Daily Integration of AMS (DIAMS)

HSgB NICU Antimicrobial Database

➢ EXTRACTED FROM HSgB NEONATAL INTENSIVE CARE UNIT (NICU) DRUG DATABASE 2024

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Only for internal circulation (Hosp Sungai Buloh).

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Special thanks to the Department of Pharmacy Hospital Sungai Buloh, Dr Syamhanin Adnan (Senior Clinical Pharmacist). Ms Chong Pei Feng (Head of Clinical Pharmacy) and Ms Abby Ang (PRIC Pharmacist) for coordinating and reviewing this Drug Database. Also, thanks to all the pharmacist colleagues who have helped review this database.

NEONATAL INTENSIVE CARE UNIT (NICU) HOSPITAL SUNGAI BULOH

DRUG DATABASE

Version 2.0. Updated 2024

INTRODUCTION

In the intricate landscape of neonatal intensive care units (NICUs), every decision holds profound significance. Premature and critically ill new-borns necessitate meticulous medication management tailored to their unique physiology. In this high-stakes environment, healthcare professionals rely on a dependable resource for comprehensive drug information customized for neonatal patients.

Enter the NICU Drug Database, an updated version of our pioneering repository, meticulously designed to cater to the specialized needs of NICU healthcare providers. Crafted with precision and expertise, this new iteration stands as a beacon of knowledge, building upon the foundation of its predecessor and offering an expanded wealth of information on medications tailored specifically for neonatal use.

Navigating the complexities of neonatal pharmacotherapy can be daunting, with considerations ranging from dosage adjustments based on weight and gestational age to potential drug interactions and adverse effects unique to this vulnerable population. The NICU Drug Database mitigates this challenge by consolidating up-to-date, evidence-based data into an intuitive platform, empowering healthcare professionals to make informed decisions swiftly and confidently.

Whether it's a seasoned neonatologist, specialist, medical officer, a diligent pharmacist, or a vigilant nurse, the NICU Drug Database equips every member of the healthcare team with the tools necessary to optimize medication management and enhance patient outcomes in the NICU.

Special thanks to Department of Pharmacy Hospital Sungai Buloh, Pn Norharlina Binti Sulaiman (Head of Pharmacy Department), Dr Syamhanin Adnan (Head of Section for In-patient and Clinical Pharmacy), Ms Chong Pei Feng (Head of Clinical Pharmacy), Ms Michelle Ngai Wen Jing (previous NICU Pharmacist), and Ms Abby Ang (PRIC Pharmacist) for coordinating and reviewing the Drug Database. Also, many thanks to all the pharmacist colleagues who have helped to review this database.

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AGE TERMINOLOGY USED IN NICU

TERM	DEFINITION	UNIT OF TIME
Gestational Age (GA), or Menstrual Age (MA)	Time elapsed between the first day of the last normal menstrual period (LMP) and the day of delivery	Completed weeks
Post Natal Age (PNA) or Chronological Age (CA)	Time elapsed since birth (days of life)	Days, weeks, months, years
Post Menstrual Age (PMA)	Time elapsed between the first day of the last menstrual period and birth (gestational age) plus the time elapsed after birth (chronological age).	Weeks
Corrected Gestational Age Corrected age (CGA)	Chronological age reduced by the number of weeks born before 40 weeks of gestation; the term should be used only for children up to 3 years of age who were born preterm.	Weeks, month

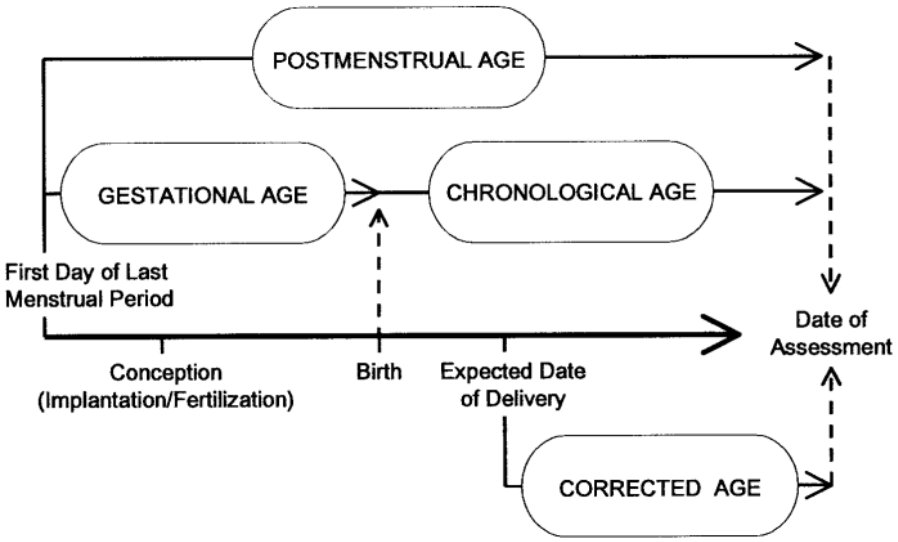

Fig 1. Age terminology during the perinatal period.

Reference:
(2004). Age Terminology During the Perinatal Period. PEDIATRICS, 114(5), 1362–1364. doi:10.1542/peds.2004-1915

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ACYCLOVIR (IV)

<table>
<tr><td>Drug Type</td><td>Antiviral</td></tr>
<tr><td>Indication</td><td>Treatment of neonatal herpes simplex virus (HSV) infection.
Treatment or prophylaxis of varicella zoster virus (VZV) infection.</td></tr>
<tr><td>Action</td><td>Pro-drug which is activated in virally infected cells and inhibits viral DNA synthesis</td></tr>
<tr><td>Presentation</td><td>250mg (Freeze dried powder) vial</td></tr>
<tr><td>Storage</td><td>Store below 30°C</td></tr>
<tr><td>Dose
Renal dose
Refer page 135</td><td>Treatment or Prophylaxis of Varicella Zoster Infections[3,4]
Duration: 5 days (if no vesicles developed): 7-10 days (if vesicles developed)
<table>
<tr><th>GA (weeks)</th><th>Dose (mg/kg/dose)</th><th>Interval (hour)</th></tr>
<tr><td>< 33</td><td>10-15</td><td>12</td></tr>
<tr><td>≥ 33</td><td>10-15</td><td>8</td></tr>
</table>
Herpes Simplex Virus Infections[2,4]
Duration of therapy:
For laboratory or clinically confirmed HSV confined to skin, eye, mouth:10–14 days.
For HSV encephalitis or disseminated disease: 21 days.
For pre-emptive therapy (high-risk asymptomatic infant without laboratory confirmed infection): 10 days (expert recommendation)
<table>
<tr><th>PMA (weeks)</th><th>Dose (mg/kg/dose)</th><th>Interval (hour)</th></tr>
<tr><td>< 30</td><td>20</td><td>8 -12</td></tr>
<tr><td>≥ 30</td><td>20</td><td>8</td></tr>
</table></td></tr>
<tr><td>Dilution</td><td>Reconstitute Acyclovir 250mg dry powder in 10ml of water for injection (concentration 25mg/ml.
Syringe out the required dose and further dilute with NS or D5% to a final concentration of 5mg/ml[2].</td></tr>
<tr><td>Administration</td><td>Intravenous infusion over 1 hour.</td></tr>
<tr><td>Stability after reconstitution</td><td><u>Zovirax</u>
Use immediately.
<u>Vaxcel Acyclovir</u>
Stable for 48 hours at room temperature. Do NOT refrigerate</td></tr>
<tr><td>Stability after dilution</td><td><u>Zovirax</u>
Stable for 12 hours at room temperature.
<u>Vaxcel Acyclovir</u>
Stable for 48 hours at room temperature. Do NOT refrigerate</td></tr>
<tr><td>Compatibility</td><td>Sodium Chloride 0.45%, Normal Saline
Compatible Via Y-Site: Amikacin, Ampicillin, Cefotaxime, Ceftazidime, Ceftriaxone, Cefazolin, Chloramphenicol, Clindamycin, Dexamethasone, Erythromycin, Fluconazole, Heparin Sodium, Hydrocortisone Sodium Succinate, Imipenem–Cilastatin, Linezolid, Lorazepam, Magnesium, Methylprednisolone Sodium Succinate, Metronidazole, Potassium Chloride, Ranitidine, Sodium Bicarbonate, Trimethoprim-Sulfamethoxazole, Vancomycin, Zidovudine</td></tr>
<tr><td>Incompatibility</td><td>TPN, D5%, D10%, Adrenaline (Epinephrine) Hydrochloride, Caffeine Citrate, Cefepime, Ciprofloxacin, Dobutamine, Dopamine, Gentamicin, Labetalol, Lidocaine (Lignocaine), Midazolam, Piperacillin–Tazobactam (EDTA-Free), Potassium Phosphate, Sodium Phosphate</td></tr>
<tr><td>Side Effects</td><td>There is an increased risk of renal impairment if there is concomitant use of other nephrotoxic drugs, pre-existing renal disease or dehydration.
The administration interval may be lengthened to minimize renal effects. Please refer to the renal adjustment dosing in page 140</td></tr>
<tr><td>Monitoring</td><td>Monitor BUN, Serum creatinine, urine output – ensure adequate hydration, infuseover longer period in the presence of renal compromise.
Phlebitis may occur at IV site – monitor IV site if phlebitis noted make infusionsolution</td></tr>
</table>

	more dilute. Even when mixed with compatible fluids, turbidity or crystallization may occur in the infusion fluid. Discard preparation if this occurs before or during the infusion.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Acyclovir (2021) 3) Malaysian Paediatric Protocol 4th Edition 2019 (Chapter 31): Perinatally Acquired Varicella 4) Neofax Neonatal Drug Database (Acyclovir). Product inserts Vaxcel Acyclovir, Zovirax

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ADENOSINE (IV)

Drug Type	Antiarrhythmic
Indication	Pharmacological conversion of supraventricular tachycardia
Action	Endogenous purine analogue with rapid onset antiarrhythmic action resulting intransient AV nodal block. It has a short half-life (1–10 seconds)
Presentation	6 mg/2 mL vial
Storage	Store below 30°C Protect from light. Do not refrigerate as crystallization may occur. (Product insert)
Dose	Dose range **0.1 to 0.3 mg/kg.** The initial recommended dose is 0.1 mg/kg but if AV block is not achieved within 2 minutes, further doses should be increased by 0.1 mg/kg aliquots to a maximum of 0.3 mg/kg.
Maximum daily doses	The first dose should not exceed 6 mg and the second dose 12 mg. If multiple doses are required within 24 hours, consult cardiologist to discuss further management
Dilution	Draw 1ml (3mg) and add 9ml NS to make the final concentration of 0.3mg/ml
Administration	Rapid IV Bolus 1-2 seconds at peripheral IV site closest to patient's heart followed by flushing the catheter with 5ml NS. It may be more effective if given close to the heart via central line administration[.12]
Stability after reconstitution	**Adenorythm, Adenocor** Does not require reconstitution. Use immediately. (Product insert)
Stability after dilution	**Adenorythm, Adenocor** Use immediately. Discard any unused portion. (Product insert)
Compatibility	Fluids: D5%, Hartmann's, NS
Incompatibility	Fluids and Y-site: No information.
Contraindications	Known hypersensitivity to adenosine; sick sinus syndrome, second- or third-degree AV block (except in patients with a functioning artificial pacemaker); long QT syndrome; severe hypotension; decompensated states of heart failure. Atrial fibrillation or flutter but can be useful to unmask atrial flutter.
Drug Interactions	Adenosine may interact with drugs that tend to impair cardiac conduction. Aminophylline, theophylline, and caffeine are competitive adenosine antagonists and should be avoided for 24 hours prior to the administration of adenosine
Side Effects	Very rare reactions (mostly reported in adults): atrial fibrillation; ventricular excitability including ventricular fibrillation and torsades de pointes; severe bradycardia not corrected by atropine and possibly requiring temporary pacing. Hypotension has been reported.
Monitoring	Adenosine should be used only where cardiac monitoring and cardiorespiratory resuscitation equipment is available for immediate use if necessary.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Adenosine (2021) 12) Paediatric Injectable Drugs 11th Editions. The Teddybear Book. ASHP Publications Product inserts Adenorythm, Adenocor

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ADRENALINE ACID TARTRATE (IV)

Drug Type	Vasopressor	
Indication	Treatment of hypotensive shock with or without myocardial dysfunction	
Action	Catecholamine with alpha- and beta-adrenergic actions. Haemodynamic effects are dose dependent: Doses of 0.01–0.1 microgram/kg/minute primarily stimulates cardiac and vascular beta 1- and beta 2-adrenoreceptors leading to increased inotropy, chronotropy, conduction velocity and peripheral vasodilation. Doses > 0.1 microgram/kg/minute adrenaline also stimulates vascular and cardiac alpha 1-receptors causing vasoconstriction and increased inotropy.	
Presentation	1 mg /ml (1:1000) ampoule Each ml contains Adrenaline Acid Tartrate 0.18% W/V (Product insert)	
Administration	Continuous IV infusion	
Storage	Store below 25°C.Protect from light.	
Dose	Low dose: **0.05–0.1 microgram/kg/minute** High dose: **0.1–1 microgram/kg/minute**	
Dilution	Dilute 3mg/kg of adrenaline in 50ml of D5%	1 ml/hr = 1microgram / kg/ min
Administration	Rapid IV Bolus 1-2 seconds at peripheral IV site closest to patient's heart followed byflushing the catheter with 5ml NS. It may be more effective if given close to the heart via central line administration[12]	
Stability after reconstitution	**CCM Adrenaline Injection** Does not require reconstitution (HSB Dilution Protocol).	
Stability after dilution	**CCM Adrenaline Injection** Stable for 24 hours in room temperature after dilution (HSB Dilution Protocol).	
Compatibility	Fluids: D5%, D10%, Hartmann's, NS. Stability Data Only Available for D5% For Very High Concentration. Y-Site: Amino Acid Solutions. Amiodarone, Dobutamine, Dopamine, Fentanyl, Glyceryl Trinitrate, Heparin Sodium, Milrinone, Morphine, Potassium Chloride, Ranitidine	
Incompatibility	Fluids: Sodium Bicarbonate, Sodium Chloride 0.45% Y-Site: Aciclovir, Aminophylline, Ampicillin, Atropine, Calcium Gluconate, Cefalotin, Chloramphenicol, Digoxin, Hydrocortisone Sodium Succinate, Phenobarbitone Sodium, Sodium Bicarbonate, Vancomycin. No Stability Data with Noradrenaline.	
Contraindications	Arrhythmia and tachyarrhythmia. Cardiovascular disease resulting in arterial narrowing including cerebrovascular disease, coronary artery disease and digital ischemia. Phaeochromocytoma. Thyrotoxicosis. Glaucoma. Known hypersensitivity to sympathomimetic amines.	
Side Effects	Tachycardia and arrhythmia. Systemic hypertension especially at higher doses. May cause hypokalaemia. Tissue necrosis at infusion site with extravasation. Digital ischemia.	
Monitoring	Continuous heart rate, ECG and blood pressure monitoring preferable.Assess urine output and peripheral perfusion frequently.	
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Adrenaline (Epinephrine) (2021) Product inserts CCM Adrenaline Injection	

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ALBUMIN/HUMAN ALBUMIN 5% (IV)

