines Information
 - Status Epilepticus
- Nutrition
 - Parenteral Nutrition
 - Re-feeding Syndrome
- Pain
 - Analgesic Chart
 - Management
 - PCA / NCA / Epidural
 - Pain control for cannulation and venopuncture
- Sedation
 - Premedication
 - Medication for Sedation
- Skin
 - Head Lice
 - Scabies
 - Skin Disorders

GUIDELINES

ACUTE SEVERE ASTHMA

RECOGNITION OF ACUTE SEVERE ASTHMA

Remember:

- in pre-school children there are other important causes of cough, breathlessness and wheeze
- if you think a child has severe asthma, give Beta₂ agonist at once
- Too breathless to talk/feed
- Respirations
<5 years >40 breaths/min
>5 years >30 breaths/min
- Pulse
<5 years >140 beats/min
>5 years >125 beats/min
- Use of accessory muscles for breathing
- PEF <50% best or predicted after inhaled bronchodilator
- SpO₂ <92%

No other investigations are needed for immediate management. Blood gas estimations are rarely helpful in deciding initial management in children.

LIFE THREATENING FEATURES

CAUTION: Children with severe attacks may not appear distressed; assessment in the very young may be difficult. The presence of any of the features below should alert the doctor.

- Cyanosis, silent chest or poor respiratory effort
- Fatigue or exhaustion
- Agitation or reduced level of consciousness
- PEF <33% best or predicted after inhaled bronchodilator
- SpO₂ < 92%

MANAGEMENT OF A SEVERE ASTHMA ATTACK

Immediate treatment

- High flow oxygen via a tight fitting mask
- Salbutamol 5mg (2.5mg <5 years) via an oxygen driven nebuliser (the early addition of a bolus dose of IV salbutamol can be an effective adjunct to treatment in severe cases). Dose can be repeated every 20-30 min. If poor response add nebulised Ipratropium Bromide (every 20-30 min) mixed with salbutamol solution. Frequent doses every 20-30 min should be used for the first few hours of admission. Discontinue long acting beta agonists when short acting beta agonists are required more than 4 hourly
- Prednisolone 1-2mg/kg orally [< 2 years= 10mg, 2-5yrs = 20mg, >5yrs = 30-40mg). Those already receiving steroids should receive an additional 2mg/kg up to a maximum dose of 60mg/kg. Treatment for up to three days is usually sufficient and does not require weaning.
- Pulse oximetry is helpful. SaO₂ <92% in air may indicate the need for admission.

GUIDELINES

Subsequent management

IF THE CHILD IS IMPROVING, CONTINUE:

- High flow oxygen to maintain $\text{SaO}_2 >92\%$
- Salbutamol dose should be weaned off to 1-2 hourly thereafter according to response. Ipratropium dose should be weaned to 4-6 hourly or discontinued. Once improving with 2 to 4 hourly salbutamol the child should be changed to pMDI plus spacer.
- Corticosteroids (Prednisolone orally or hydrocortisone intravenously).
- Other treatment already commenced e.g. intravenous salbutamol, nebulised ipratropium.

IF THE CHILD IS NOT IMPROVING AFTER 15-30 MINUTES:

- Continue oxygen and corticosteroids
- Continue Salbutamol and Ipratropium nebulised therapy
- Consider need for chest radiography

IF THE CHILD STILL NOT IMPROVING START:

Intravenous salbutamol **OR** aminophylline (if not already started).

Salbutamol: 15microgram/kg (max 250mcg) over 10-20 minutes then a continuous infusion 1microgram/kg/min (Usually maximum dose required 2microgram/kg/min and refer to PICU).

Aminophylline: Consider aminophylline, only in a HDU or PICU setting, for children with severe or life threatening bronchospasm unresponsive to maximal doses of bronchodilators plus steroids. A loading dose of 5mg/kg should be given over 20 min with ECG monitoring (omit in those with oral theophyllines) followed by a continuous infusion of 1 mg/kg/hr.

IF LIFE THREATENING FEATURES ARE PRESENT:

- Give intravenous salbutamol **OR** aminophylline (consider high dependency or intensive care unit).
Salbutamol 15microgram/kg (max 250mcg) over 10 minutes then a continuous infusion of 1microgram/kg/minute. (Higher doses can be used see monograph).
Aminophylline 5mg/kg over 20 minutes then a continuous infusion at 1mg/kg/hour.
Omit loading dose if child receiving oral aminophylline or theophylline.
- Intravenous Magnesium Sulphate (40mg/kg (max 2g) over 30 minutes) may be considered in refractory acute asthma.
- Give intravenous hydrocortisone 5mg/kg (maximum 200mg), followed by 6 hourly doses of 2-4mg/kg (maximum 100mg).

Monitoring treatment

- Pulse oximetry: maintain $\text{SaO}_2 >92\%$
- Note clinical features at regular intervals
- Repeat PEF measurement 15-30 minutes after starting treatment (if appropriate)
- Chart PEF (if appropriate) before and after inhaled Beta₂ agonists and at least 4 times daily throughout hospital stay
- Cardiac Monitoring – if tachycardic (>170 beats/min) for >5 minutes decrease IV's by 50% and measure K+.

GUIDELINES

When to transfer to Paediatric Intensive Care Unit

Transfer child to Paediatric Intensive Care Unit accompanied by a doctor prepared to intubate if there is:

- Worsening or persisting hypoxia or hypercapnia or a deteriorating PEF
- Exhaustion, feeble respirations, confusion or drowsiness
- Coma or respiratory arrest

Discharge

When discharged from hospital children should have:

- been observed on discharge medication
- had inhaler technique checked and recorded
- if recorded, PEF >75% best or predicted, and PEF diurnal variability of <25%
- if appropriate, own PEF meter (available from pharmacy)
- completed a minimum of 3-5 days of corticosteroids or have sufficient prescribed for the course to be completed after discharge. Consider the need for preventer treatment
- provide a written asthma action plan for subsequent asthma exacerbations with clear instructions about the use of bronchodilators and the need to seek urgent medical attention in the event of worsening symptoms not controlled by up to 10 puffs of salbutamol 4 hourly
- instructions to use inhaled short acting Beta₂ agonist regularly for up to 7 days
- written instructions for parents and a self-management plan if appropriate
- GP or hospital follow up arranged with direct readmission for any deterioration within 24 hours
- arrange referral to a paediatric respiratory specialist if there have been life threatening features

Adapted From British Thoracic Society Guidelines On Asthma Management (2009)

GUIDELINES

CHRONIC ASTHMA

Start at the step most appropriate to initial severity; consider 'rescue' course of prednisolone at any time and at any step. **<2 years – consider referring to respiratory paediatrician**

Once control is achieved consideration should be given to stepping down therapy.

STEP 1	Occasional use of Short Acting Beta₂ - agonist bronchodilators e.g. Salbutamol/Terbutaline. Inhaled whenever possible. (<1year Ipratropium Bromide may be more effective).
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STEP 2	Add Regular Inhaled Low Dose Corticosteroid e.g. Budesonide/Beclomethasone ① 100 – 200microgram twice a day (most patients can start at 200micrograms/ daily) plus P.R.N short acting Beta ₂ agonist See notes ②
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STEP 3	Regular Inhaled Low Dose Corticosteroid & Inhaled Long Acting Beta₂ (LABA) agonist ③ (<5 yrs just add a leukotriene to the steroid,) e.g. Budesonide/Beclomethasone ① 200 – 400microgram daily plus Salmeterol/Eformoterol ③ plus P.R.N short acting Beta ₂ agonist 3-a) If NO response to LABA: -Stop LABA -Increase inhaled steroid to 400 mcg / day 3-b) If there is a response but inadequate: -Continue LABA -Increase dose of inhaled steroid to 400 mcg / day
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STEP 4	Regular High Dose Inhaled Corticosteroid & Regular Bronchodilators Budesonide/fluticasone ④ (budesonide at 800micrograms/day) plus P.R.N long acting Beta ₂ agonist + consider add on trial therapy (Try a leukotriene antagonist or SR Theophylline) <5 years refer to a respiratory physician
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STEP 5	Use daily steroid tablets in lowest dose to provide adequate control (>5 years only) Maintain high dose inhaled steroids Refer to respiratory paediatrician Consider Omalizumab use in this age group if specific allergic response identified - but refer to appropriate service
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GUIDELINES

STEPPING DOWN

- Stepping down therapy once asthma is controlled is recommended to avoid “overtreating” patients
- Some children with milder asthma and a clear seasonal pattern to their symptoms may have a more rapid dose reduction during their “good” season
- Regular review of patients as treatment is stepped down is important

NOTES

- ❶ Twice daily dosing is associated with better outcome although once a day may be considered (same total daily dose) if good control established
- ❷ Montelukast may be used at step 2 in children <5 years who are unable to take inhaled corticosteroid
- ❸ Inhaled LABA should only be started in children on steroids. Salmeterol is available as a metered dose inhaler. Eformoterol is included as an inhaled powder device. (Turbohaler®). (N.B. Eformoterol is not licensed <6years and salmeterol is not licensed <4years).
- ❹ Budesonide is the inhaled corticosteroid of choice for high dose therapy. Fluticasone propionate (Flixotide®) may be used in place of budesonide, on the advice of a consultant, if high dose corticosteroid therapy is not effective or side-effects are a problem. N.B. Fluticasone propionate is approximately twice as potent as budesonide and is licensed for use in children over the age of 4 years.

CHOICE OF INHALER DEVICES FOR CHILDREN

Age (years)

	1 - 2	3 - 5	>5
MDI + Large volume spacer + mask	1st Choice	2nd Choice	---
MDI + Large volume spacer	2nd Choice	1st Choice	2nd Choice
Dry Powder Inhaler i.e. Turbohaler	INAPPROPRIATE	Occasionally useful for beta agonists, but not recommended for steroids	1st Choice

If swapping from a nebulizer to a turbohaler it may be possible to decrease the dose by 50%.

GUIDELINES

USE & CARE OF LARGE VOLUME SPACER DEVICES

- 1) All children using a metered dose inhaler (MDI) for bronchodilator therapy, should try and use a large volume spacer, unless inhaler technique has been assessed as competent.
- 2) All children receiving inhaled corticosteroids via an MDI should use a large volume spacer as lung deposition is improved and oropharyngeal deposition is reduced.
- 3) The appropriate spacer device for the inhaler should always be used:

The Aerochamber is suitable for most MDI's

If more than one inhaler is prescribed, inhalers which fit a common spacer should be chosen, whenever possible.
- 4) The aerosol half life after actuation is often less than 10 seconds. Patients should inhale as soon as possible after aerosol actuation. If more than one aerosol puff is required for a dose, inhalation from the spacer should be performed after each puff.
- 5) The spacer should be washed in non-ionic detergent (i.e washing up liquid) each month and allowed to dry naturally. Wiping dry can create static and reduce drug delivery. The mouth piece should be wiped clean of detergent before use. Drug delivery may vary significantly due to static charge. Metal and other antistatic spacers have been shown to be effective in this respect. It is preferable to pre-wash a spacer device before using it for the first time to eliminate any electrostatic charge transferred from the manufacturing and packaging process.
- 6) The spacer should be replaced every 6-12 months or sooner if necessary.

Adapted from British Thoracic Society Guidelines on Asthma Management (2009).

GUIDELINES

TACHYCARDIA

DRUG TREATMENT

The following are only guidelines as to the initial treatment of a specific arrhythmia, expert advice should be sought before prescribing or if there is a lack of response.

Arrhythmia	Initial treatment
Supraventricular tachycardia	1. Adenosine, repeat bolus when necessary 2. Digoxin 3. Propranolol 4. Flecainide 5. Verapamil
Sinus tachycardia	Find and treat underlying cause
Atrial fibrillation Atrial flutter Atrial tachycardia	1. Digoxin 2. Propranolol 3. Amiodarone
Ventricular tachycardia	1. Amiodarone 2. Lignocaine (if no access or only drug available) 3. Magnesium Sulphate
Wolf-Parkinson-White Syndrome with Atrial fibrillation	1. Amiodarone DO NOT GIVE digoxin or verapamil
NB. Adenosine can be used as a therapeutic agent except in Wolf-Parkinson-White Syndrome with Atrial fibrillation	

GUIDELINES

DIABETIC KETOACIDOSIS (EMERGENCY TREATMENT)

The following recommendations are guidelines. Individual children's requirements may vary and frequent reassessments are always necessary.

Children who are more than 5% dehydrated and/or drowsy and/or acidotic will usually require intravenous fluid and electrolyte correction. Those not in this group may tolerate oral rehydration and subcutaneous insulin.

The leading causes of mortality associated with diabetic ketoacidosis are: cerebral oedema, hypokalaemia and inhalation of vomit.

MANAGEMENT RECOMMENDATIONS

1. **Notify registrar and consultant on call.**
2. **Assess vital signs**
Conscious level, perfusion, TPR, blood pressure, oxygen saturation.
3. **Establish/maintain airway**
Ensure patency. Insert airway if comatose or recurrent vomiting. Give oxygen if necessary.
4. **Insert NG tube**, aspirate and leave on open drainage.
5. **Establish IV access**
6. **Confirm diagnosis**
 - a) blood glucose .
 - b) acidosis (urinary, ketones and blood gases).
 - c) urea & electrolytes (request urgent potassium).
 - d) other blood tests (FBC and differential, PCV, CRP, LFT, blood cultures, serum osmolality).
7. **ECG monitor**
Look for large T waves on ECG.
8. **Assess degree of dehydration**
 - a) weigh the child and compare with last clinic weight.

1kg of weight loss = 1 litre of fluid loss
 - b) clinical assessment:

mild dehydration (3%)
moderate dehydration (5%)
severe dehydration (8%)
9. **Monitor urinary and capillary ketones and glucose**
Record all urine output.

GUIDELINES

SPECIFIC TREATMENT RECOMMENDATIONS

Shocked children need immediate treatment. If tachycardic, poor capillary refill time and hypotensive give 10ml/kg sodium chloride 0.9%. Repeat as necessary up to 30ml/kg.

Rehydrate, over 48hrs by calculating child's fluid requirement.

$48 \text{ fluid requirement (ml)} = 48\text{hr maintenance} + \text{deficit} - \text{resus fluid already given}$

Maintenance

0 - 12.9kg	=	80ml/kg/24 hours	(increase in neonates)
13 - 19.9kg	=	65ml/kg/24 hours	
20 - 34.9kg	=	55ml/kg/24 hours	
35 - 59.9kg	=	45ml/kg/24 hours	
>60kg	=	35ml/kg/24 hours	

Deficit (ml) = dehydration (%) x body wt (kg) x 1000
e.g: 5% dehydration and 40kg
 $5/100 \times 40\text{kg} \times 1000 = 2000\text{mls}$

NOTE: Maximum dehydration used is 8%.

Initially -Infuse sodium chloride 0.9% at calculated hourly rate. Unless child is anuric add 20mmol of potassium chloride to each 500ml intravenous. Check potassium levels every 2-4 hours for the first 24 hours and use ECG monitor. Alter potassium supplements to keep potassium levels between 4-5mmol/l.

Continue under observation until blood glucose <14mmol/l. Then convert to 5% glucose/0.9% sodium chloride with potassium.

Check serum sodium every 2-4 hours and maintain between 145-155mmol/l. Serum sodium levels must be brought down slowly, avoiding rapid shifts which may be associated with cerebral oedema.

Insulin: start IV infusion of soluble insulin (1unit/ml).

Rate of infusion: 0.1units/kg/hr

When pH is above 7.3, blood glucose is down to 14mmol/L and glucose infusion has been started -insulin infusion rate may be reduced to no less than 0.05units/kg/hr

If blood glucose falls <4mmol/l, do **not** stop insulin. Give additional IV glucose 10% (2ml/kg bolus and consider increasing glucose infusion concentration).

- Children already taking long acting insulin may be continued at the same time and dose throughout the treatment of the DKA
- Children with insulin pumps should have the pump stopped when starting DKA treatment

Continued acidosis is usually a sign of incomplete resuscitation. Consider bicarbonate only if child is profoundly acidotic (pH \leq 6.9) and shocked with circulatory failure or has distressing hyperventilation (Kussmaul respiration).

Discuss with registrar or consultant before administering bicarbonate

Introduce oral feeds and S/C insulin Restart feeds as soon as child is able to tolerate them. Reduce IV infusion as appropriate. When child is free of ketonuria (<1mmol/L) and maintaining an adequate oral intake discontinue IV insulin infusion 1 hour after first dose of subcutaneous insulin has been given (10 minutes after if using Novorapid or Humalog). Seek advice from paediatric dietitian.

Anticogulant Prophylaxis

There is significant risk of Femoral Vein thrombosis in sick children with DKA who have femoral lines inserted. Consideration should be given to administering Dalteparin at 100units/kg once a day.

GUIDELINES

TYPE 1 DIABETES

GENERAL PRESCRIBING INFORMATION

Insulin preparations are principally classified by their absorption characteristics after subcutaneous injection. The majority of insulin used in the UK is human sequenced and is a standard strength of 100units/ml (U100).

Children rarely require porcine or bovine insulin and human insulin is the treatment of choice. Occasionally, children from abroad may be using unusual strengths of insulin e.g. 40 or 80 units/ml.

ABSORPTION CHARACTERISTICS

The duration of action of different insulin preparations varies considerably and needs to be assessed for every individual patient. The figures below are average values and significant variations occur between and within individual children. The effects of insulin may vary further in children with hepatic or renal failure or hypothyroidism.

a) Short Acting Insulins: Soluble Human Insulin

Soluble Insulin is the only insulin suitable for intravenous administration. Following IV injection the effects are seen very rapidly, the active half-life is 5 minutes and the effects last less than 30 minutes.

After subcutaneous injection the onset of action is 15-60 minutes, the peak effect is seen after 2-4 hours and the duration of action is 6-8 hours.

b) Intermediate Acting Insulins:

- Isophane Human Insulin
- Insulin Zinc Suspension (Mixed)

c) Premixed Insulin Mixtures:

The mixing of short with intermediate - acting insulins at the time of injection offers the greatest flexibility of dosage, but such mixtures have to be injected immediately and may be less convenient than fixed proportion premixed insulins.

These are available in a variety of combinations of soluble insulin and isophane insulin often in cartridges suitable for use with pen injectors. If a child uses a premixed insulin solution they should keep a vial of soluble insulin in the home to be used in case of febrile illness etc.

IMMUNOGENICITY

Since the advent of highly purified insulins, these immunological phenomena are a rarity.

GUIDELINES

ADMINISTRATION

RECOMMENDED INSULIN REGIMES

- Short-acting insulin mixed with Intermediate-acting insulin: twice daily (before breakfast and evening meal).
- Intermediate-acting insulin with or without Short-acting insulin: twice daily (before breakfast and evening meal).
- Short-acting insulin: three times daily (before meals).
Intermediate-acting insulin: at bedtime.

The regime depends upon the particular needs, motivation and understanding of the child and parents or carers. Insulin should be given before meals.

INJECTION TECHNIQUE AND SITE

Good injection technique is important to minimise avoidable variations in absorption after subcutaneous injection.

The upper, outer aspects of arms and thighs, the buttocks and the central abdomen are all suitable sites for subcutaneous injection of insulin. At rest, absorption is faster from the abdomen than the limbs. However, absorption from the limbs is faster if an injected-limb is exercised. Vigorous or sustained exercise can lower blood glucose for up to 18 hours.

The site of injection should be rotated on a daily basis as repeated injection into the same site can lead to accumulation of fat and fibrous tissue, which disrupts insulin absorption and worsens glycaemic control.

The depth of injection also influences insulin absorption. If too shallow, absorption is slowed, and if given I.M. (often painful), absorption is more rapid. To ensure the correct depth of injection:

- a 5 or 6mm pen needle or a U30, U50 or U100 microfine insulin syringe should be used;
- the skin at the injection site should be pinched between the thumb and fore finger before injection and
- the needle should be inserted at right angles to the injection site

INSULIN PENS & SYRINGES

Pens are portable devices that can be used in place of syringes and offer children with diabetes a considerable degree of freedom and convenience.

Most insulin preparations are available as pen cartridges and the majority of children now use a pen device.

MONITORING

Blood glucose monitoring is essential to ensure good control of diabetes. The frequency required varies but when well, blood glucose should be monitored a minimum of twice daily before meals. In well motivated or poorly controlled patients this may be increased to four times daily. A blood test in the middle of the night should be performed occasionally especially if morning blood glucose levels are elevated. Urinary ketones should be measured if blood sugars are elevated or child is unwell.

GUIDELINES

SUBCUTANEOUS INSULIN DOSE

A child's total daily insulin requirement can only be assessed when the child is at home. However, when commencing subcutaneous insulin an initial dose must be estimated and then adjusted according to response. Independent of whether intravenous insulin has been administered, a reasonable starting dose of subcutaneous insulin is 0.5units/kg/day.

If the child is commenced on a twice daily regime of mixed intermediate and short-acting insulin before breakfast and dinner, two thirds of the estimated daily dose should be given in the morning and one third in the evening. The proportion of these doses given as intermediate and short-acting insulins is variable. However giving 25/30% of the dose as short-acting and 70/75% as intermediate-acting is reasonable.

Administration must relate to meal times: the fast acting analogues (Novorapid, Humalog, Apidra) are given just before a meal, the others should be given about 20 minutes before a meal.

Close monitoring of blood glucose is essential to tailor the predicted initial dose to a child's actual insulin requirement. The distribution of insulin doses and overall requirement varies according to the child's diet and degree of activity on a daily basis. Well-informed and confident children and/or parents/carers should be able to learn to adjust insulin doses and/or diet to match the child's activities and/or diet and in response to blood glucose measurements.

IN ILLNESS

Even when a child is not eating, their insulin requirements will be the same or greater than normal and injections must not be omitted. Under these conditions blood glucose comes mainly from the liver. The child must continue to have an adequate fluid and calorie intake, given intravenously if necessary, with appropriate adjustments to insulin dose (based on blood glucose levels and ketones). Additional analogue insulin may be required on top of the normal requirements.

- **Child reasonably well and eating**
Monitor blood glucose regularly during mild or moderate intercurrent illness. Increase dose of insulin in 10% increments should hyperglycaemia develop.
- **Child reasonably well, but off food**
Give regular carbohydrate-rich drinks (e.g. fruit juice, milk, milkshakes, Lucozade, non-diet fizzy drinks, non-diet squash) in small amounts each hour to ensure an adequate glucose intake throughout the day. Balance insulin requirement against carbohydrate intake.
- **Child severely ill and insulin-treated or less ill but unable to maintain an adequate carbohydrate intake**
Treat with insulin infusion and intravenous glucose.

GUIDELINES

ACUTE HYPOGLYCAEMIA

If the child is conscious, give fast acting carbohydrate orally. This is generally about 10-15g of carbohydrate such as a glass of Lucozade/Coke/fruit juice (all non-diet!), 3-4 glucose tablets or 5 sweets (jelly babies), followed by 10-20g of longer acting carbohydrate e.g. biscuits or bread. Review after 15 minutes.

If the child's level of consciousness is depressed, give **25% glucose** intravenously (<2 years 25mls, >2 years 50mls). If intravenous access is not available and cannot be sited quickly give glucagon I.M. Glucagon may be less effective in poor nutritional states and/or hepatic impairment due to reduced liver glycogen storage. If no response is seen 10-15 minutes after glucagon injection, I.V. glucose should be given.

GUIDELINES

DIABETES MELLITUS (PERI-OPERATIVE MANAGEMENT)

These guidelines can also be used for sick children and those who are nil by mouth. The following recommendations are for guidance only. Each child must be assessed and their management based on normal insulin requirements, diabetic control and the operative procedure.