Drug Type	Blood product derivative
Indication	Hypovolaemia/shock with or without hypoalbuminaemia Albumin is not recommended as the initial resuscitating fluid in hypotensive infants.
Action	Albumin is involved in the maintenance of colloid osmotic pressure, binding and transport of plasma compounds (bilirubin, bile acids, long-chain fatty acids, thyroxin, vitamin D, calcium, magnesium, copper, zinc), renders some potential toxins harmless, is a carrier of nitric oxide and affects pharmacokinetics of many drugs. The half-life of albumin is about 19 days
Presentation	IV Human Albumin 5% (Albutein 5%-250ml)
Storage	Store below 30°C
Administration	IV Infusion over 30 minutes-1 hour[4] If refrigerated, allowed to reach room temperature before administration. Do not use if solution appear turbid or it there is sediment in the bottle.
Dose	IV Human Albumin 5%: Volume expander: **10ml/kg (0.5g/kg) over 30 minutes** [2,4]
Dilution	**In situations where IV Human Albumin 5% is not available,** **dilution of IV Human Albumin 20% (Albumex 20) to 5% can be performed.**[2] Albumex 20 can be diluted to albumin 5% prior administration. Dilute 1ml of Albumex 20 with 4ml of NS, D5%, or D10%. (Do not dilute with water as lower tonicity will lead to intravascular hemolysis). (Product leaflet Albumex 20)
Stability after reconstitution	**Albumin (Human) U.S.P. Albutein 5% Solution** Does not require reconstitution
Stability after dilution	**Albumin (Human) U.S.P. Albutein 5% Solution** Administer undiluted. Best use within 4 hours of opening. Discard unused portion after 4 hours.
Compatibility	D5%, D10%, NS
Incompatibility	Fat Emulsion, Amino Acid Solutions, Solutions Containing Alcohol or Solutions Containing Drugs That Bind to Albumin (E.G. Calcium Channel Blockers, Antibiotics and Benzodiazepines, Vancomycin)
Precautions	Low cardiac reserve.
Contraindications	History of allergy to albumin, severe anemia, or cardiac failure with normal or increased intravascular volume
Adverse reactions	Allergic reactions. Fever, chills, nausea, vomiting, tachycardia, hypotension. Reactions usually subside when infusion rate is slowed or stopped.[4] Management of adverse effects: stop infusion. If infusion is still needed, use material from a different batch/lot. Possible harms associated with albumin infusion in neonates include fluid overload (pulmonary oedema, impaired gas exchange, worsening oxygenation, chronic lung disease, patent ductus arteriosus, myocardial dysfunction especially for infants with birth asphyxia), neurological injury (cerebral oedema, intraventricular haemorrhage due to rapid bolus administration), salt loading and fluid retention
Monitoring	Continuous cardiorespiratory and temperature observations
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Albumin 5% (2023) 4) Neofax Neonatal Drug Database (Albumin 5%) Product inserts Albumin (Human) U.S.P. Albutein 5% Solution

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ALBUMIN/HUMAN ALBUMIN 20% (IV)

Drug Type	Blood product derivative
Indication	Hypoalbuminemia
Action	Albumin is involved in the maintenance of colloid osmotic pressure, binding and transport of plasma compounds (bilirubin, bile acids, long-chain fatty acids, thyroxin, vitamin D, calcium, magnesium, copper, zinc), renders some potential toxins harmless, is a carrier of nitric oxide and affects pharmacokinetics of many drugs. Albumin 20% is hyper-oncotic but hypo-osmotic (130 mOsm/kg) compared to human serum with a pH 6.7 to 7.3. The half-life of albumin is about 19 days
Presentation	IV Human Albumin 20% (Grifols 20% -50ml), (Albumex 20- 100ml)
Storage	Store 2- 25°C (Grifols 20% -50ml) Store below 30°C. (Albumex 20- 100ml) Protect from light.
Administration	IV Infusion over 2 - 4 hours If refrigerated, allowed to reach room temperature before administration. Do not use solutions which are cloudy or have deposits.
Dose	**IV Human albumin 20%:** Hypoalbuminemia/ fluid restricted**: 2.5- 5ml/kg/dose (0.5-1g/kg/dose) over 2- 4 hours**[2]
Stability after reconstitution	**Human Albumin Grifols 20%; Albumex 20** Does not require reconstitution.
Stability after dilution	**Human Albumin Grifols 20%; Albumex 20** Administer undiluted. Albumin solutions must not be diluted with WFI as they may cause haemolysis in recipients. Albumin solutions can be diluted in D5% or NS. Best use within 4 hours of opening. Discard unused portion after 4 hours.
Compatibility	NS, D5%, D10%
Incompatibility	Should not be mixed with protein hydrolysates, amino acid solutions, solutions containing alcohol or solutions containing drugs that bind to albumin (e.g. calcium channel blockers, antibiotics, and benzodiazepines.
Contraindications	History of allergy to albumin, or to any of the excipients.
Adverse reactions	Allergic reactions. Fever, chills, nausea, vomiting, tachycardia, hypotension. Reactions usually subside when infusion rate is slowed or stopped.4 Management of adverse effects: stop infusion, if infusion is still needed, use material from a different batch/lot. Possible harms associated with albumin infusion in neonates include fluid overload (pulmonary oedema, impaired gas exchange, worsening oxygenation, chronic lung disease, patent ductus arteriosus, myocardial dysfunction especially for infants with birth asphyxia), neurological injury (cerebral oedema, intraventricular hemorrhage due to rapid bolus administration), salt loading and fluid retention
Monitoring	Continuous cardiorespiratory and temperature observations. Monitor for electrolytes imbalance as human albumin 20% are relatively low in electrolytes compared to human albumin 4-5%.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Albumin 20% (2019) 4) Neofax Neonatal Drug Database (Albumin 20%) Product inserts Albumin (Human) U.S.P. Albutein 20% Solution

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ALPROSTADIL/ PROSTAGLANDIN E1 / PROSTIN VR PEDIATRIC® (IV)

Drug Type	Prostaglandin E1 or PGE1
Indication	For temporary maintenance of ductus arteriosus patency until corrective or palliative surgery can be performed in neonates with ductal-dependent congenital heart defects.
Action	Relaxes the ductus arteriosus in early postnatal life and supports its patency.
Presentation	500mcg/ml ampoule
Storage	Store at 2 – 8°C. Do not freeze.
Administration	Continuous IV infusion
Dose	**Initial dose: IVI: 10-50 nanogram /kg/min** (doses up to 100 nanogram/kg/min has been used)[2] **Maintenance dose: 3 - 20 nanogram/kg/min[2]** (Aim is to be on the lowest dose that safely maintains ductal patency)
Dilution	Dilute 15microgram/kg of Alprostadil in 50ml of D10% | 1ml/hr = 5nanogram/kg/ min
Stability after reconstitution	**Prostin VR Paediatric** Does not require reconstitution. Once opened in ward, syringed out alprostadil is stable for 5 days in the fridge. (NICU HSB consensus) In pharmacy aseptic unit, aseptically syringed out alprostadil in 1ml polyprophylene syringe is stable for 30 days in the fridge.[12] Undiluted Prostin may interact with plastic sidewalls or volumetric infusion causing a hazy looking solution. If this occurs, the solution should not be used.
Stability after dilution	**Prostin VR Paediatric** Diluted solution with NS, D5% stable for up to 24 hours at room temperature
Compatibility	Fluids: D5%, D10%, NS Y-Site: Amino Acid Solutions, Ampicillin; Cefazolin; Cefotaxime; Dobutamine; Dopamine; Fentanyl; Gentamicin; Methylprednisolone; Potassium Chloride; Vancomycin Syringe: Caffeine; Dobutamine; Dopamine; Adrenaline (Epinephrine); Fentanyl; Midazolam; Morphine.
Incompatibility	Y-Site: Levofloxacin
Adverse reactions	Apnea in 10-12% of neonate is frequent. Commencement of alprostadil ≤20 nanogram/kg/min and low maintenance dose reduces apnea incidence. Signs and symptoms generally appear during the first hour of drug infusion. Caffeine may be used to prevent or treat apnea. Fever (14%), flushing (10%), seizures (4%), bradycardia (7%). Apnea, bradycardia, pyrexia, hypotension, flushing may be signs of drug overdosage. If this occurs, discontinue the infusion, and provide medical treatment. (Product leaflet). Abdominal distension, bradycardia, enterocolitis, vomiting and skin rash. With prolonged use, skeletal changes and hypertrophic pyloric stenosis have been reported. Extravasation may cause tissue necrosis.
References	2) ANMF Consensus Group Alprostadil (Prostaglandin E1) 2019 12) Paediatric Injectable Drugs 11th Edition. The Teddybear Book. ASHP Publications Product insert Prostin VR Paediatric

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AMIKACIN (IV)

Drug Type	Antibacterial - aminoglycoside
Indication	Treatment of suspected or proven gram-negative infection resistant to other aminoglycosides. Used in combination with a beta-lactam antibiotic for sepsis in the newborn.
Action	Bactericidal agent which inhibits protein synthesis in susceptible bacteria.
Presentation	250mg / 2ml vial
Storage	Store below 30°C.
Administration	IV infusion over 60 minutes
Dose **Renal dose** **Refer page 135**	For 2 doses only in NICU.[2,4]

PMA (Weeks)	Postnatal (Days)	Dose (mg/kg)	Interval (Hours)
≤ 29	0 - 7	**14**	48
	8 - 28	**12**	36
	≥ 29	**12**	24
30 to 34	0 - 7	**12**	36
	≥ 8	**12**	24
≥ 35	ALL	**12**	24

Dilution	Dilute 1 ampoule of amikacin 250mg/2ml with 50ml of D5% or NS making a max concentration of amikacin 5 mg/ml. Syringe out the dose required and further dilute with normal saline to 3ml.
Stability after reconstitution	**Apalin** Does not require reconstitution
Stability after dilution	**Apalin** Stable for 24 hours in room temperature after dilution with NS or D5% at 0.25 and 5mg/ml concentration4 (Product insert) Stable for 60 days in fridge after dilution at 0.25 and 5mg/ml concentration4 (Product insert)
Compatibility	Fluids: D5%, D10%, NS, Amino Acid Solutions. Aciclovir, Amiodarone, Atropine, Calcium Gluconate, Cefotaxime, Ceftazidime, Ceftriaxone, Chloramphenicol, Dexamethasone, Digoxin, Dobutamine, Adrenaline (Epinephrine), Erythromycin, Fentanyl, Fluconazole, Furosemide(Frusemide), Gentamicin, Lidocaine(Lignocaine), Magnesium Sulfate, Midazolam, Milrinone, Morphine, Noradrenaline (Norepinephrine), Phenobarbital(Phenobarbitone), Piperacillin, Piperacillin-Tazobactam, Potassium Chloride, Propranolol, Ranitidine, Sodium Bicarbonate, Vancomycin, Zidovudine
Incompatibility	Fluids: No Information. Penicillins And Cephalosporins, Amphotericin, Azithromycin, Diazepam, Diazoxide, Folic Acid, Ganciclovir, Heparin, Ibuprofen, Insulin, Pentobarbital (Pentobarbitone), Phenytoin, Potassium Chloride, Sulfamethoxazole- Trimethoprim
Adverse effects	Transient and reversible renal tubular dysfunction. Increased urinary loss of sodium, calcium, and magnesium. Serious reactions include neuromuscular blockade with subsequent respiratory paralysis. Ototoxic and nephrotoxic.
Drug interactions	Penicillins: Aminoglycosides are inactivated by solutions containing Penicillins. Ensure line is adequately flushed between antibiotics.
Monitoring	Assess renal function. Routine therapeutic drug monitoring for ≤48 hours duration of therapy is not necessary unless renal function is impaired.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Amikacin (2024) 4) Neofax Neonatal Drug Database (Amikacin) Product inserts Apalin

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AMOXICILLIN + CLAVULANIC ACID/ CO-AMOXICLAV/ AUGMENTIN (IV)

Drug Type	Antimicrobial agent–Beta-lactam aminopenicillin and Beta-lactamase inhibitor combination
Indication	Directed treatment of susceptible bacterial infections covered by amoxicillin but producing beta-lactamase when amoxicillin alone is ineffective, including skin infection, ear infection, sinusitis, urinary tract infection, upper and lower respiratory tract infection, and animal bites
Action	Amoxicillin is a semi-synthetic penicillin and has a similar antibacterial spectrum as ampicillin. Clavulanate binds irreversibly with beta-lactamases produced by a variety of gram-positive and gram-negative microorganisms and protects amoxicillin from degradation. Thus, extending the spectrum of amoxicillin. Amoxicillin is better absorbed than ampicillin, following oral administration
Presentation	Amoxicillin 1000mg + Clavulanic acid 200mg (1200mg) vial (powder)
Storage	Store below 25°C. Protect from light.
Dose **Renal dose** **Refer page 135**	(Doses are based on **co-amoxiclav component)** Dose for neonate and infant less than 3 months old: **30mg/kg/dose (co-amoxiclav) 12 hourly**[8]
Dilution	Dilute 1200mg of Augmentin in 20ml WFI. (Product insert). Further dilute in NS to a final concentration of 10mg/ml.[2]
Administration	Slow IV bolus: 3-4 minutes within 20 minutes of reconstitution Infusion: 30 minutes
Stability after reconstitution	**Clavicin** Use within 20 minutes of reconstitution in room temperature.
Stability after dilution	**Clavicin** Use within 20 minutes of reconstitution in room temperature.
Compatibility	Diluents: NS, WFI, Hartmann's, Ringer's
Incompatibility	Fluids: D5% Drugs: Amikacin, Gentamicin, Amiodarone, Ciprofloxacin, Metronidazole, Sodium Bicarbonate.
Side Effects	Mucositis, oral candidiasis, mild to life-threatening Clostridium difficile-associated diarrhoea, life-threatening hepatic dysfunction, and skin rashes including Stevens- Johnson syndrome, Toxic epidermal necrolysis, and severe hypersensitivity reactions such as anaphylaxis have been reported
Contraindications	Hypersensitivity to Penicillins, Cephalosporins and Carbapenems. Previous history of jaundice/hepatic dysfunction associated with the combination of amoxicillin or clavulanic acid. Severe renal impairment (creatinine clearance less than 10 mL/minute)
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Amoxcillin Clavulanate (2020) 8) British National Formulary Children 2022-2023: Chapter 5 Bacterial Infection (page 392) Product insert Clavicin

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AMOXICILLIN + CLAVULANIC ACID/ CO AMOXICLAV/ AUGMENTIN (ORAL)

Drug Type	Antimicrobial agent–Beta-lactam aminopenicillin and Beta-lactamase inhibitor combination
Indication	Directed treatment of susceptible bacterial infections covered by amoxicillin but producing beta-lactamase when amoxicillin alone is ineffective; including skin infection, ear infection, sinusitis, urinary tract infection, upper and lower respiratory tract infection, and animal bites
Action	Amoxicillin is a semi-synthetic penicillin and has a similar antibacterial spectrum as ampicillin. Clavulanate binds irreversibly with beta-lactamases produced by a variety of gram-positive and gram-negative microorganisms and protects amoxicillin from degradation. Thus, extending the spectrum of amoxicillin. Amoxicillin is better absorbed than ampicillin, following oral administration
Presentation	Amoxicillin 200mg + Clavulanic Acid 28mg (228mg/5ml) (1:7)
Storage	Store below 25°C. Protect from light.
Dose	**(Doses are based on Amoxycillin component)** Neonates and Infants aged less than 12 weeks (less than 3 months): **15-20 mg/kg/dose every 12 hours** [2]
Dilution	Manufacturer's recommendations should guide reconstitution of the oral suspension as multiple brands of amoxicillin-clavulanate are available
Contraindications	Hypersensitivity to Penicillins, Cephalosporins and Carbapenems. Previous history of jaundice/hepatic dysfunction associated with the combination of amoxicillin or clavulanic acid. Severe renal impairment (creatinine clearance less than 10 mL/minute)
Side Effects	Mucositis, oral candidiasis, mild to life-threatening Clostridium difficile-associated diarrhoea, life-threatening hepatic dysfunction, and skin rashes including Stevens-Johnson syndrome, Toxic epidermal necrolysis, and severe hypersensitivity reactions such as anaphylaxis have been reported
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Amoxcillin Clavulanate (2020) Product insert

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AMPHOTERICIN B CONVENTIONAL (IV)

Drug Type	Polyene antifungal.
Indication	Treatment of invasive fungal infections by susceptible fungi including Candida spp., Aspergillus spp. and Cryptococcus species. Candida lusitaniae and A. terreus are resistant
Action	Fungicidal agent which works by binding with a cytoplasmic membrane ergosterol on the organism's surface, causing cell death by increasing cell membrane permeability.
Presentation	50 mg vial of amphotericin B powder It also contains sodium deoxycholate and sodium phosphate
Storage	Store at 2–8°C. Protect from light.
Administration	IV infusion over 2–6 hours. Reconstitute 1 vial amphotericin B 50mg with 10ml WFI (concentration of 5mg/ml). Further dilute with D5% (of pH above 4.2) to a final concentration of 0.1mg/ml. (Product leaflet). IV line must be flushed with D5% before and after the dose. Do NOT flush with NS, precipitation will occur. Do not infuse concentrations greater than 0.1 mg/mL through a peripheral line. Use a central venous catheter for 0.4 mg/mL concentration. Discard the solution on reconstitution if solution is not visibly clear or contains evidence of foreign particles.
Dose **Renal dose** **Refer page 135**	**0.5–1mg/kg/dose 24 hourly**. 0.5–0.7 mg/kg/dose 24 hourly is recommended for Candida urinary tract infections including renal tract fungal balls. 1mg/kg/dose daily is recommended for Aspergillus systemic infection. Liaise with ID specialists for further dose adjustments.
Stability after reconstitution	**Amphotericin B For Injection USP (Amphotret)** Stable for 7 days after reconstitution in 2–8°C
Stability after dilution	**Amphotericin B For Injection USP (Amphotret)** No data
Compatibility	Fluids: D5%. Y site: Zidovudine.
Incompatibility	Fluids: Sodium chloride 0.9%, Amino acid/glucose solution, lipid emulsion. Y Site: Not compatible with any medications commonly used in newborns. Do not mix with any medications.
Side Effects	Fever, shaking chills, hypotension, anorexia, nausea, vomiting, headache, tachypnoea are common 1 -3 hours after starting IV Infusion. These reactions are more severe with the first few doses of amphotericin B and usually diminishes with subsequent doses. (Product leaflet) Electrolyte derangements: Hypokalaemia, hypomagnesaemia, hyperkalaemia, hypocalcaemia. Renal: Elevated urea and creatinine, nephrogenic diabetes insipidus Haematological: Anaemia, leucopenia, thrombocytopenia. Thrombophlebitis at the injection site Gastrointestinal: Diarrhoea, vomiting, elevated liver enzymes. Skin rashes. Tachyarrhythmias, hypotension, hypertension and respiratory distress have been reported in adults. Overdosage causes cardio-respiratory arrest. Discontinue therapy immediately and monitor clinical status, supportive therapy as required.
Contraindications	Hypersensitivity to amphotericin B
Precautions	Amphotericin B (conventional) has variable pharmacokinetics in neonates and this may lead to unexpected treatment failure or toxicity. Administer under close clinical supervision during the initial dosing.

	Anaphylaxis and respiratory distress have been reported in adults (though not in neonates). Renal impairment: Risk of nephrotoxicity. Concomitant use of corticosteroids and corticotropin (ACTH) should be avoided.
Monitoring	Urine output. Full blood count (FBC) for anaemia and thrombocytopenia. Renal function (for elevated creatinine), electrolytes (for hypokalaemia) and liver function (for derangements of liver enzymes). Monitor serum concentrations of concomitant nephrotoxic drugs.
Special comments	The minimum infusion duration is 2 hours. The osmolality of amphotericin B –conventional at a concentration of 0.1 mg/mL has been reported as 265–314.8 mOsm/kg. If infusion-related, immediate reactions occur (e.g. fever, hypotension), duration of infusion may be increased to 6 hours. If total parenteral nutrition (TPN) or IV fluids are turned off during the infusion, consider monitoring of blood glucose. If amphotericin B–conventional is used for Candida urinary tract infection including instances of renal tract fungal balls, a dose of 0.5–0.7 mg/kg/dose daily is suggested. However, fluconazole may be a preferred agent in susceptible Candida urinary tract infections due to favorable pharmacokinetics and fewer side effects. Although amphotericin B formulations are known to cause nephrotoxicity and may cause hepatotoxicity, reducing the dose in these disease states is not currently recommended. If nephrotoxicity or hepatotoxicity is a significant concern, consider other antifungals
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Amphotericin B Conventional (2021) Product leaflet Amphotericin B for Injection USP

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AMPICILLIN (IV)

Drug Type	Antibacterial - Penicillin
Indication	Directed treatment of infections caused by susceptible gram positive e.g. Listeria monocytogenes, Streptococcus species, Enterococcus faecalis) and susceptible gram-negative bacteria (some strains of Escherichia coli, many strains of Haemophilus Meningitis, Neisseria Meningitides, Proteus mirabilis and Salmonellae). Empiric treatment of suspected early onset sepsis including meningitis, with an aminoglycoside
Action	Bactericidal – inhibits the synthesis of the bacterial cell wall. Ampicillin is hydrolysed by beta-lactamases and therefore not effective against penicillinase producing bacteria.
Presentation	500 mg vial (powder)
Strage	Store below 30°C. Protect from light.
Administration	Direct slow bolus injection (5-10 minutes) maximum rate of 100mg/min[2]. Higher doses should be diluted to 30mg/ml and infused over 30minutes.[12] Flush lines with normal saline before and after administration of ampicillin.
Dose **Renal dose** **Refer page 135**	Standard infection: **50mg/kg/dose[2]** Meningitis: **100mg/kg/dose[2]**

PMA (Weeks)	Postnatal (Days)	Interval (Hours)
≤ 29	0 – 28	12
	≥ 29	8
30-36	0 – 14	12
	≥ 15	8
≥ 37 to 44	0 – 7	12
	≥ 8	8
≥ 45	ALL	6

Dilution	Reconstitute Ampicillin 500mg in 10ml of water for injection (Concentration 50mg/ml). Syringe out the dose required. Further dilute with NS up to maximum final concentration of 30mg/ml.[2,12]
Stability after reconstitution	**Kampibiotic (Karnataka)** Use within 1 hour. Discard balance[9]
Stability after dilution	**Kampibiotic (Karnataka)** Single use only. No stability data [9]
Compatibility	Fluids: Ns. Y Site: Aciclovir, Heparin Sodium, Labetalol, Linezolid, Magnesium Sulfate, Morphine Sulfate, Pethidine, Potassium Chloride.
Incompatibility	Fluids: Glucose and Glucose Containing Solutions, Fat Emulsions. Y Site: Amino Acid Solutions, Adrenaline Hydrochloride, Aminoglycosides – Amikacin, Gentamicin, Aminophylline, Atropine, Dobutamine, Dopamine, Fluconazole, Ganciclovir, Metoclopramide, Midazolam, Sodium Bicarbonate
Side Effects	Hypersensitivity reactions: skin rash, pruritus, urticaria have been reported. Diarrhoea; CNS excitation or seizures with very large doses reported in adults; and prolonged bleeding time with repeated doses
Contraindications	Serious and fatal hypersensitivity reactions have been reported in patients. More likely to occur in individuals with a history of sensitivity to multiple allergens. (Product insert)
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus: Ampicillin (2021) 9) HSB Dilution Protocol 2020 12) Paediatric Injectable Drugs 11th Edition. The Teddybear Book. ASHP Publications. Product insert Kampibiotic (Karnataka),

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AMPICILLIN + SULBACTAM/ UNASYN (IV)

Drug Type	Antibiotic
Indication	Lower and upper respiratory tract infections; urinary tract infections and pyelonephritis; intraabdominal infections; bacterial septicemia; soft tissue, skin, bone and joint infections, gonococcal infections
Action	Active against a wide range of gram positive and gram-negative bacteria including Staphylococcus aureus and S. epidermidis; Streptoccus pneumoniae, Streptococcus faecalis and other Streptococcus sp; Haemophilus influenzae and parainfluenzae; Bramhamella catarrhalis; anaerobes including Bacteroides fragilis and related species; Escherichia coli, Klebsiella sp, Proteus sp, Moranella morganii, Citrobacter sp and Enterobacter sp, Neisseria meningitidis and Neisseria gonorrhoeae.
Presentation	Ampicillin 1000mg + Sulbactam 500mg (1500mg) powder vial
Storage	Store below 30°C .
Dose **Renal dose** **Refer page 135**	(Doses are based on Unasyn component) **Non- CNS infections:** **Prem neonate (1st week of life): 37mg/kg/dose (Unasyn) 12 hourly** (derived from 25mg/kg/dose of Ampicillin component) (Product leaflet) **Neonate (2nd week of life onwards): 50mg/kg/dose (Unasyn) 8 hourly** (derived from 33mg/kg/dose of Ampicillin component) (Product leaflet) **For Acinetobacter: 75mg/kg/dose (Unasyn) 8 hourly** (derived from 50mg/kg/dose of Ampicillin and 25mg/kg/dose of Sulbactam) Note: Max daily dose of Unasyn is limited by Sulbactam content **(Max: 80mg/kg/day Sulbactam)** (Product leaflet)
Dilution	Dilute one vial of 1500mg with 3.2ml WFI. (Product insert). Further dilute in NS, D5% to a final concentration of 30mg/ml.[12]
Administration	Infusion: 30 minutes
Stability after reconstitution	**Amsubac 1.5g** Single use only. Discard balance.
Stability after dilution	**Amsubac 1.5g** Single use only. Discard balance.
Compatibility	HSD5, D5%, NS[12] Cefepime, fluconazole, heparin, insulin, morphine, vancomycin.
Incompatibility	Amiodarone, ciprofloxacin.
Adverse Effects	Serious anaphylactic reactions have been reported. Thrombophlebitis and pain at the injection site may occur. A high percentage of patients with mononucleosis who receive ampicillin develop a skin rash. If allergic reaction occurs, drug should be discontinued.
Contraindications	Hypersensitivity to penicillin, patients with previous history of cholestatic jaundice or hepatic dysfunction associated with prior ampicillin/sulbactam use.
References	12)Pediatric Injectable Drugs (11th Edition) The Teddy Bear Book. ASHP Product insert Amsubac, Unasyn

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ATROPINE (IV)

Drug Type	Anticholinergic
Indication	Prevention of reflex bradycardia during elective endotracheal intubation. Premedication for intubation
Action	Competitively inhibits acetylcholine at muscarinic acetylcholine receptors, decreases the effects of the parasympathetic nervous system and increases the effects of the sympathetic nervous system. Increases heart rate with a peak effect in 2–4 minutes after IV administration. Salivary secretion and intestinal and gastric motor activity are decreased for up to 6 hours. Bronchial smooth muscle relaxes, decreasing airways resistance.
Presentation	1mg/ml ampoule.
Storage	Store below 30°C. Protect from light.
Administration	Rapid IV bolus. Slow IV injection may cause paradoxical bradycardia9
Dose	Bradycardia IV: **0.01- 0.03mg/kg/dose.** Dose can be repeated every 10 -15 mins to achieve desired effect, cumulative maximum dose of 0.04mg/kg[4] Premedication for intubation IV: **0.01-0.02 mg/kg/dose** over 1 minutes immediately prior to other premedications[4]
Dilution	Dilute 1mg of atropine with 9ml of WFI (concentration of 0.1mg/ml)[2]. Withdraw 0.1-0.2 ml/kg of this diluted solution.
Stability after reconstitution	**Pharmaniaga Atropine Sulphate** Does not require reconstitution
Stability after dilution	**Pharmaniaga Atropine Sulphate** Single use only. Discard any remaining
Compatibility	Fluids: NS. Y-Site: Adrenaline (Epinephrine), Amikacin, Aminophylline, Amiodarone, Calcium Gluconate, Cefazolin, Cefotaxime, Ceftazidime, Cefuroxime, Ceftriaxone, Chlorothiazide, Clindamycin, Dexamethasone, Digoxin, Dopamine, Dobutamine, Erythromycin, Fentanyl, Fluconazole, Folic Acid, Furosemide (Frusemide), Gentamicin, Glycopyrronium Bromide (Glycopyrrolate), Heparin, Hydrocortisone Sodium Succinate, Imipenem, Indomethacin, Insulin, Lidocaine (Lignocaine), Magnesium Sulfate Heptahydrate, Meropenem, Methadone, Metoclopramide Hydrochloride, Morphine Sulfate Pentahydrate, Midazolam, Naloxone, Benzylpenicillin, Phenobarbital (Phenobarbitone), Piperacillin, Potassium Chloride, Propranolol, Pyridoxine, Ranitidine, Theophylline, Vancomycin
Incompatibility	Y-Site: Ampicillin, Diazepam, Pantoprazole, Phenytoin, Sulfamethoxazole-Trimethoprim2, Noradrenaline Bitartrate, Sodium Bicarbonate. (PI)
Side Effects	Tachycardia, arrhythmia, hyperthermia, flushing, irritability, abdominal distension, oesophageal reflux with decreased oesophageal sphincter tone, decreased gut motility, urinary retention, dry mouth.
Monitoring	Continuous cardiorespiratory monitoring during administration; Monitor for temperature and abdominal distension.
Atropine toxicity	Atropine toxicity–treat anticholinergic symptoms with physostigmine (0.01–0.04 mg/kg/dose) by slow IV infusion
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Atropine (2021) 4) Neofax Neonatal Drug Database (Atropine) 9) HSB Dilution Protocol 2020 Product insert (PI) Pharmaniga Atropine Sulphate

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AZITHROMYCIN (ORAL/IV)

Drug Type	Antibiotic- macrolide
Indication	1) Pertussis – post-exposure prophylaxis and treatment 2) Chlamydial and Mycoplasma pneumonia >3 months of age
Action	Azithromycin inhibits protein synthesis by attaching to the 50S subunit of the bacterial ribosome in susceptible organisms. It exhibits bacteriostatic activity with higher potency than erythromycin against Ureaplasma isolates in vitro. Azithromycin inhibits neutrophil influx and chemoattractant/cytokine release in murine lung non-infectious, as well as pneumonia, injury models. It is preferentially concentrated in pulmonary epithelial lining fluid and alveolar macrophages
Presentation	Oral: 200mg/5ml (powder for suspension) IV: 500mg vial
Storage	Store below 30°C
Dilution	**Binozyt (Oral)** Reconstitute 8ml of water to make up to 15ml suspension. (Product insert) **Imexa** Reconstitute 9ml of water to make up to 20ml suspension. (Product insert) Can be taken with food. **IV:** Reconstitute 1vial in 4.8ml WFI (100mg/ml), withdraw 1ml and dilute up to 5ml (30mg/ml)
Dose	Pertussis – post-exposure prophylaxis and treatment: **10mg/kg/dose 24 hourly orally or IV for 5 days** [2,4] For >3 months of age, Chlamydial and Mycoplasma pneumonia: **10mg/kg/dose 24 hourly for day 1, then 5mg/kg/dose 24 hourly for day 2 – 5 [2].**
Stability	**Binozyt** Stable for 5 days < 30°C [15] **Imexa** Stable for 5 days < 30°C [15] IV: Reconstituted: 24 hours at Room Temperature After dilution: 24 hours at Room Temperature or 7 days refrigerated (2-8'c)
Side Effects	Nausea, vomiting, abdominal pain and diarrhoea (all less than erythromycin). Rare: Increased risk of hypertrophic pyloric stenosis with infants exposed 0-13 day of age compared to older infants. In general, the risk of dysrhythmias is increased when these agents are administered in combination with other drugs that prolong the QT interval. Increased liver enzymes, hepatitis, hepatic necrosis, hypersensitivity reactions
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Azithromycin (2022) 4) Neofax Neonatal Drug Database (Azithromycin) 15) Stability of Oral Suspensions or Syrups after Opening or Reconstitution 2020. Product Insert Binozyt, Imexa, Vaxcel Azithromycin, Azomax, Zithromax

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BCG VACCINE/ DEEP-FREEZE BCG VACCINE (INTRADERMAL)

Drug Type	Used for the prevention of tuberculosis
Indication	Attenuated strain of Mycobacterium bovis.
Presentation	Each ampoule contains 0.5 mg BCG (moisture weight) Each diluent contains 1 ml physiological saline
Storage	In fridge (2- 8° C)
Administration	Intradermal. Because of sensitivity to ultraviolet light, the vaccine must be protected from sunlight.
Dose	Children < 1 year old: **0.05ml stat at birth** Each ampoule contains 0. 5 mg BCG (moisture weight)
Reconstitution	Only reconstitute with the diluent supplied. After reconstituting, maximum concentration is 0.5mg/ml The diluent supplied is specially designed for use with this vaccine. Only this diluent may be used to reconstitute the vaccine. Do not use diluents from other types of vaccine or from other manufacturers. Using an incorrect diluent may result in damage to the vaccine and/or serious reactions to those receiving the vaccine
Stability after opening	Stable for 6 hours after reconstitution in the fridge. Discard after 6 hours of reconstitution.
Adverse Reaction	A local reaction is normal after BCG. A small tender red swelling appears at the site of the injection, which gradually changes to a small vesicle and then an ulcer in 2 - 4 weeks. The reaction usually subsides within two to five months and in practically all children leaves a superficial scar 2 - 10 mm in diameter.
Contraindication	Contraindicated in individuals with cell - mediated immune deficiency. Individuals known to be infected with human immunodeficiency virus (HIV), either non-symptomatic or symptomatic, should NOT receive BCG vaccine
References	Product Insert BCG Vaccine