For major surgery and/or prolonged periods of 'nil by mouth' (NBM) it may be necessary to run glucose and insulin infusions separately for safe control of blood glucose.

Ideally, diabetic control should be optimised before admission, IV insulin and glucose replacement needs to start when the child first omits insulin injection and a meal.

Basal Bolus Regimen: the long acting analogue (eg Glargine/Detemir) should be continued throughout the procedure.

Insulin Pump Therapy: specialist advice should be given.

MAJOR SURGERY

MORNING LIST

Nil by mouth from midnight.

Give usual subcutaneous insulin on evening before operation.

At 06.00 to 08.00 start maintenance intravenous infusion of 5% glucose + sodium chloride 0.9% with added potassium (20mmol/l).

SLIDING SCALE (IV INFUSION)

At the same time start an IV infusion of soluble INSULIN (Human Actrapid) 50units made up to 50ml with sodium chloride 0.9% in a syringe pump. (1ml = 1unit insulin)

Flush giving set with insulin solution **before** connecting to the child.

Blood Glucose (mmol/l)	Insulin Infusion (ml/kg/hr)
0-5	0
6-10	0.05
11-15	0.1
16-20	0.15
>20	0.2

Measure blood glucose at bedside as soon as insulin pump is started and adjust infusion rate to keep blood glucose between 4 and 11mmol/l. Measure blood glucose each hour before surgery and every 30 minutes during the operation.

Be prepared to adjust scale if insulin infusion is not controlling blood glucose levels adequately.

Post operatively, measure blood glucose 2 hourly until stable, then 6 hourly.

Check urine for ketones if laboratory glucose are below 4 or above 17mmol/l.

AFTERNOON LIST

Give patients **half** usual pre-breakfast dose of **soluble insulin only** (omit all intermediate or long-acting insulins) with a light breakfast.

Mid morning start IV dextrose 5% + sodium chloride 0.9% and insulin as in above regimen.

Once food and drink can be taken normally, resume patients previous treatment.

DO NOT STOP INFUSION OF INTRAVENOUS INSULIN UNTIL AFTER A SUBCUTANEOUS DOSE HAS BEEN ADMINISTERED.

GUIDELINES

MINOR SURGERY

If possible, admit the child 24 hours pre-op for assessment of diabetic control. Check Blood Glucose Levels pre-meals and then 2-4 hourly.

MORNING LIST

- Ensure child is 1st on the list
- “Nil by mouth” from midnight.
- Omit morning insulin.
- At 0600 start I.V. infusion of 5% glucose + 0.9% sodium chloride

On return from theatre

Check Blood Glucose Levels (BGL) at bedside 2 hourly until midday. If the child is well enough to eat and drink, then do the following:

If Blood Glucose Level <12 pre-meal: give meal, check Blood Level Glucose 2 hourly and consider stopping glucose/saline infusion.

If BGL >12 pre-meal: give 2 units Human Soluble Insulin S.C., give meal and consider stopping glucose/saline infusion.

Later in the afternoon

If BGL 6-12 and child is well, give usual subcutaneous insulin dose prior to evening meal and if still well after meal, discharge.

If BGL less than 6 } discuss with
or BGL greater than 12 } a senior doctor

If child unable to eat or drink at any time, refer to major surgery protocol and discuss with a more senior doctor.

AFTERNOON LIST

- Ensure child first on the list

In the morning

- Administer short acting insulin S.C. at the child's usual dose, before a light breakfast.
- Omit any medium/long acting insulin.
- Place the child 'Nil by Mouth'.
- Start I.V. infusion of 5% glucose + 0.9% sodium chloride.
- Check BGL hourly before theatre.

On return from theatre

Check blood glucose at bedside 2 hourly. If the child is well enough to eat and drink, do the following:

BGL <12 pre-meal: give meal, check BGL 2 hourly and consider stopping glucose/saline infusion.

If BGL >12 pre-meal: give child their usual subcutaneous dose of short acting insulin and give meal. Check BGL 2 hourly and consider stopping the glucose/saline infusion.

Keep child in overnight and discuss with a more senior doctor how much extra insulin to give overnight and what type (i.e. short or long acting).

If the child is unable to eat or drink at any time, then refer to major surgery protocol, but discuss with a more senior doctor first anyway.

GUIDELINES

GUIDELINES FOR THE MANAGEMENT OF POST-OPERATIVE NAUSEA AND VOMITING (PONV) IN CHILDREN

Introduction

Incidence of Post operative vomiting is reported to be 13 – 42% in paediatric patients. Severe post op vomiting can result in dehydration, wound dehiscence, electrolyte imbalance and pulmonary aspiration. PONV is a leading cause of parental dissatisfaction and patient distress. These guidelines are to help in prevention and management of post op nausea and vomiting.

Low Risk Patients:

Children < 3 yrs

Children without a history of PONV following previous GA

Duration of surgery less than 30 minutes and/or surgical procedures not associated with PONV

Action

Prescribe post op PRN Ondansetron 0.1mg/Kg, PO / IV, 8 hrly (please specify on drug chart as first line of treatment)

(Consider post op PRN Cyclizine or Droperidol as a second line of treatment)

Medium Risk Patients:

Older children (>3 yrs) receiving IV morphine peri- operatively and /or undergoing surgical procedure associated with PONV

No more than 1 isolated episode of PONV following previous GA

Action

Intra - operatively IV Ondansetron 0.1 mg/kg or IV dexamethasone 0.15 mg/kg

Prescribe post op PRN Ondansetron as first line of treatment, 0.1mg/Kg, PO/IV, 8 hrly

Prescribe post op PRN Droperidol as second line of treatment, 20-50microgram/Kg, IV 6hrly

High Risk Patients:

Previous history of severe/prolonged PONV following GA

Surgical procedure associated with PONV

Action

Intra - operatively IV Ondansetron 0.15 mg/kg and IV dexamethasone 0.15 mg/kg

Post op 2 further doses of IV Ondansetron 0.15mg/kg, 8hrly and 1 further dose of dexamethasone 0.15mg/kg 12 hrly

Prescribe PRN Ondansetron after 2 regular doses of 0.15mg/Kg, PO/ IV, 8hrly

Prescribe post op PRN Droperidol as second line of treatment, 20-50microgram/Kg, IV 6hrly

Additional Measures:

Avoid long acting opioids where possible by using regional techniques/Blocks.

Consider TIVA in place of volatile anaesthetic agents.

Avoid antagonism of neuromuscular blockage with anticholine esterase drugs where possible.

Maintain normothermia and adequate hydration.

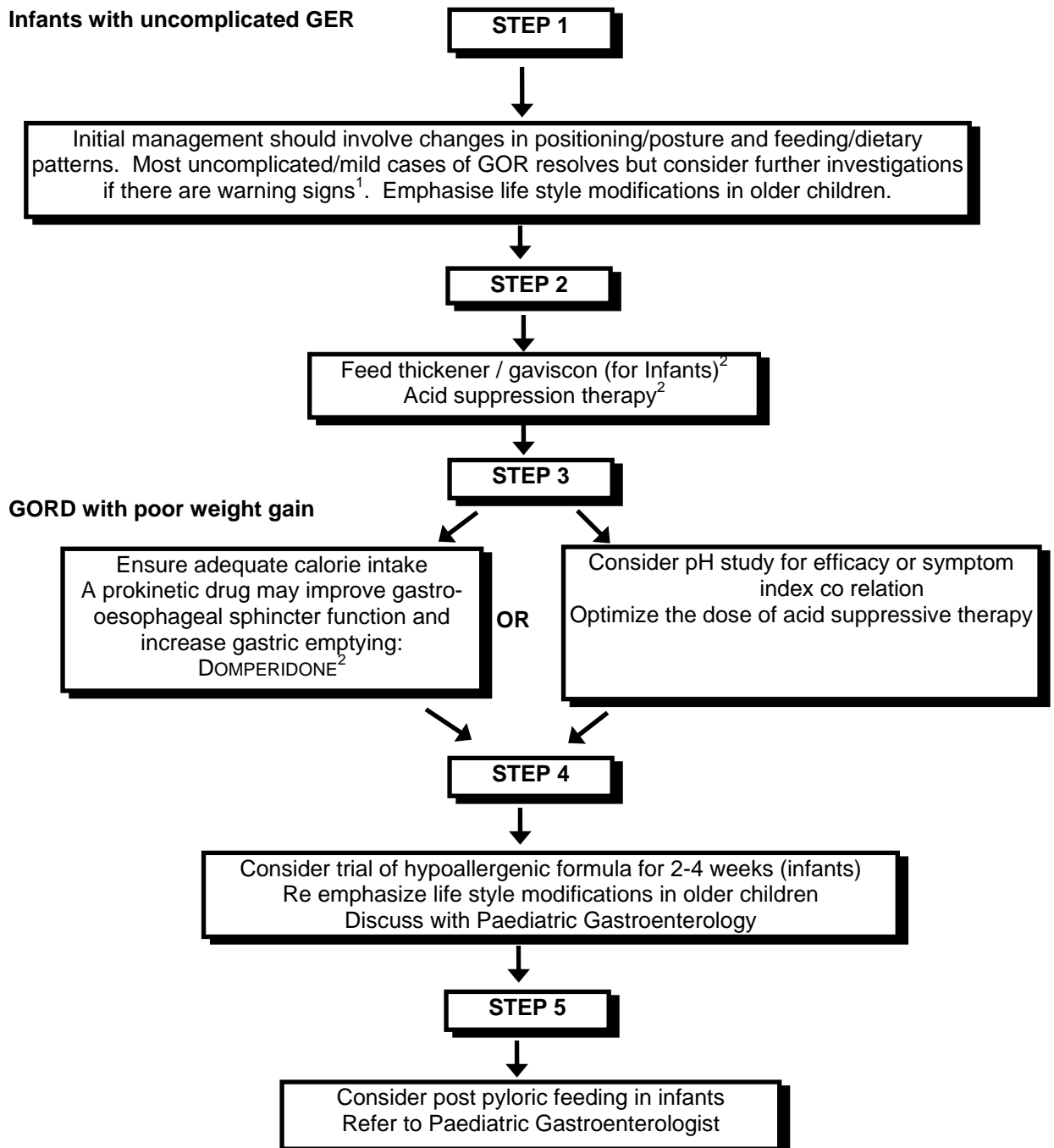
GUIDELINES

GASTRO-OESOPHAGEAL REFLUX DISEASE (GORD)

Gastro-oesophageal reflux (GOR) is most common in infancy with symptoms resolving around 12-18 months of age but can occur in children.

Gastro-oesophageal reflux disease is basically a clinical diagnosis. pH study can be used to assess the efficacy of treatment and barium contrast study is useful to exclude surgical causes of vomiting. Endoscopy should be considered in severe disease. Trial of hypoallergenic feeds should be considered in infants with suspected enteropathy or history of atopy.

Infants with uncomplicated GER



GUIDELINES

NOTE:

- 1 Warning signs: bilious vomiting, blood in vomit or stool, consistently forceful vomiting, faltering growth, diarrhoea, constipation, abdominal distension, bulging fontanelle, hepato splenomegaly or suspected metabolic condition.
- 2 Check **cautions** and **warnings** carefully before prescribing. Insufficient evidence to routinely use feed thickener / gaviscon or domperidone. PPI has stronger acid suppressive effect than Ranitidine. Initial therapy is for 2-4 weeks and can be continued up to 12 weeks if necessary. Routine use of twice a day PPI (proton pump inhibitor) is not necessary. Ranitidine exhibits tachyphylaxis and is not ideal for chronic use.
- 3 It is not usually advisable to use Ranitidine and Omeprazole concomitantly, but benefit may be seen in severe cases – seek expert advice.

ANTIBIOTIC TREATMENT

GENERAL PRINCIPLES

This guide gives recommendations for common infections; it is not intended to be an exhaustive list. **Wherever possible, specimens for microbiological examination should be taken BEFORE starting antimicrobial therapy, or as soon as possible after.** Antibiotics are usually started **before** microbiology results are available. Treatment should be reviewed with respect to the child's progress and laboratory / microbiology results (organism and sensitivities)

Isolation of bacteria from a specimen does not automatically mean antibiotic treatment is required.

Before prescribing any antibiotic **ASK** child and/or carer about **ALLERGIES**; do not assume records in the notes are accurate and if inaccuracies are found please correct them.

Doses and dose frequencies are not found in this guideline and individual drug monographs should be used.

RECOMMENDATIONS WHEN INITIATING ANTIBIOTIC THERAPY

- Consider the severity of the condition to be treated
- Consider the possible infecting pathogen(s)
- Choose the route of administration; remember that oral therapy is often appropriate

RESTRICTED ANTI-INFECTIVE AGENTS

A number of antibiotics included in the formulary are restricted for a variety of reasons including efficacy, toxicity and cost.

The use of these agents should be discussed with Infection/Pharmacy before prescribing

ORAL ANTIBIOTIC THERAPY

Monitor the child's response and consider changing from IV therapy (if used initially) to oral therapy as soon as clinically appropriate.

Oral antibiotics can often be substituted for IV therapy without loss of efficacy. Many, but not all, oral antibiotics are rapidly and well absorbed, eg ciprofloxacin, metronidazole and co-amoxiclav are well absorbed orally.

If in doubt **ASK** - advice is always available from PID consultants, microbiology doctors and pharmacists

GUIDELINES

ALLERGY

Prescribing in penicillin-allergic patients

Penicillin allergy, including the nature of the reaction, must be documented in the medical notes and on the drug chart. Remember that only a small proportion of patients who think they are penicillin allergic can be shown to have true Type 1 hypersensitivity using skin tests.

Penicillin allergy manifests as rash and/or anaphylactic reactions - including any of hypotension, breathing difficulty, swelling of the mouth, lips or throat. ALL beta-lactam agents should be avoided in these patients. For the treatment of serious infections for which there are no satisfactory alternatives (and the history does NOT include anaphylactic features), second or third generation cephalosporins or carbapenems may be used, but only with the documented approval of a senior attending doctor. In this circumstance, the patient should be closely observed for signs of anaphylaxis for one hour after giving the first dose. In order to minimise the risk of inadvertently prescribing co-amoxiclav to penicillin-allergic patients, this agent MUST NOT be prescribed as Augmentin® on the drug chart; nurses are specifically instructed not to administer this drug unless it is prescribed as co-amoxiclav.

NEVER give in Penicillin allergy

Amoxicillin
Benzylpenicillin (Penicillin G)
Co-amoxiclav (Amoxicillin + Clavulanic acid)
Flucloxacillin
Phenoxymethylpenicillin (Penicillin V)
Piperacillin + Tazobactam (Tazocin®)
Cefalexin (1st generation)

ONLY give with senior approval

Cefixime (3rd generation)
Cefotaxime (3rd generation)
Ceftazidime (3rd generation)
Ceftriaxone (3rd generation)
Cefuroxime (2nd generation)
Meropenem (carbapenem)
Primaxin® (Imipenem + Cilastatin)
(carbapenem)
Ertapenem (carbapenem)

USE OF THE GUIDE

The route of administration recommended in the table is the most appropriate if available.

If the IV route is required where oral is stated use the same antibiotic (as oral) unless otherwise defined

IV doses are the "standard" doses unless stated as *high dose* – high dose usually refers to the following per dose:

- 50mg/kg of cefotaxime
- 80mg/kg of ceftriaxone
- 50mg/kg of amoxicillin
- 50mg/kg of benzylpenicillin
- 50mg/kg of flucloxacillin
- 10mg/kg of clindamycin

3rd generation cephalosporins: cefotaxime is normally to be used on PICU and NICU (due to restrictions of use of ceftriaxone in premature babies and concomitant calcium administration). General wards can normally use ceftriaxone to ease nursing time and patient intervention. (*ceftriaxone is used in the following tables throughout*).

Cefuroxime is not usually used at ECH for treatment of infection, but is the preferred IV cephalosporin for prophylaxis as it is 2nd generation.

Clarithromycin is the macrolide of choice. Azithromycin should only be used in specific indications (eg drug interactions, immunocompromised) with approval from the paediatric infectious diseases (PID) team or pharmacy.

UPPER RESPIRATORY TRACT INFECTIONS

Condition	Usual age range	Common organisms / advice	Initial antibiotic	Usual length of treatment
Tonsillitis	>2 years	Viral Group A streptococcus (GAS); treat if proven GAS or 3 out of 4 of following: exudates, tender anterior LN, fever, lack of cough	Antibiotics not generally indicated if not systemically unwell; ensure adequate analgesia. Penicillin V po <i>(if pen allergy: clarithromycin po bd)</i>	10 days (5 days)
Retropharyngeal/lateral pharyngeal cellulitis/abscess	>2-3 years	Group A strep Oral anaerobes Staph aureus	Co-amoxiclav po	10 days
Sinusitis	>5 years	Strep pneumoniae H influenzae Moraxella catarrhalis	Co-amoxiclav po	7 days
Acute otitis media	<2 years If bilateral or otorrhoea in <2 years	Viral Strep pneumoniae H influenzae Moraxella catarrhalis	Antibiotics not generally indicated if not systemically unwell; Amoxicillin po If >2yrs give analgesia and review after 24hrs	7 days
Mastoiditis	All	Strep pneumoniae H influenzae Moraxella catarrhalis	Co-amoxiclav iv initially (usually convert to oral after 48 hours)	14 days minimum
Acute epiglottitis	All (usually 2-5 years)	H. influenzae Strep pneumoniae	Ceftriaxone iv	7 days See medical prophylaxis for contacts
Acute tracheitis	All (usually ≤ 3 years)	Staph aureus Moraxella catarrhalis	Co-amoxiclav iv initially (usually convert to oral after 48 hours)	7 days

LOWER RESPIRATORY TRACT INFECTIONS

Condition	Age range	Common organisms/ advice	Initial antibiotics	Usual length of treatment
Pneumonia	0-1 month	Group B strep	Benzylpenicillin (<i>high dose</i>) + gentamicin	7 days
	1-3 months (can be difficult to differentiate from sepsis/meningitis)	Group B strep Chlamydia Pertussis	Ceftriaxone (If pertussis or chlamydia suspected, add clarithromycin po)	7 days (5 days for clarithromycin)
	>3 months	Strep pneumoniae H influenzae Mycoplasma pneumoniae (often viral)	Mild-moderate - Amoxicillin po Severe or toxic – Co-amoxiclav iv Substitute (or add) clarithromycin on clinical suspicion of atypical organism in >5yo or child on pen V prophylaxis	7 days 5 days for clarithromycin
Aspiration pneumonia	Any age	Oral pathogens	Usually manage conservatively	7 days
		If respiratory distress & fever	Co-amoxiclav po	
Nosocomial pneumonia	(>3 days in hospital)	Ps aeruginosa Plus pneumonia pathogens	Ceftriaxone iv + gentamicin iv	7 days
Bronchiolitis with secondary bacterial infection	Usually <1 year	Strep pneumoniae	Mild-moderate - Amoxicillin po Severe or toxic – Co-amoxiclav iv	7 days
Empyema	All Ages	Strep pneumoniae Staph aureus	Ceftriaxone iv	7 days minimum

URINARY TRACT INFECTIONS

Condition	Age range	Common organisms / advise	Initial antibiotics	Usual length of treatment / Notes
UTI	0-1 month	Group B strep	Benzylpenicillin (<i>high dose</i>) + Gentamicin	7 days Then start prophylaxis
	1-3 months	E coli Klebsiella Proteus	Ceftriaxone iv	7 days
	>3 months	E coli Klebsiella Proteus	Lower UTI – Cefalexin po Upper UTI (mild/mod) – Co-amoxiclav po Upper UTI (severe) – Ceftriaxone iv	3 days 3-7 days 7 days
PD catheter infection	All	Staph aureus Coag negative Staph (Pseudomonas) (Candida)	Mild - Flucloxacillin po Severe - Vancomycin ip/iv + Gentamicin ip/iv - 2mg/kg Consider adding nystatin 1ml po qds	7 days

SKIN INFECTIONS - CELLULITIS- LYMPHADENITIS

Condition	Age range	Common organisms	Initial antibiotics	Usual length of treatment
Impetigo / infected eczema	All	Staph aureus Group A strep Herpes simplex virus (HSV)	Use topical Mupirocin initially If ineffective start Flucloxacillin po Flucloxacillin iv + Aciclovir iv	7 days (switch to oral with clinical improvement)
Cellulitis	All	Staph aureus Strep pyogenes (Group A Strep)	Flucloxacillin po (iv if severe) <i>(Flucloxacillin is excellent against both strep and staph)</i> If immunocompromised (including sickle cell disease) – Co-amoxiclav iv	7 days
Umbilical Stump Infection	< 1 month	Staph aureus	Flucloxacillin po	7 days
Necrotising fasciitis	All	Group A strep	Benzylpenicillin iv (<i>high dose</i>) + Clindamycin iv (<i>high dose</i>)	10 days
Purulent lymphadenitis	All	Group A strep Staph aureus Oral pathogens	Co-amoxiclav po	10 days
Bites - animal or human	All	Pasteurella multocida, Capnocytophaga carnimorsus Upper resp tract anaerobes and aerobes	Co-amoxiclav po	7 days

BONE & JOINT INFECTION

Condition	Age range	Organisms	Initial antibiotics	Usual length of treatment
Septic arthritis	Neonates	Staph aureus Group A strep Strep pneumoniae	Flucloxacillin and gentamicin	4-6 weeks
	> 1 month		Co-amoxiclav iv	7 days iv followed by 14 days po
Osteomyelitis	Neonates		Flucloxacillin and gentamicin	4-6 weeks
	> 1 month		Co-amoxiclav iv	14 days iv followed by 28 days po
Mastoiditis	All	Strep pneumoniae H influenzae Moraxella catarrhalis	Co-amoxiclav iv (usually convert to oral after 48 hours)	14 days minimum total

SEPTICAEMIA/ CNS INFECTIONS

Condition	Age range	Common Organisms	Initial antibiotics	Length of treatment / Notes
Suspected sepsis without localized signs (Meningitis)	0-1 month	Group B strep E.coli Listeria Strep pneumoniae	Cefotaxime iv (high dose) + Amoxicillin iv (high dose)	7 days minimum. Varies according to suspected /confirmed pathogen
	1-3 months	N meningitidis H influenzae HSV Parechovirus Enteroviruses	Ceftriaxone iv (<i>high dose</i>) + Amoxicillin iv (<i>high dose</i>)	Meningitis – usually 14-21 days (especially in neonates) Consider dexamethasone
	>3 months	Strep pneumoniae N meningitidis H influenzae Enteroviruses	Ceftriaxone iv (<i>high dose</i>)	Consider adding aciclovir iv based on clinical suspicion of HSV infection Consider adding vancomycin if central line infection, MRSA, or travel to area of high pneumococcal cephalosporin resistance
Febrile neutropenia	>3 months	Pseudomonas Staph aureus Fungi	Piperacillin with tazobactam iv + Gentamicin iv	Discuss with micro and oncology team
Meningoencephalitis	All	N meningitidis Strep pneumoniae H influenzae HSV Other viruses Mycoplasma	Ceftriaxone iv (<i>high dose</i>) + Aciclovir iv (<i>high dose</i>) + Clarithromycin po	7-14 days (clarithromycin for 5/7)
Brain abscess	All		Ceftriaxone iv (<i>high dose</i>) + Metronidazole iv	

EYE DISORDERS

Condition	Age range	Organisms	Initial Antibiotics	Usual length of treatment
Orbital cellulitis	All	Strep pneumoniae Staph aureus	Ceftriaxone iv (<i>high dose</i>)	7 days - convert from iv to oral Co-amoxiclav after 48 hours if good clinical response
Periorbital cellulitis		Anaerobes H influenzae	Co-amoxiclav iv	
Ophthalmia neonatorum		N gonorrhoea Chlamydia	Ceftriaxone iv	Single dose Discuss with PID and Ophthalmology
Conjunctivitis		Staph aureus Chlamydia	Chloramphenicol eye drops/ointment	7 days