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BERACTANT / SURVANTA® (INTRATRACHEAL)

Drug Type	Pulmonary surfactant
Indication	For the treatment of respiratory distress syndrome
Action	Lowers surface tension on alveolar surfaces during respiration and stabilises the alveoli against collapse at resting transpulmonary pressures.
Presentation	200mg of phospholipid/8 mL vial
Storage	In fridge 2-8° C. Protect from light. Unopened, unused vials that have warmed to room temperature can be returned to the fridge within 8 hours of warming for future use. Drug should not be warmed and returned to the fridge more than once.
Administration	Intratracheal administration only. Gentle swirling of the vial for redispersion of suspension. Do NOT shake. Visible flecks in the suspension and foaming at the surface are normal Before administration, Survanta should be warmed by standing at room temperature for at least 20 minutes or warmed in the hand for at least 8 minutes. Do NOT use artificial warming methods.
Dose	**4ml/kg** [3,6] (Dose may be repeated every 6 hours if required, up to 4 doses)[2,6]
Reconstitution	Does not require reconstitution.
Stability after opening	Once opened, Beractant can be used within 24 hours if kept in the fridge. (NICU Consensus) Discard balance after 24 hours.
Side effects	Transient: Bradycardia occured with 11.9% of doses in the multiple dose group. Oxygen desaturation occured with 9.8% of doses. Other reactions that occurred with <1% of doses included endotracheal tube reflux, pallor, vasoconstriction, hypotension, hypocarbia, hypercarbia, and apnea. (Product insert) These events require stopping beractant administration and taking appropriate measures to alleviate the condition. Once patient is stable, dosing may proceed with appropriate monitoring). Ventilator settings may need to be adjusted post-surfactant to accommodate increased lung compliance2.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Beractant (2020) 3) Malaysian Paediatric Protocol 4th Edition 2019, Chapter 18, Guidelines for the use of Surfactant, page 118 4) Neofax Neonatal Drug Database (Beractant) 6) Surfactant for meconium aspiration syndrome in term and late preterm infants (Review)Amr I El Shahed, Peter A. Dargaville, Arne Ohlsson, Roger Soll. The Cochrane Collaboration. DOI: 10.1002/14651858.CD002054.pub3 Product insert Survanta®

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BENZYLPENICILLIN/ PENICILLIN G (IV)

<table>
<tr><td>Drug Type</td><td>Antibacterial - Penicillin</td></tr>
<tr><td>Indication</td><td>Empiric treatment of early onset sepsis (in combination with an aminoglycoside)
Directed treatment of infection due to a susceptible bacterium
Treatment of meningitis due to a susceptible bacterium, including Group B Streptococcus (GBS)
Treatment of congenital syphilis</td></tr>
<tr><td>Action</td><td>Bactericidal agent which inhibits cell wall synthesis.</td></tr>
<tr><td>Presentation</td><td>1,000,000 units powder vial
(1 mega unit or equivalent to 600mg of benzylpenicillin sodium) Each vial contains 1.68 mmol of sodium. (Product Insert)</td></tr>
<tr><td>Storage</td><td>Store below 30°C.</td></tr>
<tr><td>Administration</td><td>IV infusion over 30-60 minutes (recommended for meningitis doses over 60 mins),
Give one hour prior to the administration of aminoglycoside. Flush line well.</td></tr>
<tr><td>Dose
Renal dose
Refer page 135</td><td>Sepsis: 100,000U / kg /dose
<table>
<tr><th>PMA (Weeks)</th><th>Postnatal (Days)</th><th>Interval (Hours)</th></tr>
<tr><td>≤ 29</td><td>0 - 28
≥ 29</td><td>12
8</td></tr>
<tr><td>30 to 36</td><td>0 - 14
≥ 15</td><td>12
8</td></tr>
<tr><td>≥ 37 to 44</td><td>0 - 7
≥ 8</td><td>12
8</td></tr>
<tr><td>≥ 45</td><td>ALL</td><td>6</td></tr>
</table>
Congenital syphilis: 50,000 U / kg /dose 12 hourly IV for 7 days, then
if CSF VDRL is negative: 50,000 U/ kg/dose 8 hourly for another 3 days.
if CSF VDRL is positive: 50,000 U/ kg/dose 8 hourly for another 7 days.[3]

GBS Meningitis: 100,000U /kg /dose 6 hourly (NICU HSB Consensus)
Derived from: Total daily dose.
1st week of life: 250,000 U - 450,000 U /kg/ day in divided doses every 8 hours. 2nd week of life: 450,000U - 500,000U /kg/ day in divided doses every 6 hours [4.]

Duration of therapy 14 days for uncomplicated meningitis, may increase duration for prolonged or complicated course).</td></tr>
<tr><td>Dilution</td><td>IV infusion: Reconstitute 1 mega unit with 5mls WFI to make 200,000 units/ml.
solution. Final concentration for IV infusion is 100,000 units to 500,000 units/ml 4. Infuse over 30-60 minutes.</td></tr>
<tr><td>Stability after reconstitution</td><td>Bepen Injection 1MU (Karnataka)
Stable for 2 days at room temperature.
Stable for 6 days in fridge 2 – 8°C.</td></tr>
<tr><td>Stability after dilution</td><td>Bepen Injection 1MU (Karnataka)
No data</td></tr>
<tr><td>Compatibility</td><td>Fluids: D5%, D10% And NS.
Y Site: Amino Acid Solutions and Fat Emulsions. Acyclovir, Amikacin, Amiodarone, Caffeine Citrate, Calcium Gluconate, Cefotaxime, Chloramphenicol, Clindamycin, Dopamine, Fluconazole, Furosemide, Gentamicin, Heparin, Hydrocortisone Succinate, Lidocaine, Magnesium Sulfate, Metronidazole, Morphine, Prostaglandin E1, And Sodium Bicarbonate[2,4]</td></tr>
<tr><td>Incompatibility</td><td>Y-Site: Aminoglycosides –Amikacin, Gentamicin, Aminophylline, Amphotericin B, Dobutamine, Erythromycin, Ganciclovir, Labetalol, Noradrenaline, Phenobarbitone[2,4]</td></tr>
<tr><td>Side Effects</td><td>Allergy. Note hypersensitivity to penicillin has not been reported in neonates. Bone</td></tr>
</table>

	marrow suppression, granulocytopenia and hepatitis are rare. Significant CNS toxicity including seizures may occur with high doses and rapid infusions
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Benzylpenicillin (2024) 3) Paediatric Protocol 4th Edtion 2019, Chapter 30 Congenital Syphillis, page 169 4) Neofax Neonatal Drug Database (Benzylpenicillin) Product insert Bepen Injection 1MU (Karnataka)

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CAFFEINE BASE (ORAL)

Drug Type	Central nervous system stimulant, respiratory stimulant
Indication	Treatment of apnoea of prematurity.
Action	Competitive inhibition of the actions of adenosine at cell surface receptors. Enhancement of respiratory effort and regularisation of breathing patterns through stimulation of central inspiratory drive and increased sensitivity of chemoreceptors to carbon dioxide. Increase in respiratory centre output, smooth muscle relaxation and cardiac output. Improvement in the contractility of the diaphragm and hence increasing the force of contraction and decreasing muscular fatigue
Presentation	10mg/ml Caffeine Base (Extemporaneous Pharmacy preparation)
Storage	In fridge (2 - 8°C) Protect from light.
Administration	Oral, with feeds to avoid gastric irritation
Dose	Caffeine base 1mg = Caffeine citrate 2mg Dosing in NICU HSB is based on Caffeine base. Loading dose: **10mg/kg/day of caffeine base** Maintenance dose 24 hours after LD: **2.5- 5mg/kg/day4 of caffeine base**
Stability	Stable in fridge (2 - 8°C) for 30 days11
Monitoring	Heart rate, number and severity of apnoea episodes and assess for agitation. Consider withholding dose if HR > 180 bpm. Cardiorespiratory monitoring should continue for at least 5-7 days after the cessation of caffeine treatment for apnoea.
Special notes	Half-life in neonates: 72–96 hours (range 40–230 hours decreasing with advancing corrected gestational age). Time to peak serum concentration: Within 30 minutes to 2 hours in oral administration. Caffeine may not reach subtherapeutic levels until 11 to 12 days post cessation
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Caffeine (2022) 4) Neofax Neonatal Drug Database (Caffeine) 11) MOH Formulary Extemporaneous 2015 page 18

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CALCIUM CARBONATE (ORAL)

Drug Type	Calcium Supplementation
Indication	Oral calcium supplement to prevent / treat calcium deficiency. Asymptomatic hypocalcaemia.
Action	Calcium is essential for the functional integrity of the nervous, muscular, skeletal and cardiac systems and for clotting function
Presentation	Calcium carbonate 500mg tablet (200mg elemental Calcium)
Storage	Store below 30°C
Administration	Oral. Administer with feeds. Do not mix with any medication that contains phosphates, sulfates or tartrates. Separate doses of the following by at least 2 hours: phosphate, iron, thyroxine, and phenytoin
Dose	**12.5mg - 50mg/kg/dose TDS - QID of oral Calcium Carbonate [4]** (Total daily dose: 50mg - 200mg/kg/day of $CaCO_3$ equivalent to 20- 80 mg/kg/day of elemental calcium, in 2-4 divided doses [4] Calcium carbonate contains 40% of elemental calcium (500mg of Calcium Carbonate = 200mg elemental Calcium)
Stability	Freshly prepared. Discard balance of the preparation.
Monitoring	Monitor calcium, phosphate and magnesium. Measurement of ionised calcium preferred over total calcium. Correct hypomagnesaemia if present
Contraindication	Caution in patients with renal or cardiac impairment
Adverse effects	Nephrolithiasis with long term use. Gastric irritation, diarrhoea and NEC have occurred during oral therapy with hyperosmolar preparations.
References	2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Calcium Oral (2020) 4) Neofax Neonatal Drug Database (Calcium Carbonate)

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CALCIUM GLUCONATE 10% (IV)

Drug Type	Mineral
Indication	Cardiac arrest due to hypocalcaemia, hyperkalaemia, magnesium toxicity or calcium channel blocker overdose. Asymptomatic or symptomatic hypocalcaemia.
Action	Calcium is essential for the functional integrity of the nervous, muscular, skeletal and cardiac systems and for clotting function. It antagonises the cardiotoxic effects (arrhythmias) of hyperkalaemia, hypermagnesaemia and calcium channel blockers
Presentation	Calcium gluconate 10% (940mg /10ml) (940mg Calcium gluconate = 2.26mmol Ca) in 10ml, 94mg/ml or 0.226mmol/ml
Storage	Store below 30°C.
Dose	**Cardiac arrest due to hypocalcaemia, hyperkalaemia, magnesium toxicity or calcium channel blocker overdose.** **0.5ml / kg/ dose** (50mg/ kg/ dose of calcium gluconate 10%)[1] Prepare 1:1 dilution of Calcium Gluconate 10% with NS or D5%[2] Slow IV Injection over 5-10 minutes via central line[2,4] Administration via central line (if possible). If no central access, give via a peripheral line (large vein)2. This is to avoid hypercalcemia, extravasation, and necrosis.[4] IV rate should be < 50mg/min (Product insert) **Acute treatment of neonatal symptomatic hypocalcemia.** **0.5 - 1ml/ kg /dose** (50-100mg/ kg /dose of calcium gluconate 10%)[1,4,12] Prepare 1:1 dilution of Calcium Gluconate 10% with NS or D5%[2] Can be given 6-8 hourly.[12] Slow IV infusion over 30 minutes[2] Not for IM administration.
Stability after reconstitution	B. Braun Does not require reconstitution.
Stability after dilution	B.Braun After dilution with NS or D5%, stable in the fridge for 24 hours. Use immediately after dilution at room temperature. Do not use it if discoloured, cloudy, turbid or if a precipitate is present. (Product insert).
Compatibility	Fluids: D5%, D10%, NS. Y-site: amikacin, amiodarone, ampicillin, cefepime, chloroamphenicol, furosemide, heparin sodium, hydrocortisone sodium succinate, labetalol, midazolam, milrinone, netilmicin, penicillin G, phenobarbitone, piperacillin-tazobactam (EDTA-free), potassium chloride, vancomycin[2,4]
Incompatibility	Fluids: TPN (phosphate content will precipitate with calcium)[12] Y-site: Adrenaline (epinephrine) tartrate, ceftriaxone, clindamycin, dexamethasone, dobutamine, fluconazole, meropenem, methylprednisolone, sodium bicarbonate, carbonate, magnesium, phosphate, and sulfate salts.[2,4] Do not mix with any medication that contains oxidizing agents, citrates, phosphates, carbonates, bicarbonates, oxalates, sulfates or tartrates. Ensure IV calcium is administered at a different time to phosphates, carbonates, sulfates or tartrates (precipitates can occur).
Side Effects	Rapid administration is associated with bradycardia or cardiac standstill. Cutaneous necrosis or calcium deposition occurs with extravasation[2]. Fatality in neonates has occurred when coadministered IV calcium and ceftriaxone together.[4]
Monitoring	Continuous ECG monitoring to monitor heart rate and rhythm (stop infusion if HR < 100 bpm). Measurement of ionised calcium preferred over total calcium.

	Blood gas machines measure ionised calcium directly and are more accurate than the main pathology laboratory which calculates the ionised calcium from a complex formula. Observe IV tubing for precipitates. Observe IV insertion site for extravasation. Correct hypomagnesaemia if present.[2,4]
Contraindications/ Precautions	Calcium gluconate should not be used during CPR when ventricular fibrillation or hypercalcemia is present or in patients with the risk of existing digitalis[4] Caution when used in renal impairment.[4]
References	1)Frank Shan Paediatric Drug Dosing 17th Edition, 2017 2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Calcium Gluconate (2022) 4) Neofax Neonatal Drug Database (Calcium Glocunate) Advanced paediatric life support. 6th Edition. UK, Appendix G: Formulary, page 337 12) Pediatric Injectable Drugs (11th Edition) The Teddy Bear Book. ASHP Product insert Calcium Gluconate 10% B. Braun

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CALCIUM POLYSTYRENE SULFONATE/ KALIMATE® (RECTAL)

Drug Type	Cation Exchange Resins
Indication	Hyperkalaemia
Presentation	5g per sachet
Storage	Store below 25°C. Protect from light.
Administration	**Only via rectal route in neonates.** Dilute 1 packet 5g of Calcium Polystyrene Sulfonate with 25ml WFI8. Syringe out the required dose and administer through ryles tube inserted rectally. Irrigate colon to remove resin after 8 – 12 hours.[8]
Dose	Rectal: **0.125-0.25g/kg/dose** 6 hourly[3] / **0.3-0.6g/kg/dose** [1]
Stability after opening	Discard balance. Freshly prepared.
Contraindication	Reduced gut motility in neonates, hyperparathyroidism, metastatic carcinoma, multiple myeloma, obstructive bowel disease
Precautions	Impaction of resin with excessive dosage or inadequate dilution[8]
Adverse reaction	Appetite decreased, constipation, (discontinue—avoid magnesium-containing laxatives), diarrhoea, electrolyte imbalance, epigastric discomfort, gastrointestinal necrosis (in used with sorbitol), hypercalcaemia (in dialysed patients and occasionally in those with renal impairment), increased risk of infection, nausea, vomiting.8
References	1) Frank Shan Drug Doses 17th Edition, 2017. 3) Paediatric Protocol 4th Edition 2019. Chapter 65: Acute Kidney Injury. Page 344 8) British National Formulary for Children 2022-2023. Chapter 9: Fluid and Electrolytes imbalance Page 678

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CALFACTANT/ INFASURF® (INTRATRACHEAL)