CARDIOVASCULAR

Condition	Age range	Organisms	Initial Antibiotics	Usual length of treatment
Bacterial endocarditis	All	Viridans strep Strep pneumoniae Staph aureus Enterococci	Seek urgent microbiology / PID input	

SICKLE CELL PATIENTS

Condition	Age range	Common Organisms	Initial Antibiotics	Usual length of treatment
Crisis with fever	All	Strep pneumoniae Mycoplasma pneumoniae Chlamydia pneumoniae	Mild – Co-amoxiclav po Moderate - Co-amoxiclav po + clarithromycin po (especially with chest crisis) Severe - Ceftriaxone iv + Clarithromycin po	7 days
Osteomyelitis Septic Arthritis		Staph aureus Salmonella Strep pneumoniae H influenzae	Mild/moderate - Co-amoxiclav iv Severe – Ceftriaxone iv	May require 6-12 weeks treatment. Discuss with PID

Sickle cell patients - comments

- Low threshold to start antibiotics when temperature $\geq 38^{\circ}\text{C}$
- Inflammatory markers are less sensitive indicators of disease severity
- Always consider bacteraemia when febrile (pneumococcal, salmonella)
- Discuss with haemoglobinopathy team early
- Ask about and document recent adherence to prophylaxis
- Stop prophylaxis during acute antibiotic course and restart upon completion

GASTROINTESTINAL

Condition	Age range	Organisms	Initial Antibiotics	Usual length of treatment
Necrotising enterocolitis	<1 year	E coli Klebsiella sp Enterobacter sp Clostridium perfringens	Amoxicillin iv (<i>high dose</i>) + Gentamicin iv + Metronidazole iv	14 days
Bacterial peritonitis	All	Gram neg anaerobic bacilli	(Co-amoxiclav + Gentamicin may be considered as at alternative to amoxicillin and metronidazole)	14 days
Appendicitis	All	Gram neg anaerobic bacilli		14 days
Cholangitis	All	Gram neg aerobic bacilli	Ceftriaxone iv + Metronidazole iv	14 days
Bloody diarrhoea	All	E Coli Shigella Salmonella Campylobacter	Ceftriaxone iv	7 days
Clostridium difficile diarrhoea	All	Clostridium difficile	Metronidazole po	14 days stop all other antibiotics (Vancomycin (po) second line)

SPECIFIC CONDITIONS ON THE NEONATAL UNIT

Condition	Organisms	Initial Antibiotics	Usual length of treatment / Notes
Early onset neonatal infection (within 72 hours of birth)	Group B strep E Coli	Benzylpenicillin (<i>high dose</i>) + Gentamicin	Consider amoxicillin instead of benzylpenicillin if Listeria suspected Consider adding acyclovir if herpes simplex suspected
Late onset neonatal infection (greater than 72 hours since birth)	Staph aureus S. epidermidis Enterobacter, Klebsiella	Flucloxacillin + Gentamicin	Vancomycin if CONS isolated
Meningitis	Group B Strep E Coli Listeria CONS Candida Entervirus	Amoxicillin + Gentamicin + Cefotaxime	2-3 weeks Consider acyclovir if HSV suspected Consider fluconazole if candida suspected
Urinary Tract Infection	E Coli Group B Strep	Amoxicillin + Gentamicin	7 days Then start prophylactic trimethoprim 2mg/kg ON or if not on feeds cefotaxime 50mg/kg ON
Gonococcal ophthalmitis	Gononoccus	Ceftriaxone iv stat	
Chlamydial conjunctivitis	Chlamydia	Po azithromycin	3 days
Umbilical sepsis	Staph aureus	Flucloxacillin + Gentamicin	5-7 days
Osteomyelitis and septic arthritis	Staph aureus Group B Strep	Flucloxacillin + Gentamicin	4-6 weeks
Orpharyngeal and or topical Candidiasis	Candida albicans	Nystatin liquid Clotrimazole cream	Continue for 7 days after lesions have healed
Fungal sepsis	Candida albicans Candida parapsilosis Aspergillois	Fluconazole	Prophylaxis for preterm infants born <26 weeks or birth weight <800g

CONGENITAL INFECTION

Babies born to mothers with	Treatment		Usual length of treatment / Notes
Hepatitis B	High infectivity	Hepatitis B Immunoglobulin (HBIG) + Hepatitis B vaccine	HBIG to be given within 24 hours of birth where necessary Hepatitis B vaccine schedule: 1 st dose: ASAP after birth (within 24 hours) 2 nd dose: 1 month of age 3 rd dose: 2 months of age 4 th dose: 12 months of age
	Low infectivity	Hepatitis B vaccine	
HIV	Low risk	Zidovudine	Start antiretrovirals within 4 hours of birth Length of course: 4 weeks for zidovudine and lamivudine 2 weeks for nevirapine
	High risk	Zidovudine Lamivudine Nevirapine	
Syphilis	In patient	Benzylpenicillin iv	Course length: Benzylpenicillin – 10 days Procaine Penicillin – 10 days Benzathine Penicillin – single dose
	Out patient	Procaine Penicillin im OR Benzathine Penicillin im	
Cytomegalovirus	Discuss case with Paediatric Infectious Diseases specialists		
Congenital Toxoplasmosis	Symptomatic baby	Pyrimethamine + Sulphadiazine + Folinic Acid	Treatment is for 1 year. Dosing regimens change over time see full neonatal guidance
	Asymptomatic baby	Discuss case with Virologist and Paediatric Infectious Diseases Consultant	
Herpes Simplex Virus	Aciclovir iv		14-21 days
Chicken Pox	Contact Virologist and Paediatric Infectious Diseases Consultant as numerous factors affect treatment		

ANTIBIOTIC PROPHYLAXIS

GENERAL PRINCIPLES

General Principles:

- Antibiotic prophylaxis is given to prevent urinary, wound and systemic infection. Prophylaxis should be directed against specific organisms relevant to the type of surgery with predictable sensitivities.
- Ideally patients should have a urine culture and sensitivities within 2 weeks of any urological procedure.
- Consider delaying elective procedures to allow treatment of any known urinary tract infection. If this is not possible, modify prophylactic antimicrobial choice to accommodate significant positive microbiology.
- If necessary this can be discussed with Infection doctors prior to the day of the procedure, to give guidance on any change in regimen that may be needed.
- All aspects of antimicrobial prophylaxis, including where prophylaxis is not given when recommended, or where post-operative antimicrobials are indicated due to intra-operative findings, should be clearly recorded in the case notes.

Timing of Prophylaxis

- Oral antimicrobials should ideally be taken 1-2 hours prior to the procedure but in an out-patient setting when this may not be feasible, doses should be given as early as possible prior to the procedure.
- Intramuscular antimicrobials should be given 30 minutes prior to the procedure to achieve high tissue levels at the time of procedure or incision.
- Intravenous antimicrobials should be given in the anaesthetic room within 1 hour of the procedure or incision (not with pre-medication on the ward) to ensure high tissue level at the time of procedure or incision. Antimicrobial concentrations in blood and bone typically peak within 20 minutes of systemic administration.
- One pre-operative antimicrobial dose is sufficient for most types of surgery. Consider additional intra-operative doses of prophylactic agents for patients with prolonged procedures (>4 hours).
- Prophylaxis should generally be prescribed in addition to existing antimicrobial treatment.

GUIDELINES

MEDICAL PROPHYLAXIS

INDICATION	COMMON PATHOGENS	RECOMMENDATION
Meningitis: patient and close domestic or very close medical contacts	<i>Neisseria meningitidis</i>	Ciprofloxacin as a single dose Rifampicin twice daily for 2 days Pregnant contacts: Ceftriaxone as a single dose
	<i>Haemophilus influenzae</i>	Rifampicin daily for 4 days
Whooping cough: unvaccinated contact < 1 year	<i>Bordetella pertussis</i>	Clarithromycin for 7 days
Tuberculosis Child < 2 years and not BCG vaccinated in contact with sputum- positive tuberculosis	<i>Mycobacterium tuberculosis</i>	Isoniazid for 6 months OR Isoniazid + Rifampicin for 3 months
Urinary Tract Infections	<i>Escherichia coli</i> <i>Proteus</i> species <i>Klebsiella</i> species	Trimethoprim (or appropriate alternative if history of resistance to trimethoprim)
Tetanus prone wound	<i>Clostridium tetani</i> +/- secondary infection	Tetanus toxoid or anti-tetanus immunoglobulin may be required + Phenoxymethylpenicillin (Penicillin V) or Co-amoxiclav
Sickle cell or Splnectomy patients	<i>Streptococcus pneumoniae</i> <i>Haemophilus influenzae</i> <i>Neisseria meningitidis</i>	Phenoxymethylpenicillin
Endocarditis		Prophylaxis is not generally recommended (NICE) – advice can be given by PID.

SURGICAL PROPHYLAXIS

INDICATION	COMMON PATHOGENS	RECOMMENDATION
Acute appendicitis and other abdominal surgery	<i>Anaerobes</i> <i>Coliforms</i>	Cefuroxime + Metronidazole up to 24 hours post op.
Cardiac surgery	<i>Staphylococcus epidermidis</i> <i>Staphylococcus aureus</i> <i>Coliforms</i>	Cefuroxime for 24 hours post op. If patient has ever had MRSA or status unknown give Teicoplanin and Gentamicin for 24 hours.
Interventional Cardiac Catheterisation	<i>Staphylococcus epidermidis</i> <i>Staphylococcus aureus</i>	Flucloxacillin single dose on induction by anaesthetist
Urological procedures	<i>Escherichia coli</i> <i>Coliforms</i>	Gentamicin single dose 2.5mg/kg
Orthopaedic Surgery	<i>Staphylococci</i> <i>Coliforms</i>	Cefuroxime single dose

ANTIRETROVIRAL DRUGS FOR CHILDREN

Notes:

- The information presented in this document is not exhaustive. Although every effort has been made to ensure the accuracy of the information, it is always advisable to check with the SPC of the relevant drug or clinical pharmacist for further details. References used to produce this table are Paediatric European Network for the Treatment of AIDS (PENTA) Guidelines 2009, SPC of different drugs, BHIVA: Guidelines for the management of HIV infection in pregnant women 2008.
- Most of the doses are expressed as total daily dose, however they can be divided in 2-3-4 different doses. This will be indicated as BD/TDS/or QDS (12 hourly, 8 hourly or 6 hourly respectively).
- The information provided on renal (RI) and liver (LI) impairment is based on data available from adult population. There are hardly any studies in children.
- The majority of antiretroviral drug therapy can potentially interact seriously with other drugs. If in doubt contact your medicines information centre or Paediatric HIV pharmacist

Babies Born To HIV Positive Mothers

1. Neonatal BCG should NOT be given. Some experts recommend measles vaccine is not given to HIV positive children with severe immunosuppression (ie CD4<15%).
2. Breast feeding should be avoided.
3. Neonatal antiretroviral treatment:
 - a. Give infant: Zidovudine 4mg/kg po BD for 4 weeks which should be commenced within 4 hours of birth
 - b. If maternal viral load is very high or unknown at delivery seek expert advice and consider triple therapy: Zidovudine 4mg/kg po BD for 4 weeks, Lamivudine 2mg/kg po BD for 4 weeks and Nevirapine 2mg/kg for 1 week and 4mg/kg for 2nd week then stop (use 4mg/kg if mother has received >3 days nevirapine). As therapy needs may be complex discuss each individual case with the HIV Specialist doctors and refer to the BHIVA pregnancy guidelines on www.bhiva.org
4. For further information on prevention of mother to child transmission see Trust's "Women's and Neonatal Services Maternal Conditions" Guidelines – HIV in pregnancy.

Nucleoside Reverse Transcriptase Inhibitors - NRTI's

* Reports of lactic acidosis and mitochondrial toxicity for most of the NRTI's drugs.

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Zidovudine (ZDV, AZT, Retrovir®)	<p>Capsules 100mg and 250mg Solution (oral) 100mg in 10ml Injection 10mg in 1ml</p> <p>Combination tablets (f/c) Combivir®: Zidovudine 300mg+ Lamivudine 150mg</p> <p>Trizivir®: Abacavir 300mg+ Lamivudine 150mg + Zidovudine 300mg</p>	<p>Premature Neonates <30 weeks PO 2mg/kg BD for 4 weeks 30 to <34 weeks PO 2mg/kg BD for 2 weeks, then 2mg/kg TDS for 2 weeks IV for premature is 1.5mg/kg bd</p> <p>Neonates-3 months PO 4mg/kg BD (or 2mg/kg QDS) or IV 1.5mg/kg QDS. For neonatal prophylaxis: PO 4mg/kg BD or 2mg/kg qds Start within 4 hours of birth (BHIVA) and continue until 4 weeks old.</p> <p>>3months Oral 180mg/m² BD (max dose 300mg BD) or (≥4kg to ≤9kg): 12mg/kg BD (max 300mg BD) (≥9kg to ≤30kg): 9mg/kg BD (max 300mg BD)</p> <p>Adult doses: 250-300mg BD May double dose for HIV encephalopathy and ensure monitor for side effects.</p>	<p>Anaemia, neutropenia, leucopenia, myalgia, nausea, headaches. Less common liver toxicity See *</p>	<p>Large volumes of syrup not well tolerated in older children. If given IV, dilute with glucose 5% to a concentration between 2mg/ml and 4mg/ml and administer over 1 hour. LI: Reduction in glucuronidation may increase concentration of zidovudine. Dose needs adjustment. RI: Plasma half-life does not appear to be significantly prolonged in RI. Give zidovudine at lower end of dosage range and adjust according to clinical response.</p>

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Didanosine (ddl, dideoxynosine, Videx®)	Capsules (enteric coated) 125mg, 200mg, 250mg and 400mg Chewable Tablets 25mg	Neonates – 3 months 60mg/m ² BD or 100mg/m ² OD >3months 200mg/m ² /day (180-240mg/m ² /day – 180mg if co-administration with zidovudine) (OD or split BD) max 250mg/day Adult <60kg 250mg OD Adult >60kg 400mg OD	Diarrhoea and abdominal pain, pancreatitis (dose related and less common in children than adults), peripheral neuropathy (dose related), abnormal electrolytes, increased liver enzymes and retinal or optic nerve changes (mainly reported in children). See *	EC capsules - swallowed whole 2hours before or after food preferably at bedtime. Tablets – at least 30minutes before food or 2hours after food. Tablets may be crushed, chewed or disperse in water. Taken 1hour before or 2hour after food. ddl tablets and liquid contain buffering agents. Drugs that need an acid environment for absorption e.g. ketoconazole, itraconazole, dapsone should be given at least 2hours before these ddl preparations. Drugs whose absorption is decreased by antacids e.g. tetracycline, ciprofloxacin should be given 2hours before or 4hours after ddl tablets or liquid. RI: dose needs adjusting
Stavudine (d4T, Zerit®)	Capsules, 20mg, 30mg and 40mg Powder for Oral solution 1mg in 1ml	Birth – 13 days old: 0.5mg/kg bd 14 days old - <30kg: 1mg/kd bd > 3 months Up to 30kg 1mg/kg BD 30kg to <60kg , 30mg BD. ≥60kg , 40mg BD. In practice, we use 30mg BD (Max: 40mg BD)	Headache, GI upset, rash, peripheral neuropathy (less frequent than in adults), pancreatitis (uncommon), lactic acidosis, hepatic steatosis, lipodistrophy syndrome (less often used as a result). See *	Large volume of suspension. Capsules may be carefully opened up and mix content with food. RI: Dose needs adjusting. LI: Adjustment not necessary.

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Lamivudine (3TC, Epivir®)	Tablets 100mg, 150mg, 300mg Oral solution 10mg in 1ml Combination tablets -Combivir®: Zidovudine 300mg +Lamivudine 150mg -Trizivir®: Abacavir 300mg +Lamivudine 150mg + Zidovudine 300mg -Kivexa®: Abacavir 600mg + Lamivudine 300mg	Neonates<30 days: 2mg/kg BD 1 month – 12 years: 4mg/kg bd ≥12 years: 300mg/day (od or split bd) (Maximum 300mg daily)	Headache, GI upset, abdominal pain, rash, pancreatitis (rare mainly seen with advanced HIV infection and receiving multiple medications but if occurs stop lamivudine immediately), peripheral neuropathy, thrombocytopenia and abnormal LFT's. Anaemia and neutropenia reported when combined with AZT. See *	Well tolerated. Store solution at room temperature (use within one month of opening). RI: Dose needs adjusting. LI: Adjustment not needed.
Abacavir (ABC, Ziagen®)	Tablets 300mg Liquid 20mg in 1ml -Trizivir®: Abacavir 300mg +Lamivudine 150mg +Zidovudine 300mg -Kivexa®: Abacavir 600mg + Lamivudine 300mg	Neonates 2mg/kg BD >3 months 8mg/kg BD (Max 600mg/day) 300mg tablets: 14-21kg: 1 tablet daily 21-30kg: 1½ tablets daily >30kg: 2 tablets daily Adult (≥12 years) 300mg BD or 600mg OD	1-5% may develop hypersensitivity reaction (fever, malaise, GI upset, mucositis +/- rashes) usually in first 6 weeks. Stop drug, do not rechallenge. HLA testing should be done prior to using. A second reaction can be life threatening. Must warn parents about hypersensitivity reaction (difficult to assess in paediatric population). Special care needed if Abacavir is started with NNRTI's because they also produce skin toxicity and it will be difficult to differentiate between a rash and hypersensitivity reaction. See*	Syrup well tolerated. Caution with drug inhibiting or metabolised by alcohol dehydrogenase or UDP transferase: disulfiram, chlorpromazine, isoniazid, chloral hydrate and alcohol. RI: No dose adjustment in renal dysfunction but better avoided in end-stage renal disease. LI: No dose adjustment in mild LI, no data in moderate and contraindicated in severe LI.

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Emtricitabine (FTC, Emtriva®)	Capsules 200mg Oral solution 10mg in 1ml Truvada®: Tenofovir 300mg + emtricitabine 200mg	Less than 4 months: no data ≥4 months 6mg/kg OD (maximum of 240mg OD-solution, 200mg OD- capsule) Adult: ≥33kg 200mg OD capsule 240mg OD oral solution	Headache, diarrhoea, nausea, rash and skin discoloration (hyperpigmentation on palms and soles, predominantly seen in non Caucasian patients) See *	The oral bioavailability of the solution is lower therefore maximum dose is 240mg OD, equivalent to 200mg capsule. RI: Dose needs adjusting LI: unlikely to require dose adjusting
Tenofovir disoproxil fumarate (Viread®)	Tablets 300mg	2-8 years 8mg/kg OD >8 years 210mg/m ² OD (limited data, max dose 300mg OD) Adult ≥ 18years 300mg OD All doses based on Tenofovir DF	Tubular leak syndrome (Increased serum creatinine, glycosuria, proteinuria,, phosphaturia, and/or calcuria. Hypophosphataemia in >10%). Approximately 1% discontinued due to GI Side effects. In animal studies it caused bone toxicity; decreases in bone mineral density have been shown in both adults and children, however clinical significance unknown; no increase in fracture incidence has been observed. Severe hepatomegaly with steatosis. See *	Tenofovir disoproxil 245mg=tenofovir disoproxil fumarate 300mg Administer with food to enhance absorption Ddl serum concentrations increased with tenofovir Dose of ddl may need adjusting. Patients with swallowing difficulties may disperse tablets in ½ a glass of water or orange juice. RI: Dose needs adjusting

Non Nucleoside Reverse Transcriptase Inhibitors - NNRTI's

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
<p>Nevirapine (NVP, Viramune®)</p>	<p>Tablets 200mg Oral suspension 50mg in 5ml</p>	<p>Child: (>14 days)150-200mg/m² once daily for 2 weeks, then increase up to 150-200mg/m² TWICE daily if no rash develops. NB: Total daily dose should not exceed 400mg/day.</p> <p>Alternatively: Term Neonates: (as part of triple antiretroviral prophylaxis) 2mg/kg OD for week 1, then 4mg/kg OD for week 2 then stop. (use 4mg/kg OD for 2 weeks if mother has received >3days nevirapine)</p> <p>2months – 8 years 4mg/kg OD for 14 days then 7mg/kg BD. Maximum 400mg daily. 8 – 16 years (<50kg) 4mg/kg OD for 14 days then 4mg/kg BD. Maximum 400mg daily.</p> <p>Adult dose (>16years / ≥50kg): 200mg od for 2 weeks then increase to 200mg/bd if no rash develops (400mg od – unlicensed dose; when VL undetectable; monitor LFT's)</p>	<p>Rash 5-10%, allergic reactions, nausea, headache, hepatic abnormalities, granulocytopenia. If signs of Stevens-Johnson syndrome or toxic epidermal necrolysis. STOP. Patients should be intensively monitored during the first 3 months including LFT's. If rash develops in first 14 days, dose should not be increased until it is resolved. Nevirapine should not be initiated at higher CD4 counts (women: 250; men: 400) due to an increase in hepatotoxic reactions.</p>	<p>Ltd. data on use with PIs. Decreases concentrations of protease inhibitors (induces cytochrome P450). If use in combination with PIs the dose of PIs may need to be adjusted by about 30%. No data on RI or LI. Nevirapine apparent clearance adjusted for body-weight is approximately two-fold greater in children aged >8years, therefore an abrupt decrease in dose size is seen on 8th birthday when using mg/kg dosing!</p>

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Efavirenz (EFV, Sustiva®)	Capsules 50mg, 200mg, Oral solution 30mg/ml Tablets 600mg (f/c)	Once daily dosing as: (C-capsules, S-Suspension). 3 - 5 years 13<15kg 360mgS 15<20kg 390mgS 20<25kg 450mgS 25<32.5kg 510mgS Over 5 years 13<15kg = 200mgC = 270mgS 15<20kg = 250mgC = 300mgS 20<25kg = 300mgC = 360mgS 25<32.5kg = 350mgC = 450mgS 32.5kg <40kg = 400mgC = 510mgS ≥40kg = 600mgC = 720mgS Adult: 600mgC = 720mgS	Skin rash, Stevens- Johnson syndrome reported in <1%, nausea, CNS toxicity's, somnolence, abnormal dreams, and "spacey kids", impaired concentration, hallucinations, euphoria). Avoid if previous psychological problems. Teratogenic in animal studies.	Dose is best given at night because of CNS side effects, especially during first 2-4 weeks. Different bioavailability between capsules and solution. 600mg tablet equivalent to 720mg solution. Capsules may be opened and added to food. Contents have a peppery taste. RI: Only 1% of the drug is renally cleared. LI: Caution in liver disease.
Etravirine (ETR, TMC 125, Intelligence®)	Tablets 100mg	Child: dosing currently under investigation Adult: 200mg BD	Diarrhoea, flatulence, abdominal pain, headache, pruritus, rash. Cutaneous reactions usually resolve within 1-2weeks on continued therapy; Stevens-Johnson Syndrome rare	For use in treatment- experienced patients Take with food Tablet disperses in water

Protease Inhibitors - PI's

** When using dual PI treatment dose modification may be required.

*** Reports of new or exacerbated diabetes mellitus and hyperglycaemia, reports on lipodistrophy, increased bleeding in haemophiliacs. Potential serious drug interactions.