Drug Type	Extract of natural surfactant from calf lungs which includes phospholipids, neutral lipids, and hydrophobic surfactant-associated proteins. Off white suspension of Calfactant in 0.9% normal saline solution.
Indication	Infants ≤ 72 hours of age for the treatment of *Respiratory Distress Syndrome* (Confirmed by clinical and radiological findings) and requiring endotracheal intubation
Action	Calfactant modifies alveoli surface tension thereby stabilizing the alveoli.
Presentation	6ml per vial (1ml contains 35mg of total phospholipids)
Storage	In fridge 2-8° C Unopened, unused vials that have warmed to room temperature can be returned to the fridge within 24 hours for future use. Infasurf should not be returned to the fridge more than once.
Administration	Intratracheal administration only. Gentle swirling of the vial for redispersion of suspension. Do NOT shake. Visible flecks in the suspension and foaming at the surface are normal Warming of Infasurf before adminstration is not necessary.
Dose	**3ml/kg/dose** [3,4] Dose can be repeated after 12 hours for up to 3 doses.[4] In Infasurf® vs Survanta® treatment trial, repeat doses were administered as early as 6 hours after the previous dose for total up to 4 doses if the infant was still intubated and required FiO2 >30% to maintain SPO2 80%. (PI)
Stability after opening	Once opened, Infasurf can be used within 24 hours if kept in the fridge. (NICU concensus) Discard balance after 24 hours.
Adverse effects	Transient episodes of reflux of Infasurf into endotracheal tube, cyanosis, bradycardia, or airway obstruction have occurred during the dosing procedures
References	3)Malaysian Paediatric Protocol 4th Edition 2019, Chapter 18, Guidelines for the use of Surfactant, page 118 4) Neofax Neonatal Drug Database (Calfactant) Product Insert (PI) Infasurf®

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CAPTOPRIL (ORAL)

Drug Type	ACE inhibitor
Indication	Heart failure
Action	Blocks conversion of angiotensin 1 to angiotensin II, a potent vasoconstrictor. Decreases plasma and tissue concentrations of angiotensin II and aldosterone, and increases plasma and tissue renin activity.
Presentation	1mg/ml (Extemporaneous Pharmacy preparation)
Storage	In fridge (2 - 8°C) Protect from light11
Administration	Oral, 1 hour before feeds Food decrease absorption
Dose	Initial dose: **0.01mg/kg/dose 12 hourly** Heart failure: **0.1-0.5mg/kg/dose 8 hourly** [4]
Stability	Stable for 30 days in fridge (2 - 8°C)[11.]
Monitoring	Blood pressure, renal function, serum potassium. Neonates are more sensitive to effects of captopril than older infants.
Contraindication	Contraindicated in patients with bilateral renovascular disease or with unilateral renal artery stenosis in a solitary kidney as the loss of adequate renal perfusion could precipitate acute renal failure
References	4) Neofax Neonatal Drug Database (Captopril) 11) MOH Formulary Extemporaneous 2015 page 19

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CEFAZOLIN (IV)

Drug Type	Antibiotic
Indication	Infection due to susceptible organism, gram positive bacteria (Streptococci and susceptible Staphylococci)
Action	First-generation cephalosporin which is active against most gram-positive organisms (including group B streptococcus and Staphylococcus Aureus)
Presentation	1g Cefazolin powder vial
Storage	Store at room temperature below 25°C. Protect from light
Dose [4]	See table below
Dilution	For slow bolus: Reconstitute 1 vial (1g) up to 10ml water for injection (100mg/ml). Take required dose, undiluted IV Infusion: Reconstitute 1 vial (1g) up to 10ml water for injection (100mg/ml). Draw up 1 mL (100 mg) and make up to 5 mL total volume with appropriate diluent (20 mg/ml). Take required dose. IM : Use concentration of 225mg/ml (maximum concentration 330mg/ml)[4]
Administration	Slow bolus: 3-5 minutes at 100mg/ml IV infusion: 20 mg/mL • Infuse via syringe driver pump over 30 minutes (10 to 60 minutes).
Stability after dilution	12 hours at Room temperature 24 hours at 2-8'c
Compatibility	Fluids: Glucose 5%, Glucose 10%, Sodium Chloride 0.9%, Water for Injection
Incompatibility	IV Aminoglycoside antibiotics, including Gentamicin, are inactivated by IV cephalosporins, Penicillins and Teicoplanin. Ensure lines are adequately flushed between antibiotics.
Adverse effects	Common: Diarrhea, pain and inflammation at the injection site, clostridium difficile-associated disease Serious: anaphylaxis, thrombocytopenia Hypothrombinaemia has been associated with cefazolin. This may affect bleeding and clotting times.
References	4) Neofax Neonatal Drug Database (Cefazolin) 17) Women and Newborn Health Service (Western Australia) Cefazolin

PMA (weeks)	Postnatal Age (days)	Dose	Interval (hours)
≤29	0 to 28 >28	**25mg/kg/dose**	12 8
30 to 36	0 to14 >14		12 8
37 to 44	0 to 7 >7		12 8
≥45	ALL		6

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CEFEPIME (IV)

Drug Type	Antibacterial
Indication	Treatment of infections with serious gram-negative organisms including extended spectrum beta-lactamase (ESBL) producing E. coli and Klebsiella species and Enterobacteriaceae, Pseudomonas species, Citrobacter species and Serratia species Experience with the use of Cefepime in neonates is limited.
Action	Fourth-generation cephalosporin with broad-spectrum activity against gram-negative and gram-positive bacteria. Active against methicillin sensitive staphylococcus aureus and streptococcus pneumoniae. Inhibits bacterial cell wall synthesis by binding to penicillin-binding proteins.
Presentation	1g powder vial
Storage	Store below 30°C. Protect from light
Administration	IV slow bolus IV infusion over 30 minutes
Dose **Renal dose** **Refer page 135**	**Term and preterm infants > 28 days:** 50mg/kg 12hourly[4] **Term and preterm infants ≤ 28 days**: 30mg/kg 12hourly[4] **Meningitis, severe infections due to Pseudomonas aeruginosa or Enterobacter:** 50mg/kg 12 hourly[4]
Dilution	Reconstitute with 10ml WFI, D5%, or NS to make a concentration of 90mg/ml. Further dilute with NS or D5% to make up to final concentration of 1 - 40mg/ml. Infuse over 30 minutes. (Product insert)
Stability after reconstitution	**Cefmex** No data after reconstitution.
Stability after dilution	**Cefmex** Stable for 48 hours in fridge (2-8°C) after dilution with NS, D5% (concentration of 1 - 40mg/ml) (Product insert).
Compatibility	Fluids: D5%, D10%, NS. Y Site: Amikacin, Ampicillin, Calcium Gluconate, Dexamethasone, Fluconazole, Furosemide, Gentamicin, Heparin, Hydrocortisone Succinate, Imipenem/Cilastatin, Methylprednisolone, Metronidazole, Milrinone, Piperacillin-Tazobactam, Potassium Chloride, Ranitidine, Sodium Bicarbonate, Trimethoprim/Sulfamethoxazole, Zidovudine
Incompatibility	Acyclovir, Aminophylline, Amphotericin B, Diazepam, Dobutamine, Dopamine, Erythromycin, Magnesium Sulphate, Metoclopramide, Midazolam, Morphine, Phenytoin, Vancomycin
Contraindications	Hypersensitivity to cefepime or other cephalosporins or previous history of major allergic response to a Penicillin
Precautions	Liver and renal disease.
Adverse effects	GI and hypersensitivity reactions: diarrhoea, nausea, vomiting, colitis (including pseudo-membrane colitis- consider this if the patient develops diarrhoea after use of the antibiotic) Hypersensitivity reactions: rash, pruritus, urticaria Elevated hepatic transaminases, transient elevations of BUN and creatinine. Leukopenia, neutropenia. Superinfection following prolonged use
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Cefepime (2020) 4) Neofax Neonatal Drug Database (Cefepime) Product insert Cefmex

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CEFOTAXIME (IV)

<table>
<tr><td>Drug Type</td><td>Antibacterial</td></tr>
<tr><td>Indication</td><td>As part of therapy for suspected meningitis. Treatment of proven meningitis and sepsis caused by susceptible organisms (e.g E.coli, H. influenzae, Klebsiella spp.)</td></tr>
<tr><td>Action</td><td>Bactericidal agent which inhibits cell wall synthesis in susceptible bacteria.
Broad spectrum against gram positive and many gram-negative organisms but not Pseudomonas species.</td></tr>
<tr><td>Presentation</td><td>500mg powder vial</td></tr>
<tr><td>Storage</td><td>Store 15 - 30°C. Protect from light</td></tr>
<tr><td>Administration</td><td>IV slow bolus, IV infusion over 30 minutes</td></tr>
<tr><td>Dose
Renal dose
Refer page 135</td><td>Sepsis: 50mg/kg/dose[2,4]
<table>
<tr><th>PMA (Weeks)</th><th>Postnatal (Days)</th><th>Interval (Hours)</th></tr>
<tr><td>< 30</td><td>0 – 28
≥ 29</td><td>12
8</td></tr>
<tr><td>30 to 36</td><td>0 – 14
≥ 15</td><td>12
8</td></tr>
<tr><td>37</td><td>0 – 7
≥ 8</td><td>8
6</td></tr>
</table>
Meningitis: 50mg/kg/dose[4]
<table>
<tr><th>Postnatal (Days)</th><th>Interval (Hours)</th><td rowspan="3">Consider longer intervals for VLBW (≤2kg)[4]</td></tr>
<tr><td>0 - 7</td><td>8 - 12</td></tr>
<tr><td>≥8</td><td>6 - 8</td></tr>
</table></td></tr>
<tr><td>Dilution & Administration</td><td>Reconstitute 500mg of cefotaxime with 10mls of WFI making the solution to 50mg/ml4.
IV slow bolus: For IV bolus, a concentration of 50 -100mg/ml may be used. Draw out the required volume. IV slow bolus over 3 - 5 minutes [4]
IV Infusion: Further dilute with NS or D5% to make a final concentration 10 - 40mg/ml. Infuse over 30 minutes [4]</td></tr>
<tr><td>Stability after reconstitution</td><td>Rekaxime
Stable for 24 hours in fridge 2 - 8ºC or room temperature. [8]</td></tr>
<tr><td>Stability after dilution</td><td>Rekaxime
No data. [8]</td></tr>
<tr><td>Compatibility</td><td>Fluids: D5%, D10%, Hartmann’s, NS. Y Site: Amino Acid Solutions, Aciclovir, Magnesium Sulfate, Midazolam, Morphine Sulfate, Pethidine</td></tr>
<tr><td>Incompatibility</td><td>Fluids: Alkaline Solutions E.G., Containing Sodium Bicarbonate.
Y Site: Aminoglycosides – Amikacin, Gentamicin, Azithromycin, Dobutamine, Fluconazole, Ganciclovir, Phenobarbitone, Sodium Bicarbonate,</td></tr>
<tr><td>Contraindications</td><td>Hypersensitivity to cefotaxime or other cephalosporins or previous history of major allergic response to a penicillin</td></tr>
<tr><td>Precautions</td><td>Liver and renal disease. Sodium restriction–cefotaxime contains 48.2 mg/g (2.1 mmol/g) sodium</td></tr>
<tr><td>Adverse Effects</td><td>Rash, phlebitis, diarrhoea, and candidiasis. Vomiting, abdominal discomfort, headache, allergic reactions, leucopenia, eosinophilia.</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Cefotaxime (2020)
4) Neofax Neonatal Drug Database (Cefotaxime)
8) HSB Dilution Protocol, 2020
Product insert Rekaxime</td></tr>
</table>

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CEFTAZIDIME (IV)

<table>
<tr><td>Drug Type</td><td>Antibacterial</td></tr>
<tr><td>Indication</td><td>Treatment of meningitis and sepsis caused by susceptible gram-negative organisms (especially Pseudomonas aeruginosa) and susceptible gram-positive organisms.</td></tr>
<tr><td>Action</td><td>Bactericidal agent which inhibits cell wall synthesis in susceptible bacteria.</td></tr>
<tr><td>Presentation</td><td>2g dry powder vial</td></tr>
<tr><td>Storage</td><td>Store below 30°C. Protect from light</td></tr>
<tr><td>Administration</td><td>IV slow bolus, IV infusion over 30 minutes</td></tr>
<tr><td>Dose
Renal dose
Refer page 135</td><td>Standard dose: 30mg/kg/dose[2,4]
<table>
<tr><th>PMA (Weeks)</th><th>Postnatal (Days)</th><th>Interval (Hours)</th></tr>
<tr><td>≤ 29</td><td>0 – 28
≥ 29</td><td>12
8</td></tr>
<tr><td>30 to 36</td><td>0 – 14
≥ 15</td><td>12
8</td></tr>
<tr><td>37 to 44</td><td>0 – 7
≥ 8</td><td>12
8</td></tr>
<tr><td>≥ 45</td><td>All</td><td>8</td></tr>
</table>
Meningitis/Severe infections due to: Pseudomonas Aeruginosa, Burkholderia Pseudomallei: 50mg/kg/dose[4]
<table>
<tr><th>Postnatal (Days)</th><th>Interval (Hours)</th><td rowspan="3">Consider longer intervals for VLBW (≤2kg)[4]</td></tr>
<tr><td>0 - 7</td><td>8 - 12</td></tr>
<tr><td>≥8</td><td>6 - 8</td></tr>
</table></td></tr>
<tr><td>Dilution</td><td>Reconstitute 2g with 10mls of WFI (making a concentration of 170mg/ml). (Product insert)
IV slow bolus: For IV bolus, a concentration of 100- 170mg/ml may be used12. Draw out the required volume. IV slow bolus over 3- 5 minutes
IV Infusion: Further dilute with NS or D5% to make concentration of 1 - 40mg/ml.12 Infuse over 30 minutes</td></tr>
<tr><td>Stability after reconstitution</td><td>Cefatum
Stable for 12 hours at room temperature or 7 days in fridge (2-8°C) after reconstitution with WFI at 170mg/ml. (Product insert)</td></tr>
<tr><td>Stability after dilution</td><td>Cefatum
Stable for 12 hours at room temperature or 7 days in fridge (2-8°C) after dilution with NS, D5% at 1- 40mg/ml. (Product insert).</td></tr>
<tr><td>Compatibility</td><td>Fluids: Ns, D5%, D10%, Hartmann’s.
Y-Site: Amino Acid Solutions, Aciclovir, Ibuprofen, Linezolid, Morphine Sulfate, Pethidine, Sodium Valproate, Zidovudine. [2]</td></tr>
<tr><td>Incompatibility</td><td>Fluids: Sodium Bicarbonate.
Y-Site: Acetylcysteine, Aminoglycosides – Amikacin, Gentamicin, Amiodarone, Azithromycin, Dobutamine, Erythromycin, Fluconazole, Midazolam, Phenytoin, Vancomycin, [2]</td></tr>
<tr><td>Contraindication</td><td>Hypersensitivity to Penicillins or Cephalosporins.</td></tr>
<tr><td>Precautions</td><td>Sodium restriction (each gram contains 52mg [2.3mmol] of sodium).
Renal impairment: Consider increasing dosage interval in those with significant renal impairment (refer renal dosing page 120).
Hepatic impairment</td></tr>
<tr><td>Adverse effects</td><td>Rash Diarrhoea
Elevated hepatic transaminases Eosinophillia, thrombocytopenia, haemolytic anaemia, positive Coombs test
Superinfection following prolonged use (esp. Candida)</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Ceftazidime (2020)
4) Neofax Neonatal Drug Database (Cefotaxime)</td></tr>
</table>

	12) Pediatric Injectable Drugs (11th Edition) The Teddy Bear Book. ASHP Product Insert Cefatum

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CEFUROXIME (IV)