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Ritonavir (RTV, Norvir®)	Solution 80mg in 1ml (contains 43% alcohol) Tablets 100mg	Not recommended as a single PI. Child: For boosting other PI's, refer to specific product information. Adults Low dose to boost other PIs: 100mg OD or BD or 200mg bd depending on second PI.	Vomiting and diarrhoea, circumoral paraesthesia, headache, rash, and increase in liver enzymes, hepatitis and pancreatitis also seen. See ***	Take with food. Liquid tastes bitter. Oral Administration: 1-Mix solution with milk, chocolate milk or ice cream. 2-Dull the taste buds before giving with ice or lollies. 3-Coat the mouth with peanut butter before the dose (if patient is not allergic to nuts). 4-Give strong tasting food straight after dose (cheese, chewing gum) RI: No data available. Highly protein bound, unlikely to be removed by peritoneal dialysis or haemodialysis. LI: Avoid in severe LI.

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Saquinavir (SQV Invirase®)	Hard gel capsules 200mg (Invirase®) Film-coated tablets 500mg (Inverase®)	Adults and adolescents over 16 years: With low dose ritonavir: Invirase f/c tabs 1g BD with ritonavir 100mg BD Child: Appropriate dosing in children not yet determined. See **	Rash, headache, GI upset See ***	Give within two hours after a meal. SQV concentration increased by grapefruit juice RI: No dose adjustment. Caution in severe RI. LI: Caution (mainly metabolised in liver).
Lopinavir/ritonavir (LPV/r, Kaletra®)	Oral solution: Lopinavir 80mg/ Ritonavir 20mg in 1 ml Tablets: Lopinavir 200mg/Ritonavir 50mg Paed strength tablet: Lopinavir 100mg/Ritonavir 25mg	Neonate/Infant: (≥14 days-6 months) 300mg/m ² BD ≥2 years: 230mg/m ² BD up to a maximum of 400mg BD Without EFV/NVP: ≈ 0.5 to < 0.9m ² : 200mg BD ≈ 0.9 to < 1.4m ² : 300mg BD ≈ 1.4m ² : 400mg BD <u>In combination with NVP or EFV or low susceptibility</u> ≥2 years: 300mg/m² (max 500mg BD) Adult: 400mg BD = 2 tabs BD = 5mls BD = 4 paed tabs BD All doses based on lopinavir See **	Rash, diarrhoea, nausea, lipid elevation, asthenia, pancreatitis. See ***	Give with food oral solution only.. 5ml liquid=2 tablets Oral solution contains 42% alcohol (bitter taste). Increase in dose from 230/57.5 mg/m ² to 300/75mg/m ² should be considered when co-administered with nevirapine or efavirenz. Tablets are large LI: Caution in mild to moderate RI: No dosage adjustment. Caution in severe RI. Avoid oral solution due to propylene glycol content

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Fosamprenavir (Telzir®)	Tablets 700mg Suspension 50mg/ml	With low dose ritonavir Child 25-32kg: Fosamprenavir 18mg/kg BD + Ritonavir 3mg/kg BD Child 33-38kg: Fosamprenavir 18mg/kg BD + Ritonavir 100mg BD Adolescent / Adult >39kg Fosamprenavir 700mg BD +Ritonavir 100mg BD Unlicensed dose: (Adult) Fosamprenavir 1400mg od + ritonavir 100mg od + TDM – shouldn't be used in treatment- experienced patients.	In adults diarrhoea, nausea, vomiting, abdominal pain and flatulence, headache, hypertryglyceridaemia and rash. See ***	Suspension must be administered with food in children Use with caution in patients who have a sulphonamide allergy as theoretical potential for cross-sensitivity. RI: no dosage adjustment LI: may need dose adjusting
Atazanavir (Reyataz®)	Capsules 150mg, 200mg and 300mg.	<u>With low dose ritonavir</u> Child: (15-25kg) 150mg OD with Ritonavir 80mg OD Child: (25-32kg) 200mg OD with Ritonavir 100mg OD Child: (32-39kg) 250mg OD with Ritonavir 100mg OD Child: (≥39kg) 300mg OD with Ritonavir 100mg OD Adult: 300mg OD with Ritonavir 100mg OD Unboosted: 400mg OD (unlicensed)	Asymptomatic elevations in unconjugated bilirubin (30%), jaundice 10%, headaches, fever, arthralgia, depression, insomnia and GI upset. See ***	Should be taken with food to increase absorption. Atazanavir should be taken at least 1h before or after antacid or ddl. Do not give with PPIs, caution with H2 antagonists – take H2 antagonist at least 2 hours after atazanavir and/or at least 10 hours before dose. RI: No dosage adjustment LI: Caution in mild

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Tipranavir (Aptivus)	Capsules 250mg Oral solution 100mg/ml	2-12 years tipranavir 375 mg/m ² BD with ritonavir 150mg/m ² BD or 14mg/kg BD with ritonavir 6mg/kg BD Adult + child ≥12years: Tipranavir 500mg BD with ritonavir 200mg BD	In adults diarrhoea, nausea, fatigue, headache and vomiting are common. Less common lipid abnormalities and hepatotoxicity.	Take with food Use with caution in patients with a known sulphonamide allergy. RI: no dosage adjustment LI: use with caution
Darunavir (Prezista)	Tablets 75mg, 150mg, 400mg, 600mg	Child: (>6years) (20-30kg) 375mg BD with ritonavir 50mg BD (30-40kg) 450mg BD with ritonavir 60mg BD (>40kg) 600mg BD with ritonavir 100mg BD Adult: (Experienced) 600mg BD with ritonavir 100mg BD (Naïve) 800mg OD with ritonavir 100mg OD	Diarrhoea, nausea, headache, nasopharyngitis. Skin rash (7%) usually mild to moderate. Stevens-Johnson syndrome 0.3%.	Take with food RI: no dosage adjustment LI: caution in mild/moderate; avoid in severe Use with caution in patients with a known sulphonamide allergy

Fusion Inhibitors

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Enfuvirtide (T20, Fuzeon®)	Injection 90mg in 1 ml	SC injection Children >6years: 11-15.5kg 27mg (0.3ml) BD 15.6-20.0kg 36mg (0.4ml) BD 20.1-24.5kg 45mg (0.5ml) BD 24.6-29.0kg 54mg (0.6ml) BD 29.1-33.5kg 63mg(0.7ml) BD 33.6-38.0kg 72mg (0.8ml) BD 38.1-42.5kg 81mg (0.9ml) BD >42.6kg 90mg (1ml) BD Adults/Adolescents >16years: 90mg (1ml) BD	Injection site reactions (pain, discomfort, induration, erythema,etc)Usually mild to moderate. Unclear association with an increased rate of bacterial pneumonia. Hypersensitivity reactions, Immune reactions, Guillan-Barre syndrome are rare	108mg of enfuvirtide powder for injection when reconstituted with 1.1ml EFI. (WFI). Do not shake as can cause excessive foaming. Can take up to 45 min to dissolve RI: no dosage adjustment LI: no data available
Maraviroc (Celsentri®)	Tablets: 150mg, 300mg	Child: insufficient data Adult: 300mg BD 150mg BD (when co-administered with CYP3A4 inhibitor) 600mg BD (with CYP3A4 inducer – except with nevirapine: 300mg BD) *TROFILE ASSAY FOR CO-RECEPTOR TROPISM*	Nausea, constipation, headache, dizziness, pruritus	With or without food Seek dosing advice from pharmacy with regard to drug interactions Should only be used when CCR5-tropic HIV-1 is detectable Contains soya lecithin – avoid in soya or peanut hypersensitivity

Integrase Inhibitors

ANTIRETROVIRAL	FORM & STRENGTH	TOTAL DAILY DOSE	SIDE EFFECTS	COMMENTS
Raltegravir (Isentress®)	Tablets: 400mg	Child: insufficient data Adult: (≥16years): 400mg BD	Nausea, dizziness, insomnia, rash, elevated ALT, AST, GGT	With or without food

GUIDELINES

IMMUNISATION GUIDELINES FOR CHILDREN

“It is every child’s right to be protected against infectious diseases. No child should be denied immunisation without serious thought as to the consequences, both for the individual child and the community. Where there is any doubt, advice should be sought from a Consultant Paediatrician or Consultant in Communicable Disease Control”.

Immunity can be induced, either **actively** (long term) or **passively** (short term), against a variety of bacterial and viral agents.

ACTIVE IMMUNISATION

Vaccines are used to induce active immunity and are of three types:

1. **Live attenuated** form of a virus (e.g. measles, mumps, rubella, varicella) or bacteria (e.g. BCG vaccine).
2. **Inactivated preparations** of the virus (e.g. influenza vaccine and inactivated poliomyelitis) or bacteria (e.g. pertussis, wholecell typhoid).
3. **Immunising components** of the organisms (e.g. pneumococcal vaccine, meningitis C) or **toxoids** (toxins inactivated by treatment with formaldehyde) (e.g. tetanus, diphtheria).

SPECIAL RISK GROUPS

Children with certain conditions which increase the risk of complications from infectious diseases should be immunised as a matter of priority. These conditions include the following: asthma, chronic lung and congenital heart disease, Down’s Syndrome, Human Immunodeficiency Virus (HIV) Infection, premature and growth retarded neonates. Neonates of all gestational ages should be immunised according to the standard protocol from two months of age.

Children with no spleen or with functional hyposplenism are at increased risk of bacterial infections especially those caused by encapsulated bacteria. In addition to antibiotic prophylaxis and standard vaccination schedule, such children should receive Hib vaccine (irrespective of age), meningococcal A and C vaccine and influenza vaccine. Where possible, immunisation should be given at least two weeks before splenectomy.

GENERAL CONTRAINDICATIONS

Children suffering from an acute illness should have immunisation postponed unless the child has a minor infection without fever or systemic upset.

Immunisation should not be carried out in individuals who have a definite history of a **severe** local or general reaction to a preceding dose. Appropriate further advice should be sought if there is any doubt.

A history of allergy is not a contraindication. Hypersensitivity to egg contraindicates influenza vaccine; previous anaphylactic reaction to egg contraindicates influenza and yellow fever vaccines. The MMR vaccine should be given even to children with a history of anaphylaxis after egg ingestion. Administration to these children should be given after specialist consideration.

Surgery is not a contraindication to immunisation, nor is recent immunisation a contraindication to anaesthesia or surgery.

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LIVE VACCINES - SPECIAL RISK GROUPS

Certain patient groups may not be able to make a normal immune response to live vaccines and could suffer from severe manifestations such as disseminated infection with BCG or paralytic poliomyelitis. These children include:

- All those receiving cytotoxic chemotherapy or generalised radiotherapy, or within 6 months of terminating such treatment.
- All those receiving immunosuppressive therapy e.g. after organ transplantation.
- All those receiving high-dose corticosteroids e.g. the equivalent of prednisolone at an oral dose of 2mg/kg/day or 40mg/day for at least one week or 1mg/kg/day for one month. Postpone live vaccines for at least 3 months after stopping treatment or after non-immunosuppressive doses have been reached. Lower doses of steroids given in combination with cytotoxic drugs should also be considered to cause immunosuppression.
- Children with immunodeficiency states (seek further advice).
- Recipients of renal transplants and patients with chronic renal disease are at increased risk of infection and should be considered for Hib, pneumococcal and influenza vaccination. Furthermore, haemodialysis patients are at an increased risk of hepatitis B and hepatitis C. These children should be screened for serological evidence of hepatitis B vaccine (ideally before dialysis commences).

HIV Infection

HIV-positive children (with or without symptoms) should receive all vaccines apart from BCG and yellow fever. Vaccine efficacy may however be reduced.

THE FOLLOWING ARE NOT CONTRAINDICATIONS FOR IMMUNISATION:

- Family history of any adverse reaction following immunisation.
- Previous history of pertussis, measles, rubella or mumps infection.
- Prematurity: immunisation should not be postponed.
- Stable neurological conditions such as cerebral palsy or Down's syndrome.
- Contact with an infectious disease.
- Asthma, eczema, hay fever or 'snuffles'.
- Treatment with antibiotics or locally-acting steroids.
- Child's mother is pregnant.
- Child being breast fed.
- History of jaundice after birth.
- Under a certain weight.
- Over the age recommended in immunisation schedule.
- Child taking "replacement" corticosteroids.

MMR Vaccine

The Department of Health can find no established causal link between MMR vaccine and inflammatory bowel disease or autism and recommends the continued use of MMR vaccine.

There is no evidence to support the use of separate doses of monovalent vaccines of measles, mumps and rubella over MMR in this situation. Indeed monovalent measles and mumps vaccines are no longer available.

There is good evidence that MMR vaccines can be given safely to children who are

GUIDELINES

allergic to food containing egg.

ADMINISTRATION OF VACCINES

- When administering a vaccine the following information should be recorded in the patient notes: Vaccine name, strength, batch number, expiry date, and the site of injection when two or more vaccines need to be given simultaneously.
- Timing of vaccine administration: Administration of live vaccines at an age earlier than recommended increases the likelihood of a poor response due to maternal antibody. For vaccines that require booster doses for full immunisation, dosing at less than the recommended intervals may result in sub-optimal antibody response. Intervals between doses that are longer than recommended do not impair final antibody levels.

Immunisation Intervals:

- Different vaccines can usually be given simultaneously although live vaccines (unless a combination product) should be given at different sites, except in the case of varicella and measles vaccines where there should be an interval of one month between them.
- If live vaccines are not given simultaneously, it is usually recommended that they are separated by at least four week intervals. No interval is required between the administration of live and inactivated vaccines. Live vaccines (except yellow fever) should not be given during the three months after immunoglobulin injection, as the response is likely to be impaired.
- It is also recommended that a three week interval should be allowed between the administration of live virus vaccines especially measles vaccine, and tuberculin testing; there is experience that shows that measles infection or immunisation can give false negative results in tuberculin positive individuals.

Route of administration

Oral typhoid vaccine is the only vaccine that is given orally. BCG vaccine is usually given intradermally. In neonates, infants and small children can be given percutaneously. All other vaccines are given by deep subcutaneous or intramuscular injection. In infants, the antero-lateral aspect of the thigh or upper arm are recommended sites. If the buttock is used, injection into the upper outer quadrant avoids the risk of sciatic nerve damage.

Storage of vaccine

Manufacturer's recommendations on storage must be observed e.g. temperature of 2-8°C. Storage at temperatures below 0°C causes freezing which can lead to deterioration of the vaccine and breakage of the container. If vaccines have been stored at an inappropriate temperature, advice should be obtained from a paediatric pharmacist before they are used.

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SCHEDULE FOR IMMUNISATION

Refer to individual monographs for dosing and route of administration.

Vaccine	Age		Comments
DTaP+Hib+IPV	1 st dose	2 months	Primary Course
	2 nd dose	3 months	
	3 rd dose	4 months	
Meningococcal C	1 st dose	3 months	Primary Course
	2 nd dose	4 months	
Pneumococcal (PCV)	1 st dose	2 months	Primary Course
	2 nd dose	4 months	
Meningococcal C (and Hib)	Around 12 months		Can be given at any age over 12 months. (Hib if not previously immunised).
Pneumococcal (PCV) MMR 1 st dose	Around 13 months		
Booster dTaP/IPV MMR 2 nd Dose	3-5 years		3 years after completion of primary course (before school or nursery school entry)
BCG ❶	Infancy or 10-14 years		For tuberculin negative children only. If < 3 months of age, tuberculin testing is unnecessary.
HPV	Girls aged 12-13 years		Cervical cancer vaccination
Td/IPV	Booster at 13-18 years.		

DtaP/Hib/IPV Adsorbed Diphtheria, Tetanus, acellular Pertussis Vaccine, Haemophilus Influenzae and Inactivated Polio Vaccine

dTaP/IPV Adsorbed Diphtheria and Tetanus Vaccine, acellular Pertussis and Inactivated Polio Vaccine

Td/IPV Adsorbed Diphtheria (Low Dose) Tetanus Vaccine and Inactivated Polio for Adults and Adolescents

MMR Measles, Mumps and Rubella Vaccine

Hib Haemophilus Influenzae B Vaccine

PCV Prevenar 13

HPV Human papillomavirus

❶ According to our local policy BCG vaccine will be given to all infants and this will be provided in the community.

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PASSIVE IMMUNISATION

Passive immunity is transferred by the injection of human immunoglobulins. These can be divided into two types: Human normal immunoglobulin (HNIG) and specific immunoglobulins. HNIG is derived from the pooled plasma of donors and contains antibody to infectious agents currently prevalent in the general population. Specific immunoglobulins are prepared from plasma pooled from donors with high titres of the required antibody as a result of, for example, recent infection or vaccination. The protection after immunoglobulin is immediate but only lasts a few weeks. Immunoglobulins may interfere with the immune response to live vaccines, which should therefore be given at least 3 weeks before or three months after an injection of immunoglobulin.

IMMUNOGLOBULINS

A - HUMAN NORMAL IMMUNOGLOBULIN (HNIG)

Intramuscular Human Immunoglobulin

HNIG contains antibody to measles, varicella, hepatitis A, rubella and other viruses.

Use in Measles

Immunocompromised children who come into contact with measles and infants (<12 months) in whom there is a particular reason to avoid measles (e.g. recent severe illness) may be given HNIG. Infants should subsequently be given MMR vaccine after an interval of at least 3 months.

USE	AGE OF CHILD	DOSE
To prevent an attack	< 1 year	250mg
	1-2 years	500mg
	3 years and over	750 mg
To allow an attenuated attack	< 1 year	100mg
	1 year and over	250mg

Use in Hepatitis A

HNIG offers short-term protection (up to four months) against Hepatitis A infection. It's use should be considered in the following circumstances: Contacts of cases of hepatitis A infection and control of outbreaks; and as an alternative to the vaccine for those travelling occasionally or for short periods (< 3 months) to countries outside Northern & Western Europe, North America, Australia and New Zealand.

USE	AGE OF CHILD	DOSE
To control outbreaks	< 10 years	250mg
	10 years and over	500mg
Travelling abroad for 2 months or less	< 10 years	125mg
	10 years and over	250mg
Travelling abroad for 3-5 months	< 10 years	250mg
	10 years and over	500mg

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Use in Rubella

There is no evidence that the administration of HNIG to a susceptible pregnant woman exposed to rubella has any effect on the likelihood of the foetus being infected and/or developing the congenital rubella syndrome. However, some authorities would feel that HNIG is indicated.

Intravenous Human Immunoglobulin

Special formulations for intravenous administration are available for replacement therapy for patients with congenital agammaglobulinaemia, for the treatment of idiopathic thrombocytopenic purpura and Kawasaki syndrome, and for the prophylaxis of infection following bone marrow transplantation. Intravenous immunoglobulin is also used in the treatment of Guillain-Barre Syndrome and is now preferred to plasma exchange. Other indications include cardiomyopathy and post-transfusional hyperhaemolysis in sickle cell patients. (Refer to IV Immunoglobulins monograph).

B – SPECIFIC IMMUNOGLOBULINS

These are available for tetanus, hepatitis B, varicella-zoster and rabies. The specific immunoglobulins are often scarce and should be used with discretion.

HUMAN TETANUS IMMUNOGLOBULIN (HTIG)

HTIG offers immediate protection against tetanus and may be required for the treatment of children with tetanus-prone wounds. The following are considered tetanus-prone wounds:

- a) Any wound or burn sustained more than six hours before surgical treatment.
- b) Any wound or burn at any interval after injury that shows one or more of the following characteristics:
 - A significant degree of devitalised tissue
 - Puncture-type wound
 - Contact with soil or manure
 - Clinical evidence of sepsis
 - Wounds containing foreign bodies
 - Compound fractures

The following children require HTIG in addition to antibiotics for the immediate treatment of tetanus-prone wounds.

- a) Unimmunised
- b) Immunisation status uncertain
- c) Last tetanus vaccine over 10 years ago

Furthermore HTIG may be given to children with an acceptable immunisation history if the risk of infection is considered especially high, e.g. stable manure contamination. Children with an unacceptable immunisation history should also receive appropriate tetanus toxoid treatment.

HTIG DOSAGE

Prevention (all ages) Give 250units intramuscularly **or** 500 units if more than 24 hours have elapsed since injury or there is risk of heavy contamination or following burns.

Treatment (all ages) Give 150 units/kg intramuscularly (multiple sites). *

* Tetanus Immunoglobulin for Intravenous use is supplied on a named-patient basis by BPL and used for proven or suspected clinical tetanus

GUIDELINES

HEPATITIS B IMMUNOGLOBULIN (HBIG)

HBIG gives passive protection against hepatitis B and is normally used in conjunction with hepatitis B vaccine to confer passive/active immunity after exposure.

Neonates

All infants who fulfil the necessary criteria mentioned in the Hepatitis B Vaccine monograph should receive HBIG as well as hepatitis B vaccine (see relevant monograph).

Accidental exposure

Children who are accidentally inoculated, or who have contaminated their eyes or mouth or fresh cuts or abrasions of the skin, with blood from a known HbsAg positive person may require post exposure prophylaxis. Determine the recipient's hepatitis B vaccine status and consult the Medical Virologist on call. Following accidental exposure HBIG should be given preferably within 48 hours and not later than a week after exposure.

VARICELLA-ZOSTER IMMUNOGLOBULIN (VZIG)

The use of VZIG is restricted to individuals who fulfil **all** of the necessary criteria listed on the relevant monograph.

If further information is required concerning immunisation, please refer to the "DoH Immunisation Guidelines" or seek advice from the virology or pharmacy department.

GUIDELINES

PERIPHERAL EXTRAVASATION TREATMENT GUIDELINE

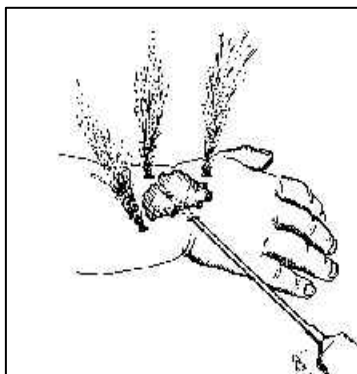
- Extravasation is inadvertent leakage of IV fluid/drug from intravascular to interstitial space potentially leading to tissue necrosis
- Extravasated drugs (with the exception of sodium chloride 0.9%) should be treated as set out below
- Treatment should ideally be instituted **within 1 hour** of extravasation, and no later than 12 hours
- Drugs causing the most severe extravasation injuries are: hyperosmolar (>290 mOsm), alkaline (pH>7.5) or acidic (pH<5)
Common examples*
Calcium Chloride, Sodium Bicarbonate, Potassium Chloride, Magnesium Sulphate, ALL inotropes (including milrinone), acyclovir, diazepam, digoxin, thiopental, phenytoin, phenobarbitone, etc.
*For further information contact pharmacy

Recognition of extravasation

- Infusion pump occlusion alarm triggered
- Discolouration of infusion site (redness / blanching)
- Swelling of area
- Indication of pain or discomfort

MANAGEMENT OF EXTRAVASATION

1. Stop infusion immediately, do not remove cannula, mark area with pen.
2. Aspirate any residual drug.
3. Flush technique for non cytotoxic drugs (see below).
4. Remove peripheral cannula.
5. Elevate affected limb.
6. Ensure child has adequate pain relief.
7. Inform parents.
8. Notify plastic surgeons.



For cytotoxic drugs

Refer to cytotoxic extravasation kit & guidelines

FLUSH TECHNIQUE (STERILE)

1. Dissolve 1,500 units of hyaluronidase in 1 ml of 0.9% Sodium Chloride or WFI.
2. Infiltrate the area immediately surrounding the extravasation with the hyaluronidase.
3. Make 4 to 6 small, shallow scalpel incisions 2mm in length around the periphery of extravasated area.
4. Using a green needle inject aliquots of 20 mls 0.9% NaCl (up to 500ml may be needed) subcutaneously through scalpel incisions to flush out the extravasated solution from the tissues.
5. Inject through each scalpel incision in turn so that the solution flushes through the subcutaneous space and exits through the incisions. Injected fluid should not collect in the subcutaneous tissues. If this occurs the incisions are not adequate for drainage.
6. Apply paraffin gauze and dry dressing once procedure complete.
7. Elevate affected limb for 24 hours.
8. Consider prophylactic antibiotics in immuno-compromised children. Steroids not indicated.

NB. Document in medical and nursing notes extent of injury and any treatment

Medical photography may also be required in severe cases.

GUIDELINES

INTRAVENOUS FLUID MANAGEMENT FOR PAEDIATRIC PATIENTS

(Excluding renal disease, diabetic ketoacidosis, acute burns, critical care and metabolic patients)

The core recommendations of this guideline are:

- Use of 0.9% sodium chloride with 5% glucose as standard fluid
- Fluid restriction to $\frac{2}{3}$ maintenance in children with excess ADH secretion
- Increased vigilance by monitoring weight, fluid balance and electrolytes

Note: Hyponatraemic encephalopathy is a medical emergency and should be treated using hypertonic intravenous fluids under senior medical supervision.

1. BASIC PRINCIPLES

- a) These are broad based guidelines for initial management - fluid therapy has to be tailored to individual requirements.

Always use patient's weight to calculate fluid volumes.

In exceptional circumstances if cannot weigh patients, use formula:

$$\text{Weight} = (\text{Age} + 4) \times 2\text{kg}$$

- b) Always review fluid regime in light of plasma electrolytes and fluid input / output charts and clinical progress.
- c) Fluids are usually prescribed in 500 mL bags in children - remember this if calculating volumes of extra electrolytes per litre.
- d) Read through the whole of these guidelines before the first time you prescribe fluids for a child.
- e) Follow disease specific guidelines where available e.g. DKA.
- f) If clinically appropriate use the enteral route (either P.O. or NG).
This guideline applies once the decision to give intravenous fluids has been taken.

All children ill enough to have intravenous fluid therapy must have hypovolaemia corrected and have U+E, blood glucose and, where indicated, a blood gas performed at baseline . Subsequent progress must be re-assessed clinically (and biochemically where indicated).

GUIDELINES

2. MAINTENANCE

This is the volume required in a 24 hour period to maintain normal hydration when there is no significant prior fluid deficit from dehydration and no significant ongoing fluid loss.

2.1. Type of Fluid:

0.9 % sodium chloride with 5 % glucose
(Babies under 1 month of age: see neonatal guideline)

Note: Use of Hartmann's Solution or sodium chloride 0.9% may be considered as an alternative

This is the standard starting fluid at commencement ESPECIALLY if:

- Significant hyponatraemia: serum sodium less than 135 mmol/L
- Moderate – Severe dehydration / Intravascular volume depletion
- Need to replace ongoing fluid losses
- Peri- and immediate post-operative patients
- CNS infection
- Head injury
- Bronchiolitis
- Sepsis
- Excessive diarrhoeal or gastric losses
- Salt wasting states (cystic fibrosis, pituitary deficiency)

0.45 % sodium chloride with 5% glucose

Children who do not fall into any of the above categories may be safely given 0.45% sodium chloride with 5 % glucose (potassium added as needed) for maintenance only.

Potassium: Add potassium chloride 10 mmols to 500 mL (20 mmol/L) once U+E is known and urine output established. Children with hypokalaemia may need more (40 mmol/L).

2.2. Volume of Maintenance Fluid

Weight: kg	Fluid requirement mL/kg/24 hours
Age < 1 month – See neonatal/PICU guideline	Up to 150
10 kg or less	100
Additionally for each kg up to 20 kg	50
Additionally for each kg thereafter	20

Usual maximum of 2500 mL/day in males and 2000 mL/day females

Prescribe rate to the nearest whole millilitre per hour (mL/hr) to avoid transcription errors due to decimal points i.e. 67 mL/hr and not 66.7 mL/hr.

GUIDELINES

2.3. Fluid restriction

Some acutely ill children with non-osmotic ADH secretion should have fluid restriction to 2/3rd maintenance:

- Bronchiolitis/Pneumonia
- Head Injury
- Meningitis/Encephalitis
- Peri and post-operative

Fluid balance must be monitored and fluids adjusted as needed depending on clinical state (including weight), urine output, environmental factors and plasma U+E measurement.

3. TREATMENT OF FLUID DEFICIT

- If significant fluid DEFICIT exists:
Fluid Requirement = Maintenance Fluid + Fluid Deficit
- Replace over a minimum of 24 hours: 48 – 72 hours if hypernatraemic
- The child may be SHOCKED and require RESUSCITATION.
Treat shock with 20 mL/kg 0.9% sodium chloride as a bolus (10 mL/kg in trauma)
- Volume used to treat shock must be subtracted from the estimated deficit volume

Clinical assessment of dehydration - see table 1

Type of Fluid: 0.9% sodium chloride (+ glucose) is appropriate in most cases.
Volume of Fluid Deficit = Percentage of body weight lost converted to mL using the formula:
Weight X percent dehydrated X 10

The clinical assessment of dehydration gives only a rough approximation. Only rarely is an accurate up-to date pre-treatment out of hospital weight available. Clinical and biochemical reassessment during fluid therapy of children with dehydration is essential

4. REPLACEMENT OF ONGOING LOSSES.

e.g. NG tube, small bowel obstruction etc.

- Fluid Requirement = Maintenance Fluid + Ongoing Fluid Losses
- Reassess losses every 4 hours
- Replace losses mL for mL
- Type of fluid depends on composition, but 0.9 % sodium chloride is appropriate in most cases (with or without potassium chloride added)

For practical purposes, those requiring maintenance with replacement for dehydration or on-going losses should receive a SINGLE infusion with isotonic fluid as 0.9 % Sodium Chloride (as 0.9% Sodium chloride or 0.9% sodium chloride with 5% Glucose as needed) with appropriate potassium chloride as needed.

Note:

Overall Fluid Requirement may involve:

Maintenance Fluid + Fluid Deficit + Ongoing Fluid Losses

GUIDELINES

5. NEONATES - BABIES UNDER 1 MONTH OF AGE: SEEK SENIOR ADVICE IF ANY DOUBT.

These babies are a special group. The renal electrolyte and fluid homeostatic capacity, fluid volume requirement and obligate glucose requirement vary significantly from a baby age 1 day and age 5-7 days and age 28 days. Factors such as current weight, growth retardation, length of poor feeding and type of illness etc also are important. Fluid management has to be tailored to the needs of the individual child.

General guidance provided renal function normal and no cardiac disease:

5.1 Age less than 7 days :

See Fluid Guidelines for Neonates (NICU) or PICU Guidelines– seek expert advice.

5.2. Age more than 7 days

Maintenance volume: 120 mL/kg/day (up to 150 mL/kg/day if predict higher insensible losses e.g. fever, open bassinet (not in an incubator) etc.

Fluid Type: **10% glucose**

<i>Electrolytes:</i>	sodium	3 mmol/kg/day
	potassium	2 mmol/kg/day

Adjust according to plasma U+E monitoring.

Fluid restrict to 90 – 100 mL/kg/day in appropriate clinical setting.

Fluid deficit/ongoing losses – replace with 0.9% sodium chloride (with potassium as required).

Note: *If baby has bronchiolitis, the fluid regimen must be isotonic by having a sodium chloride concentration of 0.9%.*

5.3. Weight over 4 kg:

0.45% sodium chloride with 5% glucose with 10 mmol potassium chloride in 500mL is likely to be safe and is available as a stock solution. It will give higher sodium load, so must review urine output and weight (as could possibly lead to oedema). Monitor blood sugars – may need to switch to 10% glucose.

5.4. NPSA Guidance on Administration to Neonates

- When using a syringe pump to administer intravenous fluids or medicines to neonates, a bag of fluid should not be left connected to the syringe
- All clamps on intravenous administration sets must be closed before removing the administration set from the infusion pump, or switching the pump off. This is required regardless of whether the administration set has an anti-free flow device

GUIDELINES

6. MONITORING

Monitor fluid replacement both clinically and biochemically.

AVOID HYPONATREMIA: Hyponatraemia may pre-exist or develop during therapy
Symptomatic hyponatraemia is a medical emergency

Other electrolyte disturbances may occur and need fluid regime tailoring based on results

- Check plasma electrolytes before commencing the infusion, except prior to the majority of elective surgery. Consider monitoring plasma glucose if glucose-free solutions are used. If post-operative fluids for more than 6-8 hours is needed – must send U+E.
- Check plasma electrolytes every 24 hours whilst intravenous fluids are being administered. If plasma electrolytes are abnormal, consider rechecking every four to six hours, but definitely if plasma sodium concentration is below 130mmol/L.
- Check plasma electrolytes if clinical features suggestive of hyponatraemia develop; these features include nausea, vomiting, headache, irritability, altered level of consciousness, seizure and apnoea.
- Where possible, all children on intravenous fluids should be weighed prior to the commencement of therapy and be weighed again each day.
- Document accurate fluid balance daily. Assess urine output – oliguria may be due to inadequate fluid, renal failure, obstruction or the effect of ADH

Hyperchloraemic Acidosis

Some children receiving large volumes of 0.9% sodium chloride may develop a mild hyperchloraemic acidosis. This can be suspected when the ratio of serum chloride divided by sodium is greater than 0.8. Provided other causes have been looked for and excluded, specific treatment is not required and will resolve.

Table 2 Types of Intravenous Fluid

There is a wide stock of various fluids available and the following table outlines the electrolyte composition and suitable uses of the most common used in paediatric practice per 1000 mL

Type of Fluid	Sodium mmols/litre	Potassium mmols/litre	Glucose Grams/litre
0.9% Sodium chloride	154	---	---
0.9% Sodium chloride) + KCL	154	20 or 40	
0.9% Sodium chloride + 5% glucose	154	---	50
0.9% Sodium chloride + 5% glucose + KCL	154	20 or 40	50
0.9% Sodium chloride + 10% glucose	154	---	100
10% glucose	---	---	100
0.45 % sodium chloride + 5% glucose	75	---	50
0.45 % sodium chloride + 5% glucose + KCL	75	20 or 40	50
5% glucose	---	---	50
G. Hartmann's (Ringer-Lactate Also contains Ca ²⁺ 2 mmol/L Bicarbonate (as lactate) 29 mmol /L, Chloride 111 mmol/L	131	5	---

PREPARING INFUSIONS

Drug	Solute	Paediatrics		Neonates		Dose Range
		Amount in 50ML (0.3 x weight) mg	Infusion at 1ml/hr 0.1 mcg/kg/min	Amount in 50ML (3 x weight) mg	Infusion at 0.1ml/hr 0.1 mcg/kg/min	
Adrenaline (Epinephrine)	N/S or G5%					0.1 - 1.5 mcg/kg/min
Amiodarone	G5%	(30 x weight) mg	10 mcg/kg/min	(150 x weight) mg	5 mcg/kg/min	25 mcg/kg/min for 4 hours then 5 – 15 mcg/kg/min
Argipressin	N/S	(1.5 x weight) units	0.0005 units/kg/min	(1.5 x weight) units	0.00005 units/kg/min	0.0001-0.002 units/kg/min
Clonidine	N/S or G5%	(50 x weight) mcg	1 mcg/kg/hr	(50 x weight) mcg	0.1 mcg/kg/hr	0.1 – 2 mcg/kg/hr
Dinoprostone (Prostin)	N/S or G5%	(30 x weight) mcg	10 nanogram/kg/min	(30 x weight) mcg	1 nanogram/kg/min	5 - 20 nanogram/kg/min
Dobutamine	N/S or G5%	(30 x weight) mg	10 mcg/kg/min	(150 x weight) mg	5 mcg/kg/min	2 - 20 mcg/kg/min
Dopamine	N/S or G5%	(30 x weight) mg	10 mcg/kg/min	(150 x weight) mg	5 mcg/kg/min	2 - 20 mcg/kg/min
Epoprostenol (Prostacycline)	N/S^	(15 x weight) mcg {use only for 5.6-33kg}	5 nanograms/kg/min	(150 x weight) mcg	5 nanograms/kg/min	2 – 40 nanograms/kg/min
Furosemide (Frusemide)	N/S	(10 x weight) mg	0.2 mg/kg/hr	(100 x weight) mg	0.2 mg/kg/hr	0.1 - 1 mg/kg/hr
GTN	N/S or G5%	(3 x weight) mg	1 mcg/kg/min	(3 x weight) mg	0.1 mcg/kg/min	0.1 - 10 mcg/kg/min
Heparin	N/S or G5%	(1000 x weight) units	20 units/kg/hr	(2000 x weight) units	4 units/kg/hr	5 - 50 units/kg/hr
Insulin (soluble)	N/S or G5%	(1 x weight) units	0.02 units/kg/hr	(25 x weight) units	0.05 units/kg/hr	0.01 – 0.2 units/kg/hr
Midazolam	N/S or G5%	(3 x weight) mg	1 mcg/kg/min	(15 x weight) mg	0.5 mcg/kg/min	0.5 - 6 mcg/kg/min
Milrinone	N/S or G5%	(1.5 x weight) mg {max 50mg/50ml}	0.5 mcg/kg/min	(6 x weight) mg	0.2 mcg/kg/min	0.3-0.75 mcg/kg/min
Morphine	N/S or G5%	(1 x weight) mg	20 mcg/kg/hr	(5 x weight) mg	10 mcg/kg/hr	0 - 60 mcg/kg/hr
Nitroprusside	N/S* or G5%	(3 x weight) mg {max 50mg/50ml}	1 mcg/kg/min	(6 x weight) mg	0.2 mcg/kg/min	0.2 - 5 mcg/kg/min
Noradrenaline	N/S or G5%	(0.3 x weight) mg	0.1 mcg/kg/min	(1.5 x weight) mg	0.05 mcg/kg/min	0.02 - 0.1 mcg/kg/min
Salbutamol	N/S or G5%	(1.5 x weight) mg {max 25mg/50ml}	0.5 mcg/kg/min	(6 x weight) mg	0.2 mcg/kg/min	0.5 - 1 mcg/kg/min

KEY: ^ Reconstitute vial with glycine buffer provided

 * Sodium Nitroprusside should always been reconstituted with G5% and further diluted with N/S or G5%.

N/S = Sodium Chloride 0.9%

G5% = Glucose (Dextrose) 5%

WFI = Water For Injection

All weights are in kilograms (kg).

PLEASE NOTE THAT mcg = MICROGRAMS

GUIDELINES

METABOLIC DISORDERS

INTERCURRENT ILLNESS IN INBORN ERRORS OF INTERMEDIARY METABOLISM

Diet is the mainstay of treatment for many inborn errors of intermediary metabolism. However an emergency regimen may need to be started, and feeds stopped, at times of metabolic stress such as an intercurrent infection.

The basic emergency regimen is essentially the same for all disorders. A solution of glucose polymer e.g. Maxijul[®], is used as the major energy source because it is simple, palatable and usually well tolerated. Fat emulsions can provide additional energy but are less well tolerated. Fat delays gastric emptying, may cause vomiting and is not routinely used. It is also contra-indicated in some disorders.

EMERGENCY REGIMEN

Age	% Glucose polymer	Energy kcal/100ml	Fluid allowance ml/kg
0 - 5 months	10	40	150 - 200
6 -11 months	10	40	120 - 150
1 - 2 years	15	60	95
3 - 6 years	20	80	85 -95
7 - 10 years	20	80	75
> 10 years	20	100	50 - 55

NB: Halve % of glucose polymer in mitochondrial disorders/primary lactic acidoses

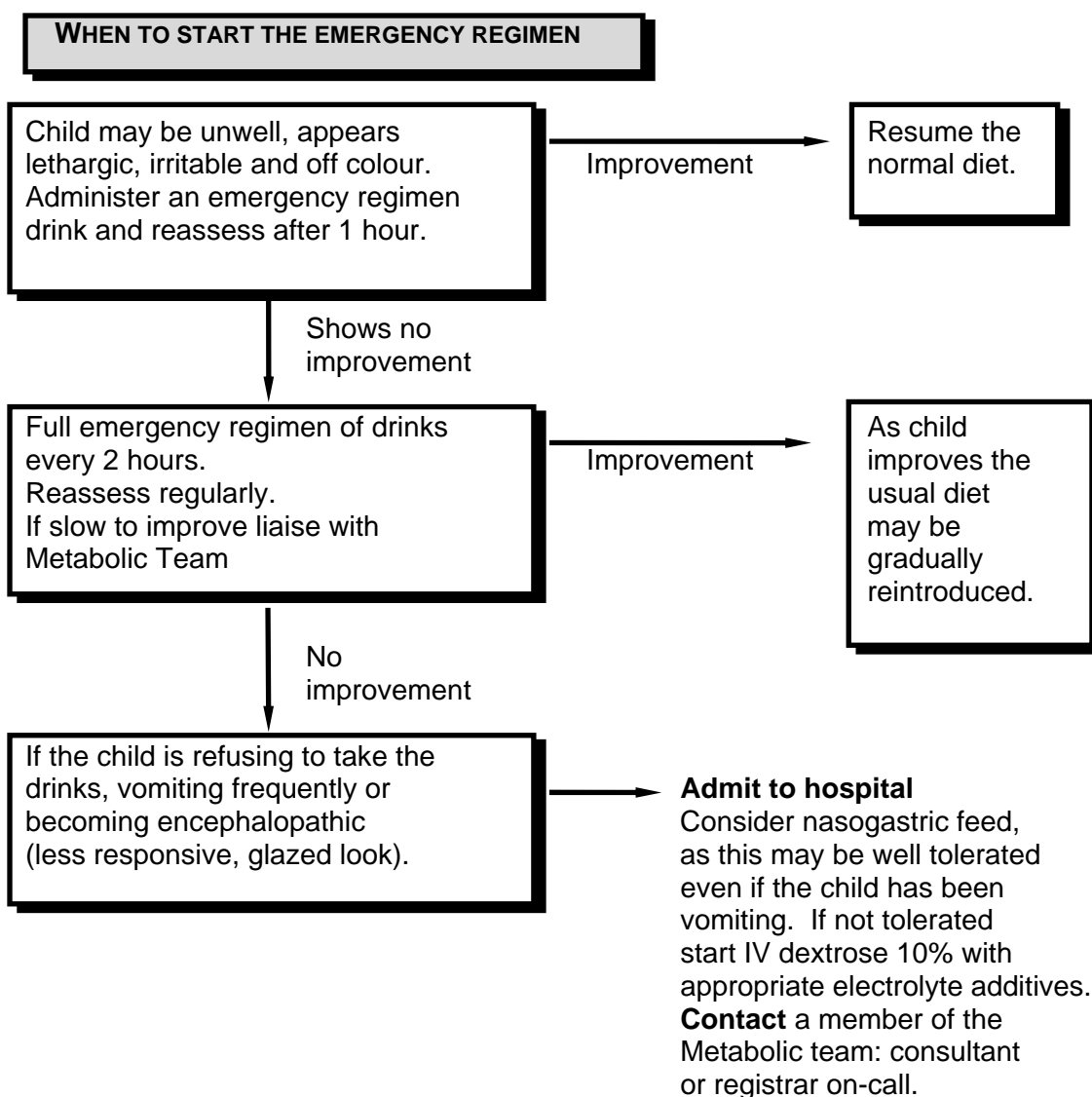
Give the drink as oral or nasogastric boluses every 2 to 3 hours or as a slow continuous feed if child is vomiting. There is some flexibility in the frequency of the drinks particularly in older children and during recovery. However, it is important not to allow a gap of longer than 4 hours between feeds, particularly during the night.

This regimen should not be continued for long periods of time as it does not supply adequate nutrition.

IV Lipid should be considered

- Use Intra Lipid 20% (2g in 10ml) at 1g/kg given over 24 hours

GUIDELINES



NOTE 1: The emergency regimen should not be continued for longer than 24-48 hours without discussion with the metabolic team.

NOTE 2: In addition to the emergency regimen the usual medication should continue to be administered, including arginine/citrulline if these are being given with the diet. The medications may need to be given by another route e.g. intravenously, if not tolerated orally. If uncertain about dosage conversion, seek advice. For some disorders it may be appropriate to increase the usual medication however this will need to be done in conjunction with the metabolic team.

GUIDELINES

EMERGENCY TREATMENT OF SUSPECTED INBORN ERRORS OF METABOLISM

STOP FEEDS

- Repeat plasma samples i.e. ammonia, lactate, acylcarnitines. Sample must be free flowing and taken immediately to laboratory (Pre-warn labs of imminent arrival).
 - Check glucose to exclude hypoglycaemia
- Check blood gas to assess presence/absence of acidosis
 - Save urine for metabolic investigations and dipstick for the presence/absence of ketones.

- Establish IV infusion of 10% dextrose, (with appropriate electrolyte additives), to promote anabolism, (5% if primary lactic acidosis suspected).
See table 1 below.
If hyperglycaemic add insulin at 0.05 to 0.1 unit/kg/hour.
- Correct metabolic acidosis and other electrolyte disturbances in usual way
 - Sodium bicarbonate is indicated in the management of metabolic acidosis in some metabolic disorders
Frequent monitoring of serum sodium (rise) and potassium (fall) during correction of the acidosis is essential

Discuss with metabolic team (consultant or registrar on-call) for further investigations and management options including haemodialysis/peritoneal dialysis and other medication.

TABLE 1.

AGE (years)	INFUSION RATE
<1	150ml/kg/day
1 - 2	100ml/kg/day
3 - 6	1200 - 1500ml/day
>6	1500 - 2000ml/day

MANAGEMENT OF STATUS DYSTONICUS

Status dystonicus - frequent dystonic spasms, causing discomfort or pain, which can lead to compromised respiration, hyperthermia, rhabdomyolysis and multiorgan failure. Patient with status dystonicus may require intensive care settings.

Important note:

1. Most of children with severe dystonia will be taking multiple muscle tone reducing medication.
2. Possible difficulties in maintaining airway, respiratory depression, aspiration, drowsiness and coma, autonomic dysregulation have to be taken into consideration when offering additional treatment.
3. Patients taking regular benzodiazepines for a long time are likely to develop significant tolerance and may not respond to smaller doses given in an emergency.
4. All dystonias respond to sleep and a major part of dystonia management should be directed to improving sleep patterns.
5. In status dystonicus, it may be desirable to induce sleep for longer periods, e.g. into day-time hours by using a hypnotic (e.g. chloral) in the day-time as well as night until the crisis is over: this may be preferable to escalating benzodiazepines if the patient is already on high doses of these at the outset.

Treatment of early status dystonicus

Diazepam PO/PEG	up to 4 times daily, not more often than 4 hourly
< 12/12 months	0.25mg/kg
1 - 5 years	2.5mg - 5mg
5 - 12 years	5mg - 7.5mg
Above 12 years	5 - 10mg

Consider introducing or increasing the dose of **nitrazepam PO/PEG** (can significantly reduce muscle tone).

1 - 5 years	1.25mg - 2.5mg up to twice daily,
5 - 10 years	1.25mg - 5 mg up to twice daily (max 10mg twice daily)
> 10 years	2.5mg - 10mg up to twice daily (max 15mg twice daily)

Consider **Chloral hydrate** PO/PEG 30-50mg/kg/dose 3-4 times a day. Do not exceed 4g in 24 hours.

Treatment of severe status dystonicus:

The mainstay is supportive management.

- Maintain Airway/ Breathing/ Circulation

IV access and investigations: FBC, renal function tests, liver function test, CK, CRP, other investigations as appropriate.

Midazolam buccal 0.5mg/kg (max 10mg)

Or

Diazepam IV 0.1-0.4mg/kg (Max 20mg/day). Repeated ONCE at 10-15 min

If unsuccessful consider IV Midazolam infusion on PICU

Or

Lorazepam IV 0.1mg/kg (Max 4mg). Repeated ONCE at 10-15 min

If unsuccessful consider IV Midazolam infusion on PICU.