Drug Type	Antibacterial
Indication	Second-generation cephalosporin which is active against most gram-positive organisms (including group B streptococcus) and a wide variety of gram-negative organisms (including group B strep) and a wide variety of gram-negative organisms. poor penetration in the central nervous system.
Action	Bactericidal agent which inhibits cell wall synthesis in susceptible bacteria.
Presentation	750mg powder vial
Storage	Store below 30°C. Protect from light
Administration	IV slow bolus IV infusion over 30 minutes
Dose **Renal dose** **Refer page 135**	**25 -50mg/ kg /dose 12 hourly** (1st week of life) [1,8,16] **25 -50mg/ kg /dose 8 hourly** (2nd week of life onwards)[1,8,16]
Dilution	Reconstitute 750mg vial of cefuroxime with 10ml WFI to make a concentration of 75mg/ml. (Concentration < 90mg/ml). IV slow bolus: For IV bolus, a concentration < 90mg/ml may be used[12] Draw out the required volume. IV slow bolus over 3- 5 minutes IV Infusion: Further dilute up to 5ml of NS or D5%. Infuse over 30 minutes
Stability after reconstitution	**Pharmaniaga** Stable for 5 hours at room temperature and 24 hours in fridge (2-8°C) after reconstitution **Anikef** Stable for 5 hours at room temperature and 48 hours in fridge (2-8°C) after reconstitution
Stability after dilution	**Pharmaniaga** No data. **Anikef** No data.
Compatibility	Fluids: D5%, D10%, NS, HS, WFI Y site: Acyclovir, amiodarone, clindamycin, furosemide, gentamicin. Heparin, metronidazole, milrinone, morphine, potassium chloride
Incompatibility	Azithromycin, fluconazole, midazolam, ranitidine, sodium bicarbonate, vancomycin
Adverse effects	Rash Diarrhoea Elevated hepatic transaminases Eosinophillia, thrombocytopenia, haemolytic anaemia, Nephrotoxicity in patients with existing renal impairment.
Contraindication	Hypersensitivity to penicillins or cephalosporins.
Precautions	Caution in renal impairment. Hematological status should be monitored during prolonged and high dose therapy.
References	1)Frank Shann Drug Doses. 17th edition, 2017. 8)British National Formulary Children 2022-2023: Chapter 5 Bacterial Infection (page 359) 12) Pediatric Injectable Drugs (11th Edition) The Teddy Bear Book. ASHP Publication. 16) Lexicomp Paediatric Drug Information. (Cefuroxime) Product insert Pharmaniaga, Anikef

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CEFUROXIME (ORAL)

Drug type	Antibacterial- second generation cephalosporin
Indication	Upper and lower respiratory tract infections Genitourinary tract infections Skin and soft tissue infections Gonorrhoea
Action	Bactericidal agent which inhibits cell wall synthesis in susceptible bacteria.
Presentation	125mg/ 5ml (powder for suspension)
Storage	Reconstituted suspension store in fridge (2 - 8°C)
Reconstitution	Add an amount of cold water up to the volume line on the cup provided. The water which was boiled must be allowed to cool to room temperature before adding. Do not mix Zinnat with hot or warm water.
Administration	Oral Always shake the bottle well before taking the medication. If desired, suspension can be further diluted in cold fruit juices, cold milks and should be taken immediately after mixing. (Product insert)
Dose	Urinary Tract Infection (> 2 months old)[17]: **10-15mg/kg/dose 12 hourly**[1,16,17] (Total duration oral plus IV antibiotic: 7 to 14 days)[17]
Stability after reconstitution	**Zinnat** Stable for 10 days in fridge (2 - 8°C) (Product insert)
Adverse Effects	Adverse effects are usually mild and transiet in nature. Common: Overgrowth of Candida, eosinophilia, hypersensitivity reactions, headache, dizziness., Gastrointestinal disturbances such as diarrhea, nausea, abdominal pain. Transient transaminitis.
References	1)Frank Shann Drug Doses. 17th edition, 2017. 16)Lexicomp Paediatric Drug Information (Cefuroxime) 17)Micromedex: Paediatric Drug Database (Cefuroxime) Product Insert Zinnat

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CEPHALAXIN (ORAL)

<table>
<tr><td>Drug Type</td><td>First generation of Cephalosporin</td></tr>
<tr><td>Indication</td><td>Treatment of mild infections due to susceptible strains of bacteria.
Prophylaxis of urinary tract infections in patients at risk (e.g. vesicoureteric reflux).</td></tr>
<tr><td>Action</td><td>First generation cephalosporin. Bactericidal – inhibits cell wall synthesis in susceptible organisms. Most active against Gram-positive cocci, including MSSA and streptococci. Has have no activity against enterococci, MRSA or Listeria.1</td></tr>
<tr><td>Presentation</td><td>125 mg/5mL suspension</td></tr>
<tr><td>Storage</td><td>Store powder below 25°C
Store reconstituted solution between 2 and 8°C</td></tr>
<tr><td>Dose</td><td>Treatment [2]
<table>
<tr><th>Postnatal Age (Days)</th><th>Dose (mg/kg)</th><th>Interval (hour)</th></tr>
<tr><td>0 - 7</td><td rowspan="3">25</td><td>12</td></tr>
<tr><td>8 - 28</td><td>8</td></tr>
<tr><td>≥29</td><td>6</td></tr>
</table>
UTI Prophylaxis (for G6PD Deficiency): 5mg/kg/dose ON (maximum dose 125 mg daily).[2,3]

Prophylaxis around Voiding Cystourethrogram
12.5 (10–15) mg/kg/dose 8-hourly for 3 days (day prior, on the day and one day after MCU).[2]</td></tr>
<tr><td>Dilution</td><td>Reconstitute powder for oral suspension using water for injection with the volume specified on the bottle.</td></tr>
<tr><td>Stability after reconstitution</td><td>Reconstituted solution should be discarded after 7 days.</td></tr>
<tr><td>Side Effects</td><td>Diarrhoea, dyspepsia, abdominal pain, nausea and vomiting. Pseudomembranous colitis (rare).
Transient elevation of liver enzymes.
Hypersensitivity: Immediate – urticaria, bronchospasm, anaphylaxis. Delayed – maculopapular rash, fever, eosinophilia.</td></tr>
<tr><td>Monitoring</td><td>Monitor renal, hepatic and haematological function with prolonged use.</td></tr>
<tr><td>Contraindications</td><td>Hypersensitivity to cephalosporins.
Immediate hypersensitivity or severe reaction to Penicillins.</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Cefalaxin (2020)
3) Malaysian Paediatric Protocol 4th Edition, 2019. Urinary Tract Infection, page 363
Product insert</td></tr>
</table>

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CHLORAL HYDRATE (ORAL)

Drug type	Sedative
Indication	Sedation for painless procedure (e.g. neuroimaging). Sedative/hypnotic for short-term use
Action	It is sedative-hypnotic agent, causing general CNS depression and induces quiet sleep. Chloral hydrate has no analgesic effects. Higher doses may produce respiratory depression. Onset of action occurs within 10-15 minutes, with peak action occurring within 30 minutes. The plasma half-life in neonates is reported to be 8-66 hours.
Presentation	40mg/5ml (Extemporaneous Pharmacy preparation)
Storage	Store below 250 C. Protect from light.
Administration	Oral
Dose	Sedation for painless procedure:[2,4] **Term infants: 50 mg/kg/dose** (25–75 mg/kg/dose). **Preterm infants: 25 mg/kg/dose** (25–75 mg/kg/dose). Give the dose 45 minutes before procedure. Repeated doses up to maximum of 100 mg/kg may be used with respiratory monitoring. **Short-term sedation: 10 mg/kg/dose 6–8 hourly.[1]**
Stability	Stable for 6 months at room temperature.[9]
Contraindications	Do not use in patients with significant hepatic and/or renal disease. Obstructive sleep apnoea
Precautions	Reduce dose in hepatic and renal impairment. Avoid prolonged use and abrupt withdrawal thereafter. Administration with other CNS depressants such as opioids, benzodiazepines or barbiturates may produce excessive sedation. Indirect hyperbilirubinaemia may occur after prolong use because TCE and bilirubin compete for hepatic conjugation. Use cautiously in preterm infants because of the risk of respiratory depression
Side Effects	Prolonged use has been associated with both direct and indirect hyperbilirubinaemia. Gastric and mucosal irritation; Used with other CNS depressants may potentate respiratory depression and/or hypotension In high doses it may cause respiratory depression, direct hyperbilirubinaemia, hypotension, myocardial depression and fluid retention. Serious adverse events including death/permanent neurologic injury have been reported in children in a review of adverse event care reports from the adverse drug reporting system of the Food and Drug Administration, the US Pharmacopoeia, and the results of a survey of paediatric specialist
Monitoring	Chloral hydrate is well tolerated by most patients with single dose or short-term use. Observe for respiratory depression, blood pressure and level of sedation.
References	1) Frank Shann Drug Doses. 17th edition, 2017. 2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Chloral Hydrate (2021) 4)Neofax Neonatal Drug Database 9) X-Temp Master Formulation 2018 page 16

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CHLORAMPHENICOL (GUTT & OINTMENT)

Drug Type	Broad spectrum antibiotic
Indication	Treatment of acute bacterial conjunctivitis
Action	Bacteriostatic. Acts by inhibition of protein synthesis,interfering with the transfer of activated amino acids from soluble RNA to ribosomes
Presentation	Gutt Chloramphenicol 0.5% (5ml bottle) - Preservative: Benzalkonium chloride Eye Ointment Chloramphenicol 1% (5g tube)
Storage	Gutt: Store unopened bottle at 2 – 8°C Eye Ointment: Store below 25°C. Protect from light.
Administration	Avoid contact between tip of container and infant's eyes. Gutt: After administering eye drop, gently press against the lacrimal duct (inner corner of eye) to reduce systemic absorption. The eye pouch will be full after a single drop. If other eye drop(s) need to be administered, wait 5 minutes between drops. Eye ointment: Hold eye open and administer eye ointment between the lower lid and the eye.
Dose	Gutt: Severe infection: Apply 1 drop every 2 hours in the affected eye for 48 hours and reduce frequency with controlling of infection. Less severe infection: Apply 3 to 4 times a day in the affected eye. Continue for 48 hours after clinical resolution Eye Ointment: Apply daily, at night (if use together with eye drops). Alternatively, apply 3 to 4 times a day in the affected eye (if use alone) and continue for 48 hours after clinical resolution. Severe infection: May need more often at the discretion of the treating team.
Stability	Once opened, gutt may be stored at 2–8°C for 28 days. Once opened, ointment may be stored at room temperature for 28 days. Discard after 4 weeks after opening.
Contraindications	History of hypersensitivity to chloramphenicol or any other component of the medication.
Side Effects	Local irritation e.g. burning, swelling, redness; impaired corneal healing; superinfection; hypersensitivity including sensitisation, urticaria, rash, fever, angioedema, anaphylaxis, blood dyscrasia (rare). Acute hepatitis was reported in an adult following topical chloramphenicol therapy for conjunctivitis. Bone marrow hypoplasia, including aplastic anaemia and death, has been rarely reported following local application of chloramphenicol. Overgrowth of non-susceptible organisms
References	2)ANMF Consensus Group Chloramphenicol Topical 2020 Product leaflet for Chlorop Eye Ointment, Nicol Eye Drops 0.5%

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CLARITHROMYCIN (ORAL)

Drug type	Antibiotic- macrolide
Indication	Infections of the upper and lower respiratory tract. Acute otitis media. Skin and skin structure infections. Disseminated or localized mycobacterial infections due to Mycobacterium avium or Mycobacterium intracellular, Mycobacterium chelonae, Mycobacterium fortuitum, Mycobacterium kansasii.
Action	Effective against many grams positive and gram-negative microorganisms as well as Mycobacterium species, that displays concentration independent killing.
Presentation	125mg/ 5ml (powder for suspension)
Storage	Reconstituted suspension store at 15- 30°C. Protect from light
Administration	Oral. Can be taken with or without meals, can be taken with milk. Shake well before use.
Dose	**7.5mg/kg/dose 12 hourly**[1,8] Prevention of pertussis: 7 days[8] Community acquired pneumonia: 5 days[8]
Stability after reconstitution	**Klacid** Stable for 14 days at 15- 30°C. Do NOT refrigerate. (Product insert)
Adverse Effects	Common: Headache. Gastrointestinal disorders such as diarrhea, nausea, abdominal pain dyspepsia, vomiting Hepatic enzyme increased.
References	1)Frank Shann Paediatric Drug Doses. 17th Edition, 2017 8)British National Formulary Children 2022-2023: Chapter 5 Bacterial Infection (page 376) Product leaflet Klacid

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CLOXACILLIN (IV)

<table>
<tr><td>Drug Type</td><td>Antibacterial- anti-staphylococcal penicillin.</td></tr>
<tr><td>Indication</td><td>Mainly used for the treatment of infections caused by, or suspected of being caused by susceptible, penicillinase - producing staphylococci (eg. cutaneous infections, septicemia, endocarditis and osteomyelitis).</td></tr>
<tr><td>Action</td><td>Active against MSSA but not MRSA.
Cloxacillin distributes well into body fluids (synovial fluid, pleural fluid, bile) and tissues (liver, kidneys); however, it penetrates poorly into the CSF</td></tr>
<tr><td>Presentation</td><td>500mg powder vial</td></tr>
<tr><td>Storage</td><td>Store below 30°C. Protect from light.</td></tr>
<tr><td>Administration</td><td>IV Infusion</td></tr>
<tr><td>Dose
Renal dose
Refer page 135</td><td>Late onset sepsis > 48 hours (MSSA, Coagulast Negative Staphylocci (CONS): [7]
Usual dose: 25 – 50 mg/kg/dose [4]
Meningitis: 50mg/kg/dose [4]
<table>
<tr><th>PMA (weeks)</th><th>Postnatal age (days)</th><th>Interval (hour)</th></tr>
<tr><td>≤ 29</td><td>0 – 28
>28</td><td>12
8</td></tr>
<tr><td>30 - 36</td><td>0 – 14
>14</td><td>12
8</td></tr>
<tr><td>37 - 44</td><td>0 – 7
>7</td><td>12
8</td></tr>
<tr><td>≥45</td><td>ALL</td><td>6</td></tr>
</table>
For catheter related blood stream infection: Exact duration of therapy has not been established in children with or without catheter removal. 10-14 days after first negative blood culture is usually recommended.[7]</td></tr>
<tr><td>Dilution</td><td>Reconstitute 1 vial of Cloxacillin 500mg in 10ml WFI to make up to concentration of 50mg/ml. (Product insert).
IV infusion: Withdraw 1ml from reconstituted solution and dilute up to 5ml NS/D5% (10mg/ml)
Infuse over 30-40 minutes. (Product insert)
Final concentration 1-2mg/ml is not feasible in neonates as the final volume for infusion is large (Product insert)</td></tr>
<tr><td>Stability after reconstitution</td><td><u>Cloxacillin (Karnataka)</u>
Use immediately after reconstitution.</td></tr>
<tr><td>Stability after dilution</td><td><u>Cloxacillin (Karnataka)</u>
Discard after single use. Available stability data is for concentration of 1 -2mg/ml. (Product leaflet)</td></tr>
<tr><td>Compatibility</td><td>No data.</td></tr>
<tr><td>Incompatibility</td><td>Penicillin and aminoglycoside may result in substantial mutual inactivation. Separate the two groups by administration by at least 1 hour.</td></tr>
<tr><td>Adverse Effects</td><td>Hypersensitivity reactions (rash, eosinophilia, hemolytic anemia); these reactions are rare in newborns.
Hematological effects (including transient neutropenia, thrombocytopenia)[12]</td></tr>
<tr><td>References</td><td>4) Neofax Neonatal Drug Database (Oxacillin)
7) National Antibiotic Guideline 2019, B6 Neonatal Infections, B15 Vascular Infections
12) Pediatric Injectable Drugs (11th Edition) The Teddy Bear Book. ASHP
Product insert Karnataka</td></tr>
</table>

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CLOXACILLIN (ORAL)

Drug Type	Antibacterial
Indication	Mainly used for the treatment of infections caused by, or suspected of being caused by susceptible, penicillinase - producing staphylococci (eg. cutaneous infections, septicemia, endocarditis and osteomyelitis).
Action	Anti-staphylococcal penicillin. Active against MSSA but not MRSA. Cloxacillin distributes well into body fluids (synovial fluid, pleural fluid, bile) and tissues (liver, kidneys); however, it penetrates poorly into the CSF
Presentation	125mg/5ml (powder for suspension)
Storage	Reconstituted suspension store in fridge (2 - 8°C). Protect from light.
	Oral 30 minit to 1 hour before food.
Dose	**15mg/kg/dose 6 hourly**[1]
Stability after reconstitution	**Cloxacilla** Stable for 7 days in fridge (2 - 8°C) after reconstitution.
Side Effects	Usually mild and transient in nature. Gastrointestinal disorders such as diarrhea, nausea, vomiting Hypersensitivy reactions such as eosinophilia, skin rashes, fever, joint pains, angioedema. Intrahepatic cholestasis.
References	1)Frank Shann Drug Doses. 17th edition, 2017. Product leaflet Cloxacilla

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CYCLOPENTOLATE HYDROCHLORIDE + PHENYLEPHRINE HYDROCHLORIDE/ CYCLOMYDRIL® (GUTT)

Drug Type	Antimuscarinic (cyclopentolate) and sympathomimetic (phenylephrine)
Indication	Mydriatic (dilates the pupil) and cycloplegic (prevents accommodation of the eye) for ophthalmic examinations and therapeutic procedures
Action	Cyclopentolate hydrochloride is an anticholinergic drug and phenylephrine hydrochloride is an adrenergic drug. This combination induces mydriasis that is greater than that of either drug alone at its respective concentration. The concentrations of cyclopentolate and phenylephrine has been selected to induce mydriasis with little accompanying cycloplegia.
Presentation	Gutt Cyclopentolate hydrochloride 0.2% and Phenylephrine hydrochloride 1% (5ml bottle) Preservative: Benzalkonium chloride
Storage	Below 30°C
Administration	**Instil one drop in each eye.** Apply pressure to the lacrimal sac during and for 2 minutes after instillation of eye drop to minimise systemic absorption. Wipe away excess medication.
Dose	One drop into each eye 30–60 minutes prior to procedure may be repeated up to three times (maximum of four drops), at least 5 minutes apart. Dark irises may require additional drops
Stability	Once opened, gutt can be stored at room temperature 4 weeks after opening. Discard after 4 weeks after opening.
Monitoring	Observe infants for at least 30 minutes up to 120 minutes. Blood pressure, heart rate and oxygen saturation. Signs of ileus
Contraindications	Concurrent use with beta-blockers. Acute stage of necrotising enterocolitis (NEC).
Adverse Effects	These usually only occur with excess dosing. Anticholinergic side effects include fever, tachycardia, vasodilation, dry mouth, restlessness, delayed gastric emptying and decreased gastrointestinal motility, and urinary retention. Alpha-adrenergic side effects include decreased pulmonary compliance, tidal volume, and peak airflow in babies with bronchopulmonary dysplasia. Increased heart rate and blood pressure. Newborns and infants (especially premature and low birth weight infants) are especially prone to central nervous system, cardiopulmonary and gastrointestinal side effects (due to cyclopentolate) and experience transient increases in blood pressure- (due to phenylephrine). The lowest dose necessary to produce desired effect should always be used. Feeding intolerance may occur following use - recommended that feeding be withheld for 4 hours after examination. Ataxia, incoherent speech, restlessness, hallucinations, hyperactivity, seizures, disorientation to time and place may occur in paediatric patients.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Cyclomydril (2020) Product leaflet Cyclomydril Ophthalmic Solution

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COLISTIN IS AN 'ID ADULT AND ANEST DEPARTMENT' ITEMS. KINDLY CALL THEIR SPECIALIST TO ASK PERMISSION TO USE BEFORE STARTING ANTIBIOTIC

COLISTIMETHATE SODIUM/COLISTIN/POLYMYXIN E (IV)

Drug Type	Antibiotic
Indication	For infections related to multidrug-resistant Gram-negative bacilli (MDR-GNB)
Action	Colistin is mainly active against gram-negative organisms. Its mode of action involves inducing changes in the permeability of the cell wall by binding anionic lipopolysaccharide molecules and displacing calcium and magnesium, thus causing cell leakage and death
Presentation	1 million International Unit Colistimethate Sodium.
Dose Conversion	1MU = 33mg Colistin-based activity (CBA)9 75000u = 2.5mg
Storage	Store below 30°C
Dose	Gram Negative Infection/ Multi-drug Resistant Organism (MRO): **37,500u/kg/dose BD up to 50,000u/kg/dose TDS** (150,000u/kg/day of Colistin base, IV or IM in 2 to 4 divided doses, depending on severity).[4,8] Maximum: 150,000u/kg/day of Colistin base activity in patient with normal renal function.[4]
Dosing Adjustment	There are no data available on pediatric patients with renal impairment, however, the following dose adjustment are based on recommendations for adults with renal impairment 50-79ml/min: 37,500u/kg/dose BD to 50,000u/kg/dose BD 30-49ml/min: 37,500u/kg/dose BD 10-29ml/min: 45,000u/kg/dose 36 hourly
Dilution	IV: Reconstitute 1MU (1 vial) with 2ml WFI Dilute 1ml from above (500,000u) in 50ml NS/D5% (10,000u/kg)
Administration	Infuse over 30 minutes
Stability after reconstitution	Room temperature (<25'C): Use immediately Fridge (2-8'C): 24 hours
Stability after dilution	No data on stability after dilution
Compatibility	Sodium Chloride 0.9%, Glucose 5%
Incompatibility	Mixed infusions, injection and nebuliser solutions involving colistimethate sodium should be avoided.
Adverse effects	Common: Nephrotoxicity, neurotoxicity Serious: Hypersensitivity reactions, apnoea, sensory disorder
Contraindications	Hypersensitivity to Colistimethate Sodium (Colistin) or Polymyxin B. Patient with myasthenia gravis
References	4)Neofax Neonatal Drug Database (Colistin) 8) British National Formulary (BNF) for Children 2022-2023. Chapter 5 : Bacterial Infection (page 397) 9) HSB Dilution Protocol 2020 Product leaflet Colomycin Injection Australian Medicines Handbook. Colistin. In: Australian Medicines Handbook [Internet]. Adelaide (South Australia): Australian Medicines Handbook; 2021 [cited 2023 Dec 04]. Available from: https://amhonline.amh.net.au/

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DEXAMETHASONE (IV)

Drug Type	Anti-inflammatory
Indication	To facilitate weaning from assisted ventilation and improve lung function in infants at risk of chronic lung disease. To facilitate extubation
Action	Long-acting glucocorticoid with potent anti-inflammatory action. No significant mineralocorticoid activity
Presentation	IV: 8mg/2ml ampoules 1 ml of Dexamethasone Sodium Phosphate 4mg equivalent to Dexamethasone Phosphate 4mg
Storage	Store below 30°C. Protect from light.
Administration	Slow IV bolus over 3 - 5 minutes
Dose	IV **Low dose (DART) protocol** [2,4] 0.075 mg/kg/dose 12 hourly for 3 days then, 0.05 mg/kg/dose 12 hourly for 3 days then, 0.025 mg/kg/dose 12 hourly for 2 days then, 0.01 mg/kg/dose 12 hourly for 2 days then cease. **High dose (DART) protocol** [2] 0.25 mg/kg/dose 12 hourly for 3 days then, 0.15 mg/kg/dose 12 hourly for 3 days then, 0.1 mg/kg/dose 12 hourly for 3 days then, 0.05 mg/kg/dose 12 hourly for 3 days then, 0.025 mg/kg/dose 12 hourly for 6 days then cease. **Extubation protocol**[2] 0.25 mg/kg 8 hourly for up to 3 doses only Commence 4 hours before extubation
Dilution	IV: Draw up 0.5 mL (2 mg) and add 9.5 mL NS to make a final volume of 10 mL with a concentration of 0.2 mg/mL. (Can be administered undiluted or diluted to a concentration of 0.1mg- 1mg/ml in NS)4 If volume is too small, further dilute: Draw up 1 mL of solution (0.2mg of dexamethasone) and add 9 mL of NS to make a final volume of 10mL with a concentration of 0.02 mg/mL.
Stability after reconstitution	**Penatone** Does not require reconstitution
Stability after dilution	**Penatone** Stable for 24 hours in room temperature after diluting with NS or D5%
Compatibility	Fluids: D5%, sodium chloride Y-site: Amino acid solutions, aciclovir, amikacin, fentanyl, fluconazole, heparin sodium, hydrocortisone sodium succinate, linezolid, morphine sulfate, pethidine, piperacillin-tazobactam, potassium chloride,
Incompatibility	Y-site: calcium gluconate, dobutamine, gentamicin, magnesium sulfate, midazolam, rocuronium
Monitoring	Blood glucose levels (BGLs) at least daily. When on oral feeds measure BGL only if there is glucose in urine. Blood pressure at least daily. Electrolytes.
Precautions	Use preservative free drug where possible. Avoid concurrent use with NSAIDs for PDA treatment. Corticosteroids may increase susceptibility to or mask the symptoms of infection
Contraindications	Systemic fungal infections. Hypersensitivity to sulphites of any other component of this medication. Administration of

	live virus vaccines. (Product insert).
Drug Interaction	Barbiturates, phenytoin and rifampicin may increase the metabolism of dexamethasone. Antithyroid agents may decrease the metabolism of dexamethasone.
Adverse Effects	Early (< 8 days) postnatal corticosteroids cause short-term adverse effects including gastrointestinal bleeding, intestinal perforation, hyperglycaemia, hypertension, hypertrophic cardiomyopathy and growth failure. Late (after seven days) postnatal corticosteroids in high doses in particular are associated with short-term side effects including gastrointestinal bleeding, higher blood pressure, glucose intolerance, severe retinopathy of prematurity and hypertrophic cardiomyopathy. Other effects include: Hypertriglyceridemia in association with hyperinsulinism and raised free fatty acids. Increase in total and immature neutrophil counts; increase in platelet count. Adrenal insufficiency is associated with higher doses (initial >0.2 mg/kg/day) longer courses (>14 days) of dexamethasone. Myocardial hypertrophy and outflow obstruction may occur with higher doses and prolonged courses of dexamethasone. May increase risk of infection.
References	2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Dexamethasone (2022) 4) Neofax Neonatal Drug Database (Dexamethasone) Product Insert Penatone

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DEXAMETHASONE (ORAL)

Drug Type	Anti-inflammatory
Indication	To facilitate weaning from assisted ventilation and improve lung function in infants at risk of chronic lung disease. To facilitate extubation.
Action	Long-acting glucocorticoid with potent anti-inflammatory action. No significant mineralocorticoid activity
Presentation	0.5mg/ml suspension (Extemporaneous Pharmacy preparation)
Storage	Store at room temperature. Protect from light[11]
Administration	Oral. Administer with feeds to minimize gastric irritation. Shake the bottle well before drawing up required dose.[2]
Dose	Oral[2,4] **Low dose (DART) protocol** 0.075 mg/kg/dose 12 hourly for 3 days then, 0.05 mg/kg/dose 12 hourly for 3 days then, 0.025 mg/kg/dose 12 hourly for 2 days then, 0.01 mg/kg/dose 12 hourly for 2 days then cease. **High dose (DART) protocol** 0.25 mg/kg/dose 12 hourly for 3 days then, 0.15 mg/kg/dose 12 hourly for 3 days then, 0.1 mg/kg/dose 12 hourly for 3 days then, 0.05 mg/kg/dose 12 hourly for 3 days then, 0.025 mg/kg/dose 12 hourly for 6 days then cease
Stability after reconstitution	Stable for 91 days at room temperature.[11,14]
Side Effects	Early (< 8 days) postnatal corticosteroids cause short-term adverse effects including gastrointestinal bleeding, intestinal perforation, hyperglycaemia, hypertension, hypertrophic cardiomyopathy and growth failure. Late (after seven days) postnatal corticosteroids in high doses in particular are associated with short-term side effects including gastrointestinal bleeding, higher blood pressure, glucose intolerance, severe retinopathy of prematurity and hypertrophic cardiomyopathy. Other effects include: Hypertriglyceridemia in association with hyperinsulinism and raised free fatty acids. Increase in total and immature neutrophil counts; increase in platelet count.
Monitoring	Blood glucose levels (BGLs) at least daily. When on oral feeds measure BGL only if there is glucose in urine. Blood pressure at least daily. Electrolytes.
References	2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Dexamethasone (2022) 4) Neofax Neonatal Drug Database (Dexamethasone) 11) MOH Formulary Extemporaneous 2015 page 29 14) X-Temp Master Formulation 2018, page 25

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DIAZOXIDE (ORAL)

Drug Type	Antihypertensive, antidiuretic benzothiadiazine.
Indication	Must refer to Paediatric Endocrinologist. Treatment of neonatal hyperinsulinaemic hypoglycaemia(transientor persistent).
Action	Opens potassium-ATP channels on pancreatic beta-cells to inhibit insulin secretion. Opening of these channels also occurs in cardiac and vascular smooth muscle leading to decrease in blood pressure and potential for cardiorespiratory deterioration.
Presentation	10mg/ml (Extemporaneous pharmacy preparation)
Storage	At room temperature14 Protect from light.
Administration	Oral Administer after feeds(preferred).
Dose	**2–5 mg/kg/dose every 8 hours** OR **2.5–7.5 mg/kg/dose every 12 hours**. [2] (Derived from 5 – 20mg/kg/day in 3 divided doses)[3]
Stability after reconstitution	Stable for 14 days at room temperature[14] Stability is shortened to 14 days instead of 90 days as stated in X-Temp Master Formulation due to capsule is being used instead of tablet as stated in the formula. (X-Temp Medical Information Adviser)
Monitoring	Monitor blood pressure and blood glucose levels during initial treatment. Monitor for sodium and fluid retention (urine output, electrolytes and weight). Consider monitoring albumin and liver function
Precautions	Avoid sodium and water overload. Concomitant use of a thiazide diuretic is recommended. Avoid higher doses where possible. Use with caution in premature infants –increased risk of cardiorespiratory complications. Use with caution in jaundice –may displace bilirubin from albumin. Reduce dose in infants with renal impairment. Use with caution in infants with hepatic impairment. Use with caution in mechanical hypertension, e.g. secondary to aortic coarctation or arteriovenous shunt. Use with caution in pulmonary hypertension.
Adverse Effects	Sodium and fluid retention which may precipitate congestive heart failure in patients with compromised cardiac reserve. Usually responds to diuretic therapy. Life-threatening episodes of pulmonary hypertension were observed in some neonates receiving diazoxide. Severe hypotension can be controlled with sympathomimetic agents if necessary. Hypertrichosis can sometimes be marked and distressing in young children but will be reversible after treatment cessation. Overdose of diazoxide produces hyperglycaemia and possibly ketoacidosis which should be treated promptly with insulin and restoration of fluid and electrolyte balance.
References	2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Diazoxide (2020) 3)Malaysian Paediatric Protocol 4th Edition, Chapter 96 Approach to Recurrent Hypoglyacaemia (page 547) 14) X-Temp Master Formulation 2018 page 32

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DIHTERIA, TETANUS, PERTUSIS, IPV, Hib, HEPATITIS B VACCINE/ HEXAXIM® (IM)

Drug Type	Vaccine
Indication	Diphtheria, tetanus, pertussis (acellular, component),hepatitis B (rDNA), poliomyelitis (inactivated) vaccine and Haemophilus influenzae type b conjugate vaccine, adsorbed. For primary vaccination in infants from 6 weeks of age to 24 months of age
Presentation	0.5ml suspension in vial
Storage	Store at 2 - 8°C. DO NOT FREEZE. Protect from light.
Administration	Intramuscular only. The recommended injection site is preferably the antero-lateral area of the upper thigh and deltoid muscle in older children (possibly from 15 months of age).
Dose	Given as a total of 4 doses. Each Hexaxim dose: **0.5ml** 1st dose: 2 months 2nd dose: 3 months 3rd dose: 5 months Booster dose: 18 months In the absence of Hepatitis B vaccination at birth, it is necessary to give Hexaxim booster dose, at least 6 months after the last priming dose (example at 11months old) (Product Leaflet)
Stability after opening	Single use only. Discard any remaining balance.
Contraindication	Vaccination should not be given to individuals with uncontrolled neurologic disorder or uncontrolled epilepsy until treatment for the condition has been established. Hypersensitivity: to active ingredients and excipients listed. Anaphylaxis reaction after a previous administration of Hexaxim. Encephalopathy of unknown aetiology occuring within 7 days following prior vaccination with a pertussis containing vacccine. In such individuals, Hexaxim in contraindicated.
Precautions	Immunisation should be postponed in individuals suffering from moderate -to severe acute febrile illness. Minor infection or low-grade fever should not result in deferral of vaccination.
Adverse Reaction	Extensive limb swelling and large injection -site reaction has been reported in children. Local injection-site reactions, abnormal crying, irritability, and fever
References	Product leaflet Hexaxim