Consider **Chloral hydrate** PO/PEG 30-50mg/kg/dose 3-4 times a day. Do not exceed 4g in 24 hours.

GUIDELINES

Supportive management:

1. Monitor temperature, BP, saturation, HR and manage accordingly.
2. Look for underlying cause:
 - If patient with Deep Brain Stimulation system- settings must be checked to rule out dysfunction of the device.
 - Viral/bacterial infection of any sort is a **number 1 provocative factor**: identify and treat
 - Pain- control with regular high doses of analgesia may be necessary: ascertain cause of pain apart from spasms, consider fractures, arthritis, gut and dental problems.
3. Look for any other contributing factors to improve comfort/ frustration levels of the patient: communication with the child, position, appropriate atmosphere, appropriate play activities if well enough, presence of the parent/carer, mouth care.
4. Maintain adequate fluid and electrolyte intake.
5. Monitor renal function and CK. Consult renal team if evidence of acute tubular necrosis or oligo-anuria.

GUIDELINES

KETOGENIC DIET MEDICINES INFORMATION

Medicines usually contain some form of carbohydrate so it is important that the most suitable formulation and brand for the Ketogenic diet is selected. When a child is started on the Ketogenic diet, their current medicines must be assessed and the most suitable formulation and brand selected. Once established on the diet, it is important that any new medicines that are needed are appropriately selected. Helpful tips:

- Ketogenic diets require medicines to be carbohydrate free / low carbohydrate.
- Tablets are generally better than liquids – so if in doubt use tablets.
- Suppositories are ok, even if they contain carbohydrate as it is not absorbed.
- Ketogenic diet stickers should be stuck on drug chart if child admitted to hospital.
- Intravenous fluids containing glucose should be avoided unless a child has low blood glucose levels (BMs).
- If a new medicine is started then monitor ketones and contact Ketogenic team if any concerns that the medicine is causing a reduction in ketones.

What to avoid

- Sucrose
- Fructose
- Dextrose
- Sorbitol
- Glucose
- Mannitol
- Glycerol
- Starch
- Maize Starch
- Lactose
- Maltodextrin

Laxatives for constipation

The common laxatives used in children (lactulose and senna) contain large amounts of sugar so should be avoided if possible. Movicol can be used in the Ketogenic diet. Suppositories and phosphate enema are suitable to use.

GUIDELINES

STATUS EPILEPTICUS

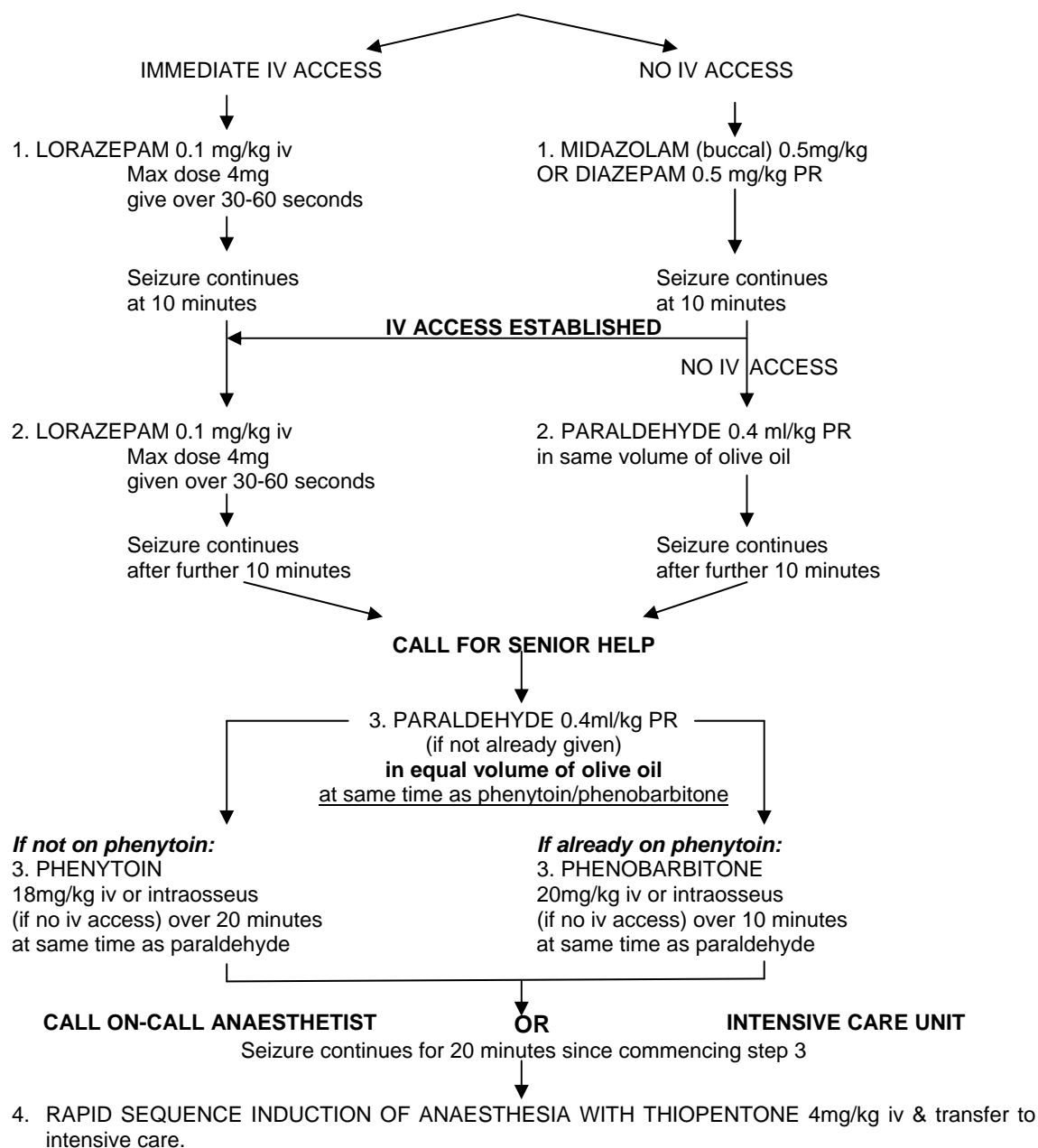
TREATMENT GUIDELINES FOR AN ACUTE TONIC-CLONIC CONVULSION INCLUDING ESTABLISHED CONVULSIVE STATUS EPILEPTICUS

(Based on The Status Epilepticus Working Party¹)

All children presenting to A&E in a convulsion should be regarded as being in status epilepticus.

Checklist: Airway
Breathing
Circulation

Immediate Management: Give high flow oxygen
Measure blood glucose
Confirm epileptic seizure



GUIDELINES

PARENTERAL NUTRITION

The purpose of these guidelines is to give background information and practical advice on prescribing Parenteral Nutrition (PN) for neonates and children. Guidance differs from adult practice as a result of two important patient characteristics: age and the need to support growth.

Age has a profound effect on protein and nutrient requirements, particularly in early infancy. For this reason standard feeds are not usually suitable and PN is individualised. The PN composition must be calculated to allow for normal requirements plus previous deficiencies, clinical condition, concurrent therapy and/or abnormal losses.

GENERAL PRESCRIBING INFORMATION

Paediatric PN prescriptions are available on all the paediatric and neonatal units in the trust. The PN will be delivered to the ward that evening.

PN may be prescribed daily or preferably 48 hourly if the patient is stable.

PN FLUID VOLUME

First calculate the child's total fluid requirement taking into account the patient's age and gestation (in neonates), clinical condition and any abnormal fluid losses. Calculate the proportion of this available for PN by subtracting from the total requirement all other intravenous fluids being administered. Multiple infusions should be carefully accounted for during this process.

Enteral fluids should not be deducted from the PN prescription when weaning from PN as there is a risk of concentrating the PN formula and thus overfeeding the child. The administration rate should be adjusted to ensure the correct fluids are administered. This will lead to some PN wastage, but will ensure the patient is not overfed.

PICU patients are usually very fluid restricted and the PN volume requirements are usually prescribed as 48ml/kg/day (2ml/kg/hr), 72ml/kg/day (3ml/kg/hr) or 96ml/kg/day (4ml/kg/hr).

PN COMPOSITION

There are four neonatal and paediatric PN standard prescriptions:

- a) Preterm neonates <37 weeks gestation
- b) Neonatal standard bag - maintenance regimen
- c) Term neonates, and infants up to 10kg
- d) Infants and children between 10kg and 30kg

Protein, carbohydrate and lipid are prescribed on a g/kg/day basis. The quantities are gradually built up to full requirements in premature neonates but can be increased more rapidly in term infants and children. If a child has been maintained on IV fluids before starting PN, the constituents of these fluids e.g. glucose, electrolytes should be considered when prescribing PN. It is rarely appropriate to increase the fat content above 3.5g/kg/day or protein above 3g/kg/day.

For neonates, a standard bag PN regimen should be considered first in all cases when initiating PN. There are several advantages to standard bags and they may be used for premature neonates < 37 weeks gestation and term neonates when clinically appropriate. Additions may be made to these bags in pharmacy of vitamins, trace elements and also sodium, potassium, calcium and phosphate, to meet patient specific requirements. Nothing can be removed from these bags so they will not be suitable for all neonates (fluid or electrolyte restricted) and no changes can be made to amino acid, glucose or magnesium content.

GUIDELINES

The regimens stated on the PN prescription sheets automatically limit the amounts of Peditrace, Additrace, Solivito N and Vitlipid N Infant to their maximum total daily dose. The other constituents are not automatically limited and care needs to be exercised particularly when prescribing for children >25-30kg.

Children receiving PN for greater than 2 weeks may require the addition of extra trace elements, depending upon blood levels. All premature neonates <32 weeks gestation or <1500g routinely receive 50nmol/kg/day of selenium (double the standard selenium dose from Peditrace).

INGREDIENTS

AMINO ACIDS

In addition to the 9 essential amino acids in adults (leucine, isoleucine, valine, lysine, methionine, phenylalanine, threonine, tryptophan and histadine), it is likely that taurine, tyrosine and cysteine are essential during infancy. Alanine and proline may also be 'semi-essential'. The neonate also has a limited ability to metabolise an excessive intake of phenylalanine and tyrosine. Solutions used are:

1) Under 10kg

Vaminolact where the amino acid profile is based on breast milk protein which includes cysteine, taurine and tyrosine essential for premature neonates (Electrolyte free).

2) Over 10kg

Vamin 9 glucose where the amino acid profile is based on egg protein but with added cysteine; it also contains Na 50mmol/l, K 20mmol/l, Ca 2.5mmol/l and Mg 1.5mmol/l.

3) Fluid Restricted Children

Vamin 18 EF may be used if fluid restriction is limiting the quantity of nitrogen being administered. This should only be a short term solution – refer to senior paediatric pharmacist or senior technical services pharmacist.

CARBOHYDRATE

Carbohydrate is supplied in the form of glucose which provides 4Kcal/g. Adequate carbohydrate must be supplied, otherwise the amino acids will be used as energy and not converted to protein. If hyperglycaemia develops a soluble insulin infusion should be considered to maintain normoglycaemia. A reasonable insulin starting dose is 0.05 units/kg/hour (lower amounts e.g. 0.01 units/kg/hour may be required for pre-term neonates) with early and frequent review.

As a rule of thumb 200 Kcal is necessary to utilise each gram of nitrogen.

1g of glucose = 10ml glucose 10% \cong 4Kcal

LIPID

Lipid is provided as a soya bean oil emulsion, Intralipid 20% (20g/100ml triglycerides), supplying 10kcal/g. It is important to include lipid as it:

- is a concentrated source of calories (contributing 30-50% of energy).
- is a vehicle for fat soluble vitamins.
- prevents the development of essential fatty acid deficiency.
- is isotonic with blood and may be infused peripherally.

Intralipid with added vitamins is given as a separate infusion to the vamin (aqueous) portion. Both infusions can be administered through the same line (y site). The infusion rates quoted for both are based on delivery over 24 hours. No attempt should be made to 'catch up' the Intralipid infusion if it is running behind, as lipid is inadequately cleared at higher infusion rates (particularly in neonates).

NOTE if lipid is contra-indicated - water soluble vitamins are put in the Vamin (aqueous) Bag but fat soluble vitamins are omitted.

GUIDELINES

CIRCUMSTANCES WHERE THE REGIMEN MAY NEED TO BE ALTERED

Poor weight gain

May require increased protein and calories.

Phototherapy

Consider increasing daily fluid allowance by 30ml/kg/day.

Overhead Radiant Heating

Consider increasing daily fluid allowance by 30ml/kg/day.

Heart failure

If the patient is in heart failure, fluid allowance may need to be reduced.

Renal failure

Seek expert advice, caution with protein and electrolytes and water soluble vitamins.

Jaundice

Consider reducing lipid intake to 1.5g/kg/day in newborn infants with levels of unconjugated bilirubin exceeding 75% of the exchange transfusion level.

Hepatic Insufficiency

Seek expert advice. SMOFlipid (soya bean oil, medium-chain triglyceride, olive oil, fish oil) may be considered as an alternative to Intralipid. It supplies 10kcal/g.

Infection\Sepsis

Consider reducing lipids, check triglyceride levels more frequently and adjust lipids accordingly.

Fluid restriction

In severely fluid restricted patients the volume prescribed may be insufficient to prepare the prescribed PN regimen. Pharmacy will inform the clinician when this situation arises.

Hypocalcaemia/Hypophosphataemia

Increases in calcium or phosphate content of the PN regimen may exceed the maximum stable amounts of these electrolytes. A technical services pharmacist will contact you if the limits have been exceeded.

Inborn errors of metabolism

Seek expert advice.

Catabolic states

Any infant or child who is catabolic (e.g. burns) will need more calories than the basic regimen provides. This should be discussed with the Paediatric Parenteral Nutrition Team.

TECHNIQUES FOR ADMINISTRATION OF PARENTERAL NUTRITION

Before administration, check the prescription has been signed by the prescribing doctor and clinical pharmacist. The PN order chart must also be signed by an aseptic technical pharmacist, which acts as a final check for quality control and accuracy of contents. The PN must be prescribed on the infusion chart by the Doctor as follows 'PN as ordered – run as maintenance fluid'

The PN should be checked by 2 nurses before administration, using aseptic or non touch technique when handling. The following checks should be made:

Compare the PN labels, prescription and insert for notes for patient name, date of birth, hospital number, day for infusion of PN, working weight and batch number. The following patient checks must also be performed – is the prescription still appropriate, patient details, allergy status, route of administration and daily fluid requirement.

GUIDELINES

ACCESS FOR PN

PN should be administered via a dedicated central line. If central access cannot be secured and PN is imperative, solutions containing less than 12.5% glucose may be infused peripherally. Central access must be gained as soon as possible since thrombophlebitis is likely and extravasation causes tissue burns.

The central line should be reserved for PN unless a multi-lumen line has been inserted, when the same lumen should be used for PN at all times.

NOTE

- **Nothing** else should be given down the PN line unless there is no alternative i.e. treatment is essential and alternative access is unobtainable – check with pharmacy.
- Blood must **not** be taken through the PN line at any time.
- The **giving set** should be changed with full aseptic precautions.

INFUSION

The PN infusions supplied by pharmacy contain an overage (an additional volume of fluid) to allow the priming of the attached giving sets without reducing the volume available for infusion into the patient. A Prescription and Daily Regimen Summary are sent to the ward with the PN. The Regimen Summary and the PN labels specify the rates of Vamin and Lipid (ml/hr) to run over 24 hours. The clear plastic outer bag in which the PN is dispensed is simply protective and is not a sterility barrier.

In-line filters are currently recommended for all neonatal PN. A 0.2micron filter is used for the Vamin (aqueous) portion and a 1.2micron filter is used for the lipid. These are changed every 48 hours and accordingly neonatal PN is dispensed every other day without a filter attached and PN should be infused through the existing filter. Care must be taken to connect the lipid to the lipid filter and the Vamin to the Vamin filter.

For children over 10kg, a 0.2micron filter is used for the Vamin (aqueous) portion and no filter is required for the lipid. Patients receiving a pre-mixed Kabiven bag will not have any filters attached.

STORAGE

Whenever possible all PN solutions should be protected from light to prevent the formation of damaging free radicals by keeping the blue/red cover over the PN during administration. Once made all PN solutions should be stored in the fridge. Allow cold PN bags to warm slightly before administering.

EXPIRY

Once connected to the patient the aqueous phase has a 24 or 48 hour expiry depending on the regimen prescribed. The lipid phase has a 24 hour expiry and 2 syringes will be provided if the patient is on a 48 hour regimen.

GUIDELINES

MONITORING

The Biochemical investigations required and their recommended frequencies are set out below. If patients are stabilised on PN these investigations may be performed less often:

Daily¹	Na	K	Urea	Albumin	Cr	Ca	PO ₄	BM/Glucose ²
Weekly	Mg	Bilirubin ³	ALT	AST	ALP	Triglycerides ⁴		Hb
Monthly	Zn ⁵	Se ⁵	Cu	Mn	Amino Acid profile	Vits A,E,D		Carnitine
3 Monthly	VQ scan	Vit B ₁₂						

1. Daily urea and electrolytes until regime established and patient is stable after which 2-3 times weekly is sufficient.
2. The glucose status is usually monitored at least twice daily.
3. In the presence of hyperbilirubinaemia do daily bilirubins and confirm conjugated bilirubin status weekly
4. Triglycerides should be done more often when initiating PN, if levels are high or in severe sepsis
5. Do initial Zn and Se at 2 weeks and then monthly

NOTE: Bloods should be taken early morning and sent as an urgent request.

WEEKENDS and BANK HOLIDAYS

PN is prepared in the pharmacy aseptic unit Monday to Friday with a reduced service on Saturday. On Fridays, it is therefore necessary to decide on the parenteral nutrition requirements for the weekend ahead. For existing patients 3 days PN should be prescribed on Friday if possible. If the patient is unstable, one day may be done on the Friday and then 2 days prescribed on the Saturday. If PN is needed outside normal working hours contingency arrangements are laid out below.

Bank holiday arrangements will be negotiated with the PN team and clinicians advised appropriately.

EMERGENCY PN REGIME

For most infants and paediatric patients, PN may be delayed until the next working day without adversely affecting the patient. Premature infants have very little energy reserves and it is imperative to start PN as soon as possible. Standard bags (without added vitamins and trace elements) are available on NICU for use out of hours. If a standard bag is not appropriate then a Vaminolact infusion should be started as part of the maintenance fluids to ensure that protein is administered as soon as possible and prevent negative nitrogen balance (see below for infusion rates).

It is recommended that a regime of glucose, electrolytes and protein is used (see note 1). The required maintenance glucose and electrolyte infusion should be prepared on the ward and administered in addition to a protein infusion (Vaminolact) run at the rates outlined in the tables below. Vaminolact is an electrolyte free solution which provides protein only.

GUIDELINES

NEONATES and INFANTS (less than 10Kg)

	Day 1	Day 2	Day 3
Vaminolact ml/kg/hr	1.1	1.5	1.8
Amino Acids (g/kg/24hrs)	1.7	2.25	2.8
Equivalent nitrogen	0.24	0.32	0.4

CHILDREN (over 10kg)

	Day 1	Day 2	Day 3
Vaminolact ml/kg/hr	0.7	1	1
Protein content (g/kg/24hrs)	1	1.4	1.4

NOTE 1: The above prescription for emergency PN may not be appropriate for renal, hepatic or metabolic patients. Seek expert advice before prescribing.

STOPPING PN

For patients who are prescribed PN long term, i.e. 2 weeks or over, the PN must be reduced gradually over at least two or three days when stopping. Full PN should still be prescribed but the solutions run at a reduced rate. When weaning, the vamin and lipid should be reduced in proportion i.e. run at a similar percentage of the full rate (see calculation below). Under these circumstances a PN bag may be infused over up to 48 hours. There are various ways of decreasing PN, but the vamin and intralipid infusions should be decreased proportionally to the increase in enteral feed with the percentage decrease in each being about the same. Thus the volume ratio of the vamin infusion rate to the lipid infusion rate should remain about the same. It is advisable to discuss the patient with the paediatric dietitian in order to determine the best route and type of enteral nutrition.

Calculation for weaning from PN to enteral feed:

Total PN volume = volume of Aqueous bag + volume of lipid

$$\frac{\text{Total PN volume (ml/kg/day)} - \text{enteral feed volume (ml/kg/day)}}{\text{Total PN volume (ml/kg/day)}} = A$$

New Aqueous phase rate = **A** X aqueous infusion rate on bag label
New Lipid phase rate = **A** X lipid infusion rate on bag label

GUIDELINES

All Units are amounts/kg/24 hours

PRETERM NEONATES PN REGIMENS (<37weeks gestation)						
Standard Regimens	Units	1	2	3	4	Maximum Amount
					(full regimen)	
Amino Acid	g/kg	1.7	2.2	2.8	3.3	3.9
Equ Nitrogen		0.24	0.32	0.4	0.48	0.56
Carbohydrate (g/Kg)	g/kg	8	10	12	14	16
	mg/kg/min	5.5	6.9	8.3	9.7	11
Sodium	mmol/kg	Min	Min-3	3 – 5	3 – 5	-
Potassium	mmol/kg	2	2.5	2.5	2.5	-
Phosphate	mmol/kg	1	1.25	1.5	1.5	-
Calcium	mmol/kg	1	1.25	1.5	1.5	-
Magnesium	mmol/kg	0.2	0.2	0.2	0.2	-
Peditrace	ml/kg	Dependant on fluid for PN – see guidance notes for prescribing				1
Lipid	g/kg	0.5	1	2	3	3.5
TOTAL KCAL		40	56	76	96	120

STANDARD BAG NEONATAL PN (Maintenance Regimen)					
Fluid for AQUEOUS PN	mL/Kg/day	60	85	110	135
Protein	g/kg	1.5	2.2	2.85	3.5
Equ Nitrogen		0.22	0.31	0.39	0.49
Carbohydrate	g/kg	6.7	9.5	12.2	15
	mg/kg/min	4.7	6.6	8.47	10.4
Sodium	mmol/kg	1.3	1.9	2.4	3.0
Potassium	mmol/kg	0.9	1.3	1.6	2.0
Phosphate	mmol/kg	0.7	0.95	1.2	1.5
Calcium	mmol/kg	0.7	0.95	1.2	1.5
Magnesium	mmol/kg	0.09	0.13	0.15	0.2
Chloride	mmol/kg	0.9	1.3	1.65	2.0
Acetate	mmol/kg	0.9	1.3	1.65	2.0
TOTAL KCAL	Kcal/kg	32	46	59	73
Lipid (Includes 1ml/kg Solivito & 4 ml/kg Vitlipid Infant)	g/kg/day	0	1	2	3
	ml/kg/day	-	8	13	18

GUIDELINES

All Units are amounts/kg/24 hours

TERM INFANTS AND PAEDIATRIC PATIENTS < 10kg					
Standard Regimens	Units	1	2	3	Maximum Amount
Protein Equ Nitrogen	g/kg	1 0.16	1.5 0.24	2.1 0.34	3.0 0.48
Carbohydrate	g/kg	10	12	14	16
	mg/kg/min	6.7	8.3	9.7	-
Sodium	mmol/kg	3	3	3	-
Potassium	mmol/kg	2.5	2.5	2.5	-
Phosphate	mmol/kg	0.4	0.4	0.4	-
Calcium	mmol/kg	0.6	0.6	0.6	-
Magnesium	mmol/kg	0.2	0.2	0.2	-
Peditrace	ml/kg	1	1	1	1
Lipid	g/kg	1	2	3	3.5
TOTAL KCAL		54	64	94	100
If patient is greater than 6 months old start at Day 2					

PAEDIATRIC PATIENTS 10-30kg				
Standard Regimens	Units	1	2	3
Protein Equ Nitrogen	g/kg	1.0 0.16	1.5 0.24	2.0 0.32
Carbohydrate (g/Kg)	g/kg	4	6	8
	mg/kg/min	2.7	4.2	5.5
Sodium	mmol/kg	3	3	3
Potassium	mmol/kg	2.5	2.5	2.5
Phosphate	mmol/kg	As req	As req	As req
Calcium	mmol/kg	0.1	0.2	0.2
Magnesium	mmol/kg	0.1	0.2	0.2
Additrace	ml/kg	0.2	0.2	0.2
Lipid	g/kg	1	1.5	2
TOTAL KCAL		30	45	60

PN for paediatric patients >30kg

Paediatric patients of greater than 30kg may be prescribed standard Kabiven bags.

The following is the contents of **100mls** of either Kabiven Central or Kabiven Peripheral.

.Regimen	Nitrogen	Kcal	Glucose	Fat	Na	K	Ca	Mg	P
<i>Central</i>	0.5	88	9.7	3.9	3.1	2.3	0.2	0.4	1.0
<i>Peripheral</i>	0.38	62.5	6.75	3.5	2.2	1.7	0.14	0.3	0.75

GUIDELINES

PREVENTION OF RE-FEEDING SYNDROME IN CHILDREN

Re-feeding syndrome can be defined as the occurrence of severe fluid and electrolyte shifts and their associated complications in undernourished patients undergoing feeding orally, enterally or parenterally.

The following patients should be considered at risk and should be prescribed prophylactic vitamin supplementation

- Chronically undernourished patients
- History of weight loss 5-10% in the preceding 1-2months

Prophylaxis – to be given immediately and for the first 10 days of feeding

Vitamins	Dose (enteral)	Dose (intravenous) Only if nil by mouth or not tolerating oral medication
Thiamine	<6years 50mg tds >6years 100mg tds Tablets can be crushed and dispersed in water if administering via feeding tube	High potency vitamins B and C (Pabrinex [®]) intravenous injection For doses and administration details see table below
Abidec	All ages 0.6ml od	

Dosing and administration guidelines for High strength vitamins B&C (Pabrinex[®])

Age of child	Volume of ampoule 1	Volume of ampoule 2	Volume of infusion fluid	Total volume of infusion to be infused over 30 minutes
Under 6 years	1ml	1ml	3ml	5ml
6 – 10 years	2ml	2ml	6ml	10ml
10 – 14 years	3ml	3ml	9ml	15ml
Over 14 years	5ml	5ml	15ml	25ml

Monitoring

Baseline bloods must be taken **before** feeding commences. These should include:

Phosphate

Sodium

Potassium

Calcium

Magnesium

These must be repeated daily for the first week and then at least twice weekly thereafter.

Consider potassium, phosphate and magnesium supplements unless pre-feeding levels are high. Oral supplements should be used where possible. In patients receiving parenteral nutrition, electrolytes should be supplemented as part of the regimen. See individual monographs for oral doses of specific supplements.

GUIDELINES

Enteral Feed Administration

In working hours (Monday-Friday 9-5pm) contact dietitian for advice on starting feeds and feed advancement.

Out of hours – select feed based on weight

- <8kg expressed breast milk/term infant formula/specialist formula if required for clinical condition/disease state. Feeds should provide ≤ 1 kcal/ml.
- >8kg use a feed that provides ≤ 1 kcal/ml eg Nutrini or specialist feed if required for clinical condition/disease state.

*High energy feeds should be avoided.

Calculate fluid requirements based on weight using the table below

Weight	Fluid allowance
Up to 10kg	100ml/kg/day
11-20kg	100ml/kg for the first 10kg +50ml/kg for the next 10kg
20kg and above	100ml/kg for the first 10kg +50ml/kg for the next 10kg +25ml/kg thereafter up to a maximum of 2500ml/day

Enteral feed advancement

It is recommended that feeds should be administered continuously over 24 hours.

Feeds can be advanced as suggested below provided that electrolyte levels are stable. It may be necessary to advance more slowly, or to reduce feeds to the previous day's rates if electrolyte levels are unstable.

NOTE IV maintenance will be required to maintain adequate hydration while enteral feeds are being increased.

- Start enteral feeds at 25% of fluid requirement on day 1
- Increase to 50% Day 2
- Increase to 75% Day 3
- Increase to 100% fluid requirement Day 4

Parenteral nutrition administration and advancement

It is recommended that the standard regimens for parenteral nutrition are used based on the working weight of the child. The regimens give suggested levels of nutrient provision that are increased over 2-4days depending on weight. Always start with the 'Day 1' regimen and increase calories cautiously, taking into account the patient's electrolyte levels.

ANALGESIC DRUGS

ANALGESIC	PREPARATIONS AVAILABLE		DOSE	FREQUENCY OF DOSE	COMMON SIDE-EFFECTS	COMMENTS
PARACETAMOL	Suspension: Tablets: Soluble tablets: Suppositories: Intravenous	120mg/5ml, 250mg/5ml 500mg 500mg 15mg, 30mg, 60mg, 125mg, 500mg 1g/100ml, 500mg/50ml	Oral/Rectal: Loading dose 30mg/kg Then 15-20mg/kg/dose Max dose: < 32weeks – 30mg/kg/24hrs 32 wks - 1mth – 60mg/kg/24hrs > 1month – 90mg/kg/24hrs IV: <10kg – 7.5mg/kg max 30mg/kg/24hrs 10-50kg – 15mg/kg max 60mg/kg/24hrs >50kg – 1g max 4g/24hrs	>3mths–6hrly <3mths-8hrly	None	<ul style="list-style-type: none"> • Caution in liver impairment. • No anti-inflammatory effect. • Can combine with NSAIDs.
IBUPROFEN	Suspension: Tablets:	100mg/5ml 200mg, 400mg	Oral: 4-10mg/kg/dose Maximum daily dose: 40mg/kg/day or 2.4g in 24 hrs (whichever is the smallest)	6-8 hourly	Gastro-intestinal irritation (least of all NSAIDs) Use with caution in asthmatics	<ul style="list-style-type: none"> • Give with or after food. • Can be combined with opioids or paracetamol. • Caution in asthmatic, hepatic, renal and cardiology patients.
DICLOFENAC	Tablets: Dispersible tablet: Slow release tablets Suspension Suppositories:	25mg, 50mg 50mg 75mg, 100mg 50mg/5ml 12.5mg, 25mg, 50mg, 100mg	Oral/Rectal: 0.5-1mg/kg/dose Maximum daily dose: 3mg/kg/day or 150mg in 24 hrs (whichever is the smallest) Only recommended for > 6 months	8-12 hourly	As for Ibuprofen	<ul style="list-style-type: none"> • Not licensed in infants - use with care. • Caution in asthmatic, hepatic, renal and cardiology patients. • Enteric coated tablets take 1 hour to work - unsuitable for acute pain relief. • Give with or after food.
CODEINE	Syrup: Tablets: Suppositories (unlicensed)	25mg/5ml. 15mg, 30mg. 5mg, 15mg, 30mg	Oral/Rectal: 0.5-1mg/kg/dose (max 30mg/dose)	4-6 hourly	<i>See morphine.</i> Less respiratory depression than morphine. Constipation prominent.	<ul style="list-style-type: none"> • Caution in renal and hepatic impairment. • Not licensed in infants – use with care. • Analgesic power does not increase if larger doses given, but side-effects do. • Give prophylactic laxative.
TRAMADOL	Capsules: Soluble Tablets:	50mg 50mg	Orally: >2 yrs- 1mg/kg /dose (max 100mg/dose)	4-6 hourly	Less respiratory depression, constipation and addiction potential than morphine. Psychiatric reactions have been noted	<ul style="list-style-type: none"> • Avoid or caution in renal and hepatic impairment. • Not licensed in <12years

ANALGESIC	PREPARATIONS AVAILABLE		DOSE	FREQUENCY OF DOSE	COMMON SIDE-EFFECTS	COMMENTS
MORPHINE	Short acting Oral solution:	10mg/5ml 100microgram/ml	Oral/Rectal 1 month- 12 years: 200-400mcg/kg/dose (maximum daily dose: 2.5mg/kg/day) > 12 years: 10-15mg/dose Take total daily dose of short acting and divide by 2.	4-6 hourly 12 hourly for SR preps.	Sedation Respiratory depression Nausea & vomiting Constipation Pruritus Urinary retention	Monitor: <ul style="list-style-type: none"> Pain relief. Conscious level – the most sensitive indicator of overdose (acute pain control only). Oxygen saturation/respiratory pattern (acute pain control only). Give: <ul style="list-style-type: none"> Prophylactic anti-emetics (acute pain control only) Prophylactic laxatives. Care with: <ul style="list-style-type: none"> S/C infusions of morphine in shocked patients. Recovery of circulation can flush in a large dose of the opioid. See Morphine monograph for withdrawal advice.
	Tablets (sevreol):	10mg, 20mg				
	Suppositories	5mg, 10mg				
	Longer acting (Slow release formulations)					
	Sachets:	20mg, 30mg				
Tablets (MST):	10mg, 30mg, 60mg, 100mg					
	Intravenous or subcutaneous solution 10mg/ml 60mg/2ml – only to make up infusions		* Doses are for non-ventilated patients, higher doses may be used in ventilated patients	Pre-term neonates	Neonates	> 1 month
			Bolus (loading dose)	25-50 mcg/kg/dose	50-100 mcg/kg/dose	100-200 mcg/kg/dose
	Pre-filled syringes are available on PICU and NICU for use with “smart” infusion pumps		Infusion Maintenance dose (see Infusion Guidelines for administration)	5 mcg/kg/hr	10-20 mcg/kg/hr	10-40 mcg/kg/hr
	PCA/NCA/Epidural – SEE PROTOCOLS					

GUIDELINES

PAIN

The purpose of these guidelines is to advise prescribers with regard to providing optimum and safe analgesia for children. However, it should be remembered that analgesia represents only one component of effective pain management. Every child is an individual and therefore analgesia must be tailored and titrated to their individual requirements.

It is also important to remember that all children, including babies, are capable of feeling pain and should never be left without appropriate analgesia. Discussion with the child's family and ward staff may help identify those children with a cognitive or communication impairment who may have difficulty in communicating their level of pain and who may benefit from the use of a validated measure such as the Paediatric Pain Profile. The fear of opioid induced respiratory depression in neonates and infants can mostly be overcome by using appropriate dosage schedules. Anticipating and preventing pain is far more effective than trying to relieve established pain. Breakthrough pain can adversely affect a child's future pain coping strategies.

POST OPERATIVE PAIN MANAGEMENT

Post operative pain and anxiety may be reduced by the pre-operative preparation of the child. This should include a full explanation of the procedure or operation to be undertaken, including what the child can expect to come back with from theatre e.g. drips, drains, catheters. All children and parents should therefore be seen pre-operatively by the surgeon, the anaesthetist and a member of recovery nursing staff. The need for and type of pre-medication and post-operative analgesia can be discussed at this time.

Decisions regarding **post operative** analgesia must take note of any analgesics (particularly opioids) that have been given intra-operatively and in the recovery room, and the type of operation that has been performed, especially if the patient's airway is compromised e.g. ENT procedures. This information must be clearly documented on the anaesthetic sheet, drug chart or operation notes BEFORE transfer to the ward.

PRESCRIBING IN PAIN MANAGEMENT

Prescriptions with variable doses or routes of administration should be avoided, as they are confusing and do not give adequate information as to the analgesia being provided. Where pain is expected to last 12-24 hours the analgesia of choice should be written up in the regular section with an appropriate valid period. "PRN" analgesics are inappropriate as they are only given if the patient is "complaining" of pain, and often lead to suboptimal analgesia.

The route of administration should in itself not be frightening or painful. It is well documented that children find IM injections frightening and will avoid them at all costs, leading to suboptimal analgesia. If an infusion is deemed inappropriate then the use of the subcutaneous, oral or rectal routes is preferable to using IM injections.

GUIDELINES

OPIOIDS:

Morphine is the gold standard opioid and the oral route is the preferred route. However there will be occasions such as in the immediate post-operative period where this route is inappropriate and the intravenous route preferred. It may be given as a continuous infusion +/- a P.C.A. (Patient Controlled Analgesia) or N.C.A. (Nurse Controlled Analgesia) system utilising a locked pump. Pre-printed drug labels and protocols of management must be used.

Children who are nil by mouth and need P.R.N. doses of an opioid on a short term basis may benefit from having an indwelling subcutaneous catheter inserted – ideally whilst anaesthetised. Subcutaneous access should not be positioned on the distal part of a limb as these areas may be inadequately perfused resulting in irregular analgesic absorption and ineffective and potentially unsafe boluses of analgesia. The site of administration should be changed every 2 – 3 days.

It is essential to prescribe Naloxone P.R.N. for all patients receiving Opioid drugs.

ANALGESIC LADDER:

The W.H.O. analgesic ladder utilises a 3 step approach to preventing and treating pain. The steps progress upwards from the mildest analgesia (Paracetamol is the gold standard) through to a moderate analgesia (e.g. Paracetamol +/- NSAID +/- a mild Opioid (Codeine Phosphate or low dose oral morphine is recommended in this category) or Tramadol and on up to strong analgesia (utilising Morphine as the gold standard Opioid). A combination of regular analgesia – e. g. Paracetamol + NSAID + Opioid – is effective both in the prevention and control of pain, and in moderating the amount of opioid required. Contra-indications to prescribing NSAID's are highlighted in the P.C.A protocol.

PAIN ASSESSMENT:

Pain assessment should be accurate and on going. There are 3 principle forms of pain assessment:

SELF REPORT

BEHAVIOURAL

PHYSIOLOGICAL

Ideally all 3 approaches are used for accurate measurement of pain, and monitoring of the success of the pain control. Pain scoring provides a useful means of assessing and recording pain.

GUIDELINES

Pain Assessment

0	= no pain
1 - 3	= mild pain
4 - 7	= moderate pain
8 - 10	= severe pain

FLACC

SUGGESTED AGE GROUP: 2months to 7 years

Behavioral Pain Assessment

Categories	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying Quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractable	Difficult to console or comfort

Each of the five categories: (F) Face; (L) Legs; (A) Activity; (C) Cry; (C) Consolability; is scored from 0-2 which results in a total

Wong & Baker

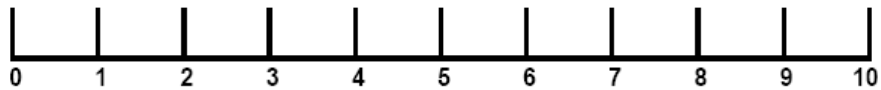
SUGGESTED AGE GROUP: 4 years and over

Self-report

Point to each face using the words to describe the pain intensity. Ask the child to choose a face that best describes their own pain and record the appropriate number overleaf. *(adapted from Wong & Baker, 1988)*



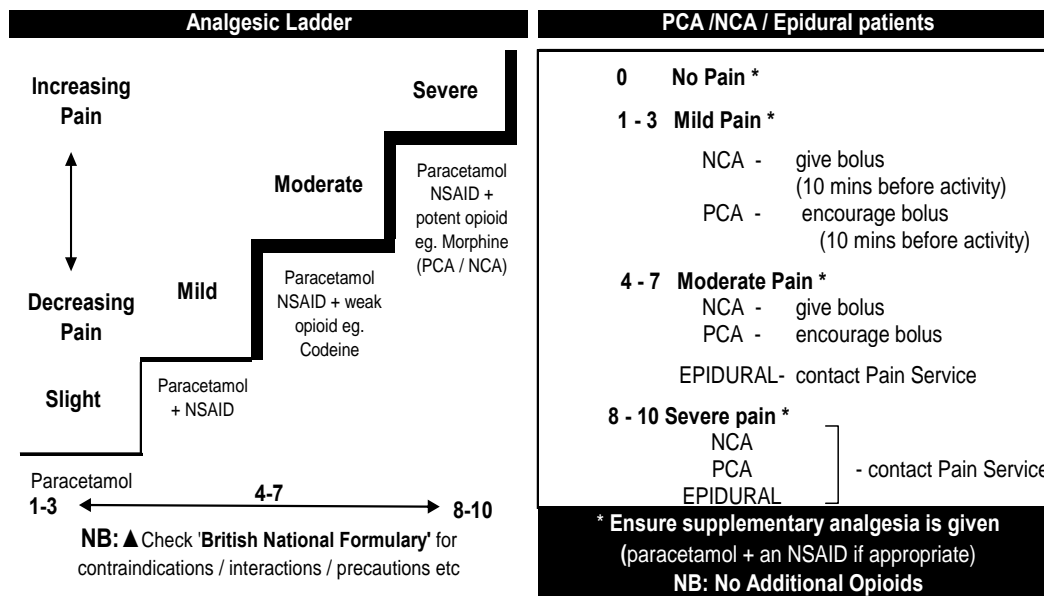
VAS



Self-report

GUIDELINES

Analgesic Interventions



WITHDRAWAL OF OPIOIDS

Where opioids have been used continuously for more than 2 weeks, the withdrawal of these drugs should be gradual. This is particularly important if the opioid has a short elimination half life e.g. fentanyl, as tolerance and dependence are seen earlier than in opioids with a longer half life e.g. morphine.

A stepping down method could involve giving oral morphine initially at an equivalent dose as the intravenous one for 24 hours and then reducing.

A typical 5 day weaning plan could be as follows:

< 2 weeks: No specific wean plan needed

> 2 week infusion:

- Decrease infusion gradually each day – can usually stop after 5microgram/kg/hr

or

- Use Oral Morphine solution when IV rate 10 mcg/kg/hr (240mcg/kg in 24 hours):- equivalent oral dose could be 120mcg/kg PO 6HRLY (480mcg/kg in 24 hours)

Wean over 5 days 120 – 100 – 80 – 60 - 40mcg/kg PO 6Hrly)

Clonidine could be considered as a useful adjunct as it works synergistically with opioids. Thus concomittant use may reduce the dose of opioid required initially and be used to enhance withdrawal. If used concomittantly wean down the opioid first and then gradually decrease the clonidine to avoid any potential rebound hypertension (see clonidine monograph).

GUIDELINES

GUIDELINES FOR THE MANAGEMENT OF SKELETAL MUSCLE SPASM POST ORTHOPAEDIC SURGERY

Skeletal muscle spasm in cerebral palsy children following orthopaedic surgery can be difficult to manage and can delay recovery.

In the immediate post operative period the child should be maintained on their pre-operative antispasmodic (e.g. baclofen) and prescribed appropriate regular analgesics for the surgical procedure performed (see recommended analgesics). Diazepam should also be prescribed on an as required basis for any breakthrough spasm.

If the child was not previously on antispasmodics, regular baclofen should be prescribed along with appropriate regular analgesics and diazepam on an as required basis for any breakthrough spasm.

The management of the spasm should then be determined using the spasm scores detailed in the table below. The amount and frequency of diazepam administered per day should also be assessed as regular administration may warrant the patient being assessed as having a higher spasm score.

LEVEL	SPASM	SEDATION/MUSCLE TONE
0	Spasm free	Awake with good tone
1	Spasm on moving	Asleep/Drowsy - rousable and manageable tone
2	Intermittent spontaneous spasm	Asleep/Drowsy - rousable but floppy
3	Continuous spasm	Hard to rouse
LEVEL	ACTION	ACTION
0	Level 0: No action	Level 0: No action
1	Level 1: Administer diazepam - if requiring regular doses increase baclofen	Level 1: Stop diazepam PRN - consider decreasing baclofen dose
2	Level 2: Increase baclofen - if patient on alternative/additional antispasmodics, start or increase baclofen	Level 2: Decrease baclofen - do not administer further doses of diazepam until adequate tone returns
3	Level 3: Seek expert advice	Level 3: Contact doctor immediately

GUIDELINES

PATIENT AND NURSE CONTROLLED ANALGESIA

PCA and NCA should always be discussed with a member of the Paediatric Pain Team. Dedicated pumps, protocols and prescription labels are necessary to ensure safe administration of these opioid infusions.

All IV PCA and NCA 50ML syringes are made up using **Morphine Sulphate or Fentanyl** diluted in glucose 5% or sodium chloride 0.9%.

The table below gives a brief indication as to the regimen used for PCA and NCA (full details and monitoring are laid out in the Paediatric Pain Team Guidelines).

S/C infusion can be used by making up the same dose in 25ml rather than 50ml.

MORPHINE

	PCA <12yrs or <40kg	PCA Adolescent	NCA <12yrs or <40kg	NCA Adolescent
Concentration in 50ml	1 mg/kg	50 mg	1 mg/kg	50mg
Background Infusion	4 mcg/kg/hr	200 mcg/hr	20 mcg/kg/hr	1mg/hr
Bolus dose	10 mcg/kg	0.5 - 1 mg	10 mcg/kg	2mg
Lockout (mins)	6	6	20 - 30	20-30
Max dose in 4 hours	0.4 mg/kg (max 20 mg)	40 mg	0.4 mg/kg (max 20 mg)	40mg

FENTANYL

	PCA <12yrs or <40kg	PCA Adolescent	NCA <12yrs or <40kg	NCA Adolescent
Concentration in 50ml	10mcg/kg	500mcg	10mcg/kg	500mcg
Background Infusion	0.1mcg/kg/hr	10mcg/hr	0.4mcg/kg/hr	20mcg/hr
Bolus dose	0.2mcg/kg	10mcg	0.2mcg/kg	10mcg
Lockout (mins)	6	6	20 - 30	20-30
Max dose in 4 hours	10mcg/kg	500mcg	10mcg/kg	500mcg

KETAMINE: Maybe used if opiates are not appropriate. Can be made up and administered in the same doses as for Morphine.

GUIDELINES

PAIN MANAGEMENT FOR CHILDREN UNDERGOING VENEPUNCTURE OR INTRAVENOUS CANNULATION

Assessment:

- Check child's allergy status
- Explain procedure to child and parent/carer
- Gain parental consent
- Site select

Age	0-3 months	3months – 5 years	>5 years
First Line Options	Sucrose 24% + Distraction	EMLA or Ametop	EMLA, Ametop or Ethyl Chloride “Cold” Spray

Sucrose 24%:

- Administer orally 1-2 minutes before painful stimulus
- Administer in 0.2ml dose increments. Drip from an oral syringe or use pacifier
- Each dip of a pacifier is estimated to be 0.2ml
- Upper volume limits are based on gestational age
 - 32-36 weeks 1ml maximum per procedure
 - >37 weeks 2ml maximum per procedure
- Do not store container once opened, discard remainder

Contra-indications; babies at risk of necrotising enterocolitis, babies less than 32 weeks gestation and less than 1500 grams. Babies of mothers who are opioid dependent.

Emla;

Term newborn to 3 months or <5kg

- Max. of 1g (1ml) under occlusive dressing for a max. of 1 hour (max 24 hourly)

3 to 12 months and >5kg

- Max. of 2g (2ml) under occlusive dressing for a max. of 4 hours (max 12 hourly)

Over 1 year

- A thick layer under occlusive dressing for a max. of 5 hours (max 12 hourly)

Side effects; transient paleness, redness, oedema

Ametop;

Over 1 month

Apply contents of tube to site of venepuncture or venous cannulation and cover with occlusive dressing

For venepuncture

- Remove gel and dressing after 30 minutes

For venous cannulation

- Remove gel and dressing after 45 minutes

Application of Ametop® can be repeated after a minimum of 5 hours if necessary. The maximum cumulative dose in a 24 hour period should not exceed 2 tubes.

Side effects; erythema, oedema and pruritis, very rarely blistering.

Ethyl chloride cold spray; Anaesthetic spray for immediate, temporary relief of pain.

Contraindications; Do not use on broken skin. **Caution;** flammable substance.

** Entenox may be considered in individual cases eg. Topical anaesthetics have been ineffective in the past and the child is needle-phobic*

GUIDELINES

PREMEDICATION

Premedication is usually given to alleviate anxiety. In addition it may facilitate the induction of anaesthesia or the process of an unpleasant procedure (e.g. central I.V. line insertion) or give a pre-emptive dose of analgesic. The premedication, itself should not induce anxiety or distress.

ELECTIVE CASES

The oral route is generally preferable when premedication is required. Midazolam is commonly used as an anxiolytic. Chloral or Alimemazine may also be used as an alternative to midazolam.

I.M. injections can cause distress and anxiety and should therefore be avoided where possible. I.M. atropine (20microgram/kg 45 mins pre op) may be used for specific indications such as airway surgery where a reduction of oral secretions is desirable; however an alternative to this is for the anaesthetist to give IV glycopyrronium at induction.

AGE	RECOMMENDED PREMEDICATION
< 1 year	EMLA/AMETOP +/- Atropine p.o. 40microgram/kg (min 0.1mg, max 0.5mg) – give 90 mins pre op (now less commonly used routinely)
> 1 year	Midazolam p.o. 0.5mg/kg (max 15mg) EMLA/AMETOP +/- Atropine p.o. 40microgram/kg (min 0.1mg, max 0.5mg) – give 90 mins pre op

Alternative sedatives include temazepam, chloral and alimemazine (see monographs for details). Ketamine should be considered for children who cannot have standard pre-med or general anaesthetic.

URGENT SURGERY

Premedication may be difficult to administer at an appropriate time before urgent surgery. If the wait for surgery is 4 hours or longer, an I.V. cannula should be inserted and I.V. fluids prescribed.

If premedication is necessary, oral drugs are less useful because absorption is unpredictable. I.V./I.M. atropine with or without I.V./I.M. morphine may be appropriate.

FASTING GUIDELINES

The fasting guidelines for elective surgery for all ages, are:

solids and formula milk	up to 6 hours before surgery
breast milk	up to 4 hours before surgery
clear liquid ❶	up to 2 hours before surgery

❶ Clear liquid does not include orange juice and fizzy drinks (stick to water!)

NOTES

1. The insertion of a peripheral IV line is usually part of the procedure. This should be covered by **EMLA CREAM or AMETOP**, applied a minimum of 1 hour prior to the needle puncture, on at least visible veins.
2. No sedation should be given in children with compromised airway or consciousness, head injury, or raised intracranial pressure.
3. For ENT/dental surgical cases the administration of pre-operative opiates is not recommended.

PRINCIPLES OF SEDATION

Principles of sedation

- Reduction of fear, anxiety and stress
- Induction of drowsiness or sleep
- Provision of pain control if necessary
- Allow uncomfortable or motion sensitive investigations (e.g. Echocardiography)

A variety of pharmacological and non-pharmacological methods should be considered to ensure optimal management of children undergoing diagnostic and therapeutic procedures.

Risks of sedation

The most common risks are as follows:

- Hypoventilation
- Upper airway obstruction
- Drift into a deeper level of unconsciousness
- Paradoxical disinhibition and poor co-operation

Use of three or more sedative agents is associated with increased risk of adverse outcomes.

Indications

- Painless procedures within the ward or day case setting e.g. CT and MRI scans, hearing testing (ABR)
- Brief but painful procedures e.g. lumbar puncture, *botox* injections, chest drain removal
- Prolonged, uncomfortable procedures where patient movement is undesirable (e.g. echocardiography)

For children who are extremely anxious, have had previous adverse reactions to sedation, or where a more prolonged procedure is required, general anaesthesia should be considered

Contra-indications to sedation

1. < 3 months of age (corrected for prematurity)
2. Apnoeic Episodes
3. Any airway problems, including obstructive sleep apnoea
4. Any other respiratory problems (e.g. active respiratory infection)
5. Saturations of < 94 % in air, in the absence of congenital heart disease*
6. Decreased level of consciousness (e.g. encephalopathy, raised ICP)
7. Inadequately fasted pre-procedure
8. Ketogenic diet**
9. Bowel obstruction
10. Neuromuscular disease
11. Allergy to drugs being used or previous paradoxical agitation with sedation
12. Informed refusal by parent or child

* Not applicable to some congenital heart disease patients, please consult cardiology team.

** Discuss with the Ketogenic Diet Team

All children with cardiac or neuromuscular disease must be discussed with their own team prior to administration of sedation.

GUIDELINES

Extra Caution

When sedation is required in the following children, extra caution may be required

- Severe gastro-oesophageal reflux
- Impaired bulbar reflexes
- Children already receiving drugs which may potentiate the effects of sedation (anticonvulsants, antihistamines, alpha blockers, clonidine, opioids, erythromycin, antidepressants).

Before Sedation is administered

Fasting

Any sedation can lead to vomiting, regurgitation and aspiration. Children may also drift into a deeper level of unconsciousness. All children undergoing *invasive* procedures under sedation must be fasted as for general anaesthesia.

- No food or bottle milk for 6 hours prior to procedure
- No breast milk for 4 hours
- Small volumes of clear fluids can be given up to 2 hours before

Exceptions:

- If nitrous oxide is the only sedation used, avoidance of a meal 1 hour prior to sedation is advisable.
- For non invasive tests such as echocardiography, fasting is not generally required.

Monitoring

All children undergoing sedation should be monitored throughout the procedure, and until fully awake.

- Baseline observations must be documented
- Monitoring and documentation of oxygen saturations, respiratory rate and heart rate must start as soon as the child becomes drowsy and continued until child is fully conscious and discharged.

An appropriately trained nurse must be with the child during the procedure to monitor vital signs as the operator will be busy with the procedure

Discharge Criteria

- Child back to normal consciousness – fully awake
- saturations - back to pre sedation level
- eating and drinking

GUIDELINES

TYPES OF SEDATION				
Medication	Dose/ Route/	Time to Onset	Notes and Caution/ Side Effects	Formulation/ Availability
Chloral Hydrate	Oral/Rectal 50-100mg/kg max 4g	Peak effect in 30-60 minutes T½ 8 hours	Avoid in severe hepatic and renal impairment	Liquid 500mg/5ml Suppositories 100mg and 500mg
Midazolam	Buccal 200-400 mcg/kg (Max. 10mg) Nasal 200-400 mcg/kg (Max. 10mg) Orally 500mcg/kg max 15mg Slow IV bolus <12 years 50-100mcg/kg STAT >12 years 2mg STAT	Buccal 2-10 mins Nasal 10- 15mins Oral 20-30 mins IV 3-5mins T½ 2 hours Need pulse oximetry, flumazenil and resuscitation facilities	Respiratory depression. Severe hypotension. Injection is painful and irritant if given nasal/ buccal. Bitter taste orally. May cause restlessness and severe disinhibition in some children. C/I; Myasthenia Gravis	Injection 10mg/5ml, 10mg/2ml Liquid 2.5mg/1ml Buccal 10mg/1ml and buccal syringes: 2.5mg, 5mg, 7.5mg and 10mg
Alimemazine (Vallergan)	Oral > 1month 2mg/kg/dose Max dose 60mg	Peak effect 30-60 mins T½ 6-8 hours	Caution in <6months. Has anti emetic effect. There is a risk of post-operative restlessness especially if the child is in pain. May lower seizure threshold. C/I; Myasthenia Gravis	Tablets 10mg Liquid 7.5mg/5ml Liquid 30mg/5ml (Contains sugar and 4.8% alcohol) Unlicensed <2yrs
Entonox Gas	50% NO and 50% O ₂	Wears off in five minutes	Self administered. The child must be able to co-operate. Professionals administering Entonox must be trained in its use.	Bleep Pain Nurse Specialist Or Anaesthetist on call

GUIDELINES

PAINLESS PROCEDURES

e.g. MRI scans, CT scans, ABRs,

If IV cannula is needed (contrast required during scan or other reasons) insert the cannula prior to administering sedation.

Sedation to be given 1 HOUR PRIOR TO PROCEDURE

Age	Sedation
< 6 months old	Feed and wrap
6 months to 1 year	100mg/Kg Chloral Hydrate (max 2g)
1-2 years	Chloral Hydrate 75mg/Kg (max 2g) & Alimemazine 2mg/Kg (max 60mg)
2-6 years	Chloral Hydrate 50mg/Kg (max 4g) & Alimemazine 2mg/Kg (max 60mg)
>6 years old	Oral sedation with 0.5mg/Kg Midazolam (max 15mg)

If sedation successful:

Continue monitoring until child returns to normal level of consciousness. Discharge home when appropriate.

If sedation unsuccessful:

Consider options after discussion with attending consultant.

1. Consider benefit and safety of an additional dose of sedation
2. Consider re-booking procedure under general anaesthetic.

If at any point saturations fall <94%, give oxygen and re-position patient. If no immediate improvement, then call the Paediatric SpR.

If acute deterioration or respiratory arrest: **CRASH CALL PAEDIATRIC TEAM**

PAINFUL PROCEDURES

e.g. chest drain removal, pacing wire removal, lumbar puncture, botox injections

- If patient < 6months, organise general anaesthesia for procedure.

Entonox should be considered where painful procedures are required. Please contact the Clinical Nurse Specialist in Paediatric Pain Management

Topical anaesthetic should be applied where appropriate

6 months to 16 years:

Oral Morphine Sulphate 0.5mg/Kg and oral Midazolam 0.5mg/Kg (Max 15mg) 30 minutes prior to procedure

In those children already taking opioid medication, a reduced dose of 0.2mg/Kg Oramorph should be used.

If sedation successful: Continue monitoring until child returns to normal level of consciousness. Discharge home when appropriate.

GUIDELINES

If sedation unsuccessful:

Consider options after discussion with attending consultant.

- Consider benefit and safety of an additional dose of sedation
- Consider re-booking procedure under general anaesthetic.
- Re-attempt procedure under repeat sedation after a minimum of 4 hours since first dose of medication given.

If at any point saturations fall from pre-sedation level; give oxygen and re-position patient. If no immediate improvement, then call the Paediatric SpR.

If acute deterioration or respiratory arrest: **CRASH CALL PAEDIATRIC TEAM**

SEDATION FOR ECHOCARDIOGRAPHY

Echocardiography can be uncomfortable and requires an absolute minimum of patient movement particularly for advanced modalities (3D echo)

Goals

- To obtain an optimal echocardiogram avoiding invasive cardiac catheterisation and angiography or MRI / CT under general anaesthesia in as many children as possible
- Minimize physical discomfort, pain, and anxiety.

If there is any doubt, please discuss with the consultant cardiologist.

Fasting for sedated echocardiography

Infants <10kg

No fasting required

Children >10kg

4 hours

The preferred medication for echocardiography are either chloral hydrate orally or buccal midazolam. Often a combination or both medications are required.

ECH Paediatric Cardiology Regimen

Time	Comment	Sedation
@ 0 minutes		Chloral Hydrate 75 mg/kg (oral)
@ 45 minutes	If pt not sedated	Midazolam 200 micrograms/kg (buccal)
@ 60 minutes	If pt not sedated	repeat Midazolam 200 micrograms/kg

If sedation successful:

Continue monitoring until child returns to normal level of consciousness. Discharge home when appropriate.

If sedation unsuccessful:

Consider options after discussion with attending consultant.

- Consider benefit and safety of an additional dose of sedation
- Consider re-booking procedure under general anaesthetic

GUIDELINES

HEAD LICE

Head lice are small insects, roughly the size of a match head when fully grown. They spread by clambering from head to head. Anyone with hair can catch them. It is estimated that one in ten primary school children are affected by head lice every year.

Head lice feed by sucking blood through the scalp of the child. The female lays eggs in sacs (nits) glued to hair where the warmth of the scalp will hatch them. The eggs take 7-10 days to hatch and are small and dull in colour. Empty egg sacs (nits) are white and shiny and may be found further along the hair shaft as the hair grows out. Lice take 7-14 days to become fully grown and able to reproduce.

GUIDELINES FOR PREVENTION AND DETECTION OF HEAD LICE

1. Comb hair each day with a fine tooth comb. Good grooming enables early detection of head lice.
2. Wet comb hair weekly to detect live head lice if present. Wash hair with normal shampoo, rinse and follow up with conditioner. Rinse and then wet comb hair, section by section, with a detection comb (fine toothed comb), over a white surface. If live lice are present, follow 'Guidelines for treatment of head lice'.

GUIDELINES FOR TREATMENT OF HEAD LICE

A rotational policy for insecticide treatment of head lice is not recommended. Mosaic prescribing/supply is recommended (i.e. an alternative preparation is used if after repeat administration of the initial preparation there are still live lice) and no one chemical treatment is recommended. Other methods of lice removal (e.g. electric combs) are of no proven value in the treatment of head lice.

1. Malathion aqueous lotion (Derbac-M[®]) is a suitable first line choice. Permethrin Cream (Lyclear[®]) is a suitable alternative
2. Ensure hair is dry before commencing treatment.
3. Rub lotion gently into scalp until all the hair and scalp is thoroughly moistened (50mls is usually required).
4. Comb hair and allow to dry naturally.
5. After a minimum of 12 hours, remove chemical by washing hair.
6. 5-7 days after treatment, a detection comb should be used to check hair for traces of lice and eggs. Action required is outlined below:

On Inspection after 5-7 days	Action
No adult lice, nymphs only	Survival of eggs - repeat same treatment
Range of lice found: adult, nymphs and new eggs	Treatment incorrectly used or resistance. Check correct use. Repeat application, try alternative or try wet combing (see below).
Adult lice only, no nymphs	Re-infection. Check contacts and repeat treatment.

7. If live lice continue to be detected seek expert advice.
8. Household contacts should not be treated routinely. Treat only if infestation.
9. Treat all patients with live lice at the same time to prevent re-infection within the household.
10. Prophylactic use of an insecticide is not recommended.

GUIDELINES

PHYSICAL REMOVAL

Wet Combing is a method of physical removal of lice and requires full understanding and motivation to be of any effect. It is suitable for all hair types, but is rarely fully effective. 'Bug Busting' is the wet combing method developed by the charity Community Hygiene Concern (CHC). 'Bug Busting' kits can be obtained from CHC (Tel: 020-8341 7167) or community pharmacies. The kit includes all the required equipment.

Method

1. Wash hair with ordinary shampoo.
2. Apply lots of conditioner and comb hair while still wet with an ordinary wide/tooth comb.
3. Section hair and comb from roots with a fine tooth comb. The teeth of the comb must be no more than 0.25mm apart.
4. Clear comb of lice between each stroke. The lice are viable and should be disposed of appropriately.
5. Comb entire head.
6. If lice found, repeat routine every 3-4 days for 2 weeks to remove lice hatching from eggs.
7. Finding large lice after/during treatment indicates re-infection.

GUIDELINES

SCABIES

Scabies is an infection caused by the scabies mite *Sarcoptes Scabei*, a parasitic mite, which burrows into the skin. The mites are usually found in the epidermis of the hands and wrists, and may also occur on the face and scalp of small children. A secondary eczematous response is common and may not always appear to correspond to the sites of infestation.

GUIDELINES FOR THE TREATMENT OF SCABIES

1. Wash, dry and allow skin to cool.
2. Apply topical permethrin or malathion aqueous lotion to whole body, including head. Avoid contact with the eyes and mouth. Take particular care to apply under the finger nails and to the soles of the feet. Permethrin is the usual first line treatment. Alcoholic lotions are not recommended owing to irritation of excoriated skin and genitalia.
3. If hands or any other parts of the body must be washed during the treatment period reapply lotion immediately.
4. Wash off lotion thoroughly after 12 hours.
5. Repeat application after 7 days will deal with mites hatched from eggs during that time and is essential.
6. After treatment, itching may take some weeks to subside - further applications of insecticide should not be used. Consider the use of 1% hydrocortisone ointment to treat associated eczema. Treatment for secondary infection may also be necessary.
7. Members of the same household, and other close contacts, should be treated at the same time, whether or not they are clinically infected.
8. Change and launder sheets, towels and any clothing including gloves worn next to the skin during the past week. It is not necessary to clean outdoor or furniture as the mites survive only briefly away from the human host.

GUIDELINES

SKIN DISORDERS

The Management of Atopic Eczema and Dry Skin

Around 50% of children with atopic eczema also have xerosis (dry skin). In the vast majority of cases treatment is straightforward.

GENERAL MEASURES

These include avoidance of soap, wearing cotton clothing next to the skin, avoidance of potential allergens where possible, (e.g. pets should be kept out of the bedroom) and keeping the child cool (e.g. avoid excessive central heating).

EMOLLIENTS

Prescribe a bath oil (e.g. Oilatum[®], Balneum[®]) 2-3 capfuls in the bath water of an adult size bath and a soap substitute (e.g. aqueous cream) to use instead of soap. Many products (Aqueous Cream[®], Diprobase[®], Epaderm[®], Double Base[®]) can serve as both soap substitute and emollient – saving on cost and also improving practicality. Some emollients (e.g. Oilatum Plus[®] Dermol[®]) contain an antimicrobial which can be useful in children prone to episodes of infected eczema. Balneum Plus[®] may be useful in eczema with pruritus. Emollients need to be applied **at least** twice a day and more frequently in severe cases. They vary in the degree of greasiness from very greasy such as 50% white soft paraffin in 50% liquid paraffin to those that are hardly greasy at all such as E45[®] cream or aqueous cream. The aim is to prescribe an emollient that the patient/parent will use and that moisturises the skin adequately. Emollients are best applied after a bath. Topical corticosteroids should be applied after the emollient. Ideally this should be 10-15minutes after the emollient although this may be difficult to achieve in practice. An infant may require up to 250g and a child 500g of emollient every week.

TOPICAL CORTICOSTEROIDS

Topical corticosteroids are the mainstay of treatment for atopic eczema even in infancy. Failure to manage eczema adequately often results from the inadequate use of topical steroid. Hydrocortisone 1% is safe to use and will not give rise to significant local or systemic side effects. Start with hydrocortisone 1% ointment applied once or twice a day to all the affected areas. Stronger preparations should only be applied to facial areas following recommendation of a dermatologist. If hydrocortisone 1% ointment is not adequately controlling the eczema on the body, increase the strength to 2.5% or use one of the moderately potent steroids (e.g. Eumovate[®]) for a short period (usually 3-5 days) until the disease is under control and then return to maintenance therapy. Ointments are preferable to creams for the treatment of eczema however creams may be easier to apply on very hairy areas. Always use the weakest possible steroid to control the disease.

ANTIHISTAMINES

Sedative antihistamines (e.g. Alimemazine) can be useful at night, particularly if the child has difficulty sleeping. Administer one hour before bedtime. Topical antihistamines should be avoided as the risk of skin sensitisation is unacceptably high and they are of no proven efficacy.

GUIDELINES

ANTI-INFECTIVE AGENTS

Secondary infection is very common in eczema and the majority of children with eczema have skin colonised by *Staphylococcus aureus* and occasionally *Group A streptococcus*. In cases where there is clinical evidence of infection treat with combined topical steroid and antibiotic (e.g. Fucidin H[®]) and if necessary systemic antibiotics. The first line agent is flucloxacillin (erythromycin if penicillin allergic or recent repeated courses of flucloxacillin). For systemically unwell children co-amoxiclav is the agent of choice. Avoid prolonged courses of topical or systemic antibiotics because of risk of emergence of resistant strains.

The skin should be swabbed prior to commencing antibiotic therapy as this may prove useful in treatment failures.

WET WRAPS

Occasionally, in cases of severe eczema, emollient and topical steroid can be applied under occlusion with 'wet wraps'. This involves the use of a layer of wet, followed by a layer of dry Tubifast[®] or Comifast[®] (*not from pharmacy*) to the affected areas i.e. limbs and trunk. Wet wraps are rarely used now since the advent of *tacrolimus* and *pimecrolimus* creams and should only be used under a dermatologist's supervision. The benefits are probably due to cooling by evaporation, relieving pruritus, enhanced absorption of the topical steroid and physical protection of the skin from excoriation. As the risk of local and systemic toxicity from topical steroids is increased the choice of topical steroid must be appropriate. A preparation formerly referred to as 1:10 Propaderm[®] now 0.0025% beclomethasone dipropionate ointment in white soft paraffin is recommended.

TOPICAL THERAPY IN CHILDREN

Parent/carers are often unsure of how much topical therapy, particularly corticosteroids, are needed to treat a particular area of a child's body. This can be quantified for parents/carers using the 'Adult Fingertip Unit' (FTU) as a guide.

Emollients may be applied in quantities greater than those suggested.

One FTU is the amount of cream or ointment expressed from a tube applied from the distal skin crease to the tip of the palmar aspect of an adult's index finger. The table below shows how many FTUs are required to cover each area of a child's body.

	Face & Neck	Arm & Hand	Leg & Foot	Trunk (Front)	Trunk (Back) inc. Buttocks
Age	Number of FTUs/area				
3-6 months	1	1	1½	1	1½
1-2 years	1½	1½	2	2	3
3-5 years	1½	2	3	3	3½
6-10 years	2	2½	4½	3½	5
Adult	2½	4	8	7	7

(Adapted from C. C. Long et al. British Journal of Dermatology 1998;138:293-296).

For further practical help such as parent information leaflets or to arrange referral please contact the Paediatric Dermatology Out-patients department at St Thomas' Hospital (ext 88498). Also consider enrolling parent/carer into Eczema Education Programme (via EPR).

GUIDELINES

MANAGEMENT OF IMPETIGO

There are 2 forms of impetigo, a bullous form caused by infection with *Staphylococcus aureus* and a non-bullous form which may be caused by infection with *Staph. aureus* or group A streptococci. The causative organism should be identified by taking skin swabs from affected sites.

Localised infection may be adequately treated with topical mupirocin ointment which is active against infection due to either organism. More severe or generalised cases should be treated with systemic antibiotics according to the sensitivities of the causal organism but erythromycin or flucloxacillin are generally suitable.

It may be appropriate to assess the patient and close contacts for Staph carriage.

MANAGEMENT OF TINEA CAPITIS (SCALP RINGWORM)

All suspected cases of tinea capitis should be confirmed by appropriate mycological examination prior to commencing treatment. It is important to assess all the children within a household. For further information contact the Mycology Department.

Systemic treatment is necessary to treat scalp ringworm. At present griseofulvin is the treatment of choice, at a dose of 10-20mg/kg. Treatment should be for 6-8 weeks in the first instance at which point the child should be re-assessed. Tablets should be prescribed where ever possible as the unlicensed liquid has a short expiry.

Topical treatment with ketoconazole shampoo may be useful in reducing cross infection to other children by reducing the spread of fungal spores in some types of fungal infection. This is not an alternative treatment to griseofulvin.

Treatment failures should be discussed with a dermatologist.

MANAGEMENT OF VIRAL WARTS

The majority of viral warts do not require treatment because they resolve spontaneously, although this may take several months or even years. However when treatment is indicated it depends upon site:

SITE	TREATMENT
Feet	Salicylic acid (Occlusal [®]) applied accurately to warts each evening after soaking and paring/rubbing off thick surface. Treatment might last from a few weeks to 3 months.
Hands	Salicylic acid (Occlusal [®]) applied accurately to warts each evening after soaking and paring/rubbing off thick surface. Treatment might last from a few weeks to 3 months.
Face	Rarely Cryotherapy or surgical removal. Seek expert advice.
Anogenital ❶	Seek expert advice.

❶ The mode of acquisition must be queried in all cases of anogenital warts in children.