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DOBUTAMINE (IV)

Drug Type	Inotropic agent	
Indication	Inotrope to increase cardiac output in neonates with myocardial dysfunction and unchanged or increased systemic vascular resistance. Not the appropriate first drug of choice In conditions with low systemic vascular resistance (SVR) (e.g.septic shock)	
Action	Catecholamine with beta-1 and beta-2 receptor actions which increases myocardial contractility, heart rate and conduction velocity and decreases SVR1. Dose dependent effects: Low dose, 2.5 microgram/kg/min – no significant hemodynamic effects in neonates with cardiovascular compromise Moderate dose, 5–7.5 microgram/kg/min – increases cardiac output Higher dose, 5–20 microgram/kg/min – increases cardiac output and blood pressure in hypotensive preterm infants An additional effect of dobutamine on increasing cardiac output has been demonstrated in hypotensive preterm infants receiving dopamine	
Presentation	250mg / 20ml vial	
Storage	Store below 30°C. Protect from light.	
Administration	Continuous IV infusion preferably via a central line. Do not flush line or suddenly stop infusion. Solution containing dobutamine may exhibit a pink color, will increase with time. Color is due to slight oxidation of the drug, but there is no significant loss of potency during the reconstituted time periods.	
Dose	**5 - 20 microgram /kg /min²**	
Dilution	30mg/kg of Dobutamine in 50ml D5% or NS	1ml /hr = 10microgram/kg/min
	60mg/kg of Dobutamine in 50ml D5% or NS	1ml /hr = 20microgram/kg/min
Stability after reconstitution	**Mobitil** Does not require reconstitution	
Stability after dilution	**Mobitil** Stable for 24 hours in room temperature after dilution. No stability data in fridge	
Compatibility	Compatible With Dopamine - May Be "Mixed" With Dopamine and Given Through One Line. Fluids: D5%, D10%, NSD5%, NSD10%, Hartmann's, NS, HS Y Site: Amino Acid Solutions, Adrenaline Hydrochloride, Amiodarone, Dopamine, Fluconazole, Glyceryl Trinitrate, Milrinone, Noradrenaline, Ranitidine, Zidovudine.	
Incompatibility	Fluids: Sodium Bicarbonate, Alkaline Solutions, Diluents That Contain Sodium Bisulfite and Ethanol. Y Site: Aciclovir, Aminophylline, Ampicillin, Benzylpenicillin, Calcium Gluconate, Cefotaxime, Ceftazidime, Ceftriaxone, Chloramphenicol, Dexamethasone, Ertapenem, Heparin Sodium, Hydrocortisone Sodium Succinate, Phenobarbitone, Piperacillin-Tazobactam (EDTA-Free), Potassium Chloride, Sodium Bicarbonate	
Contraindications	Contraindicated in patients with idiopathic hypertrophic sub aorticstenosis and previous hypersensitivity to dobutamine	
Precautions	May cause hypotension therefore ensure adequate circulating blood volume prior to commencement. Contains sodium metobisulphite that may cause serious allergic type reactions in certain susceptible patients. Do not use if known to be hypersensitive to bisulphites.	
Adverse effects	Hypertension, tachyarrhythmias, myocardial ischaemia and ventricular fibrillation. Hypotension may result from vasodilation. May cause hypokalaemia. Phlebitis has been reported	
Monitoring	Continuous heart rate, ECG and blood pressure monitoring preferable. Assess urine output and peripheral perfusion frequently	

References	2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Dobutamine (2021) Product Insert Mobitil

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DOPAMINE (IV)

Drug Type	Vasopressor	
Indication	Treatment of hypotension. May also be used to improve renal perfusion.	
Action	Catecholamine with alpha and beta adrenergic, dopaminergic and serotoninergic actions Haemodynamic effects are dose dependent:[1] Low dose 1-5 mcg/kg/min: increases renal blood flow and glomerular filtration rate. Intermediate dose 5-10 microgram/kg/min – increases cardiac output and blood pressure. Increases renal blood flow. High dose 10-20 microgram/kg/min – systemic vasoconstrictor effect outweighs all other effects. Reduces renal blood flow	
Presentation	200mg / 5 ml ampoule	
Storage	Store below 30°C. Protect from light.	
Administration	Continuous intravenous infusion via a central line. Use with caution via a peripheral line.	
Dose	**1-20 mcg /kg/ min[2]**	
Dilution	30mg/kg of Dopamine in 50ml D5% or NS	1ml /hr = 10microgram/kg/min
	60mg/kg of Dopamine in 50ml D5% or NS	1ml /hr = 20microgram/kg/min
Stability after reconstitution	**Loxin** Does not require reconstitution	
Stability after dilution	**Loxin** Stable for 24 hours in room temperature after dilution. No stability data in the fridge.	
Compatibility	Compatible With Dobutamine - May Be "Mixed" With Dobutamine and Given Through One Line. Fluids: D5%, D10%, NSD5%, HSD5%, Glucose 5% In Hartmann's, Hartmann's, Mannitol 20%, NS Y-Site: Amino Acid Solutions, Amiodarone, Caffeine Citrate, Dobutamine, Fluconazole, Heparin Sodium, Hydrocortisone Sodium Succinate, Metronidazole, Midazolam, Milrinone, Morphine Sulfate, Noradrenaline, Pethidine, Piperacillin-Tazobactam (EDTA-Free), Potassium Chloride, Ranitidine, Zidovudine.	
Incompatibility	Fluids: Sodium Bicarbonate and Other Alkaline Solutions. Y-Site: Aciclovir, Ampicillin, Insulin (Short-Acting)	
Contraindications	Contraindicated in patients with phaeochromocytoma, atrial or ventricular tachyarrhythmias, hyperthyroidism, and previous hypersensitivity to dopamine	
Precautions	Contains sodium metobisulphite that may cause serious allergic type reactions in certain susceptible patients. Do not use if known to be hypersensitive to bisulphites	
Adverse effects	Tachycardia and arrhythmia. Systemic and pulmonary hypertension especially at higher doses. Reversible suppression of prolactin and thyrotropin secretion. Tissue necrosis at infusion site with extravasation.	
Drug Interactions	Hypotension may be observed with concurrent use of vasodilators such as glyceryl trinitrate, nitroprusside and calcium channel blockers. Concurrent use of digitalis glycosides may increase the risk of cardiac arrhythmias. Concurrent use of IV phenytoin with dopamine may result in dose dependent, sudden hypotension and bradycardia	
Monitoring	Continuous heart rate, ECG and blood pressure monitoring preferable. Assess urine output and peripheral perfusion frequently. Observe IV site closely for blanching and extravasation.	
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus: Dopamine (2023) Product Insert Loxin	

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ERYTHROMYCIN ETHYLSUCCINATE (ORAL)

Drug Type	Antibacterial - macrolide
Indication	Prokinetic agent for gastrointestinal dysmotility (routine use not recommended)
Action	Inhibits protein synthesis by attaching to the 50S subunit of the bacterial ribosome in susceptible organisms.Motilin receptor agonist.
Presentation	200mg/5 ml (powder for suspension)
Storage	Reconstituted suspension store in fridge (2 - 8°C). Protect from light. (Product insert)
Administration	Oral
Dose	Prokinetic dose: [2] **2.5mg/kg/dose 6 hourly** (up to 10 days) (low dose) **5mg/kg/dose 8 hourly** (7-14 days)
Stability after reconstitution	**Ericin** Stable for 7 days in fridge (2 - 8°C) after reconstitution. (Product leaflet)
Monitoring	Monitor liver functions
Precautions	Avoid early (<8 days) treatment, higher dose and longer courses where possible to reduce side effects. Avoid concurrent use with NSAIDs for PDA treatment. Corticosteroids may increase susceptibility to or mask the symptoms of infection.
Adverse Effects	Common: Gastrointestinal disorders such as diarrhea, nausea, vomiting Hypersensitivy reactions skin rashes have been reported Rare cases of colitis, hepatotoxicity, and ototoxicity have been reported. (Product insert).
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Erythromycin Ethylsuccinate (2021) Product leaflet Ericin

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FENTANYL CINTRATE (IV)

Drug Type	Opioid analgesic agent.
Indication	Sedative Analgesia
Action	Binds to specific G protein-coupled opioid receptors that are located in brain and spinal cord regions involved in the transmission and modulation of pain.
Presentation	100mcg /2 mL
Storage	Store below 25°C. Protect from light.
Administration	Slow IV bolus Continuous IV infusion
Dose[2]	Naloxone should be readily available to reverse adverse effects. IV Bolus/loading dose: **0.5–4 microgram/kg/dose over 3–5 minutes every 2–4 hour** Premedication prior to intubation: **2–4 microgram/kg bolus**. Wait at least 3 minutes for onset of action after giving the dose. Continuous IV Infusion: **0.5–5 microgram/kg/hour**. General starting dose: 1 microgram/kg/hour. Titrate using a validated pain score.
Dilution[2]	**IV bolus** Dilute 1 mL (50 microgram fentanyl) and add 9 mL sodium chloride 0.9% to make a final volume of 10 mL with a concentration of 5 microgram/mL.2 Maximum concentration is 10mcg/ml in neonates[12] **Continuous IV Infusion** Dilute 100mcg/kg of Fentanyl in 50ml D5% or NS (1ml /hr = 2microgram/kg/hr)
Stability after reconstitution	**Tagesil** Does not require reconstitution. Discard unused portion (original ampoule) after use.
Stability after dilution	**Tagesil** No stability data after dilution. Discard unused portion after use
Compatibility	Fluids: NS, D5%, D10% (Not Tested) Y-Site: Adrenaline Hydrochloride, Amiodarone, Atropine, Caffeine Citrate, Caspofungin, Dexamethasone, Heparin Sodium, Hydrocortisone Sodium Succinate, Midazolam, Milrinone, Potassium Chloride
Incompatibility	Fluids: No information. Y-site: Azithromycin
Other Considerations	Safety. Tolerance can occur with use >5–7 days. Significant withdrawal symptoms have been reported in patients treated with continuous infusion for 5 days and longer. Respiratory depression occurs when anaesthetic doses (greater than 5 mcg/kg/min) are used and may also occur unexpectedly because of redistribution. Chest wall rigidity has occurred in 4% of neonates who received doses of 2.2 to 6.5 mcg/kg, occasionally associated with laryngospasm. This was reversible with administration of naloxone.
Side Effects	Nausea and/or vomiting Muscle/chest wall rigidity (usually naloxone responsive). Naloxone 0.01–0.04 mg/kg reversed muscle rigidity immediately allowing resuscitation in a case series of 8 patients. At high doses can cause neuro-excitation and rarely seizure like activity/myoclonic movements. Respiratory depression. Bradycardia (usually atropine responsive), Urinary retention
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Fentanyl (2023) Product Insert Tagesi

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FERRIC AMMONIUM CITRATE (ORAL)

Drug Type	Iron preparation
Indication	Prophylaxis and treatment of anaemia of prematurity in premature neonates. Iron deficiency anemia
Presentation	400mg/ 5 ml mixture
Storage	Store below 30°C. Protect from light.[11]
Administration	Oral Administer 2 hours before or 1 hour after all calcium – phosphate binding agents, antacids or food.
Dose	Dose as elemental iron [1] Prophylaxis: **2mg/kg/day** Treatment: **6mg/kg/day** Iron content in Sy FAC is 86mg/5ml = 17.2mg/ml
Stability	Stable for 90 days at room temperature.[11]
Adverse Effects	Nausea, constipation, black stools[8]. Liquid preparations can cause tooth discoloration in small children.
References	1) Frank Shann Drug Doses. 17th edition, 2017. 8) British National Formulary for Children 2019-2020, Chapter 9, Iron Deficiency Anemia, page 653 11) MOH Extemporaneous 2015, page 33

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FLUCONAZOLE (IV)

<table>
<tr><td>Drug Type</td><td>Antifungal</td></tr>
<tr><td>Indication</td><td>Treatment of systemic infection and meningitis caused by susceptible Candida species.
Prophylaxis from Candida infection.</td></tr>
<tr><td>Action</td><td>Triazole antifungal which selectively inhibits fungal cytochrome P-450 sterol C-14 alpha demethylation</td></tr>
<tr><td>Presentation</td><td>100mg/50ml vial</td></tr>
<tr><td>Storage</td><td>Store below 30°C.</td></tr>
<tr><td>Administration</td><td>IV infusion: infuse (undiluted, concentration 2mg/ml) over 30 minutes via a syringe pump.[2]</td></tr>
<tr><td>Dose
Renal dose
Refer page 135</td><td>Treatment of invasive candidiasis [2,4]
IV Loading dose: 12-25 mg/kg/dose, then
IV Maintenance dose: 6-12 mg/kg/dose
<table><tr><th>GA (weeks)</th><th>Postnatal (days)</th><th>Interval (hours)</th></tr><tr><td>≤ 29</td><td>0 -14
>14</td><td>48
24</td></tr><tr><td>≥ 30</td><td>0 -7
>7</td><td>48
24</td></tr></table>Duration of therapy is 2 weeks from documented clearance of candida from blood stream and resolutions of symptoms [4]
Prophylaxis fungal infection if on broad spectrum antibiotics eg Meropenem and Cefepime:
IV: 3 -6mg/kg 72hourly [4]</td></tr>
<tr><td>Stability after reconstitution</td><td><u>Fluconol</u>
Does not require reconstitution.</td></tr>
<tr><td>Stability after dilution</td><td><u>Fluconol</u>
Single use only. Discard remaining solution</td></tr>
<tr><td>Compatibility</td><td>Fluids: D5%, D10%, NS. Y-Site: Amino Acid Solutions, Aciclovir, Amikacin, Amiodarone, Dexamethasone, Dobutamine, Dopamine, Gentamicin, Heparin Sodium, Linezolid, Metronidazole, Midazolam, Morphine Sulfate, Pethidine, Piperacillin-Tazobactam (EDTA-Free), Ranitidine, Vancomycin, Zidovudine</td></tr>
<tr><td>Incompatibility</td><td>Y-Site: Ampicillin, Calcium Gluconate, Cefotaxime, Ceftazidime, Ceftriaxone, Chloramphenicol, Clindamycin, Digoxin, Frusemide, Imipenem-Cilastatin</td></tr>
<tr><td>Contraindications</td><td>Cardiac rhythm problems – may increase QT interval. Hypersensitivity to fluconazole or other constituents.
Concurrent therapy with other drugs known to prolong the QT interval and those drugs which are metabolized via the enzyme CYP3A4 e.g., cisapride, erythromycin.</td></tr>
<tr><td>Precautions</td><td>Use with caution in hepatic impairment. May precipitate or worsen hyperbilirubinaemia, use with caution. May increase QT interval.</td></tr>
<tr><td>Monitoring</td><td>Measure serum creatinine prior to starting therapy. Monitor liver function, renal function and full blood count.</td></tr>
<tr><td>Adverse effects</td><td>Rare: Rash, elevated LFTs, leucopaenia including neutropaenia, agranulocytosis and thrombocytopaenia.</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus: Fluconazole (2021)
4) Neofax Neonatal Drug Database (Fluconazole)
Product Insert Fluconol</td></tr>
</table>

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FLUCONAZOLE (ORAL)

<table>
<tr><td>Drug Type</td><td>Antifungal</td></tr>
<tr><td>Indication</td><td>Treatment of systemic infection and meningitis caused by susceptible Candida species.
Prophylaxis from Candida infection.</td></tr>
<tr><td>Action</td><td>Triazole antifungal which selectively inhibits fungal cytochrome P-450 sterol C-14 alpha demethylation</td></tr>
<tr><td>Presentation</td><td>100mg capsule</td></tr>
<tr><td>Storage</td><td>Store below 30°C.</td></tr>
<tr><td>Administration</td><td>Can be given with feeds.</td></tr>
<tr><td>Dose</td><td>Treatment of invasive candidiasis [2,4]
Loading dose: 12-25 mg/kg/dose, then
Maintenance dose: 6-12 mg/kg/dose

<table>
<tr><th>GA (weeks)</th><th>Postnatal (days)</th><th>Interval (hours)</th></tr>
<tr><td>≤ 29</td><td>0 -14
>14</td><td>48
24</td></tr>
<tr><td>≥ 30</td><td>0 -7
>7</td><td>48
24</td></tr>
</table>
Duration of therapy is 2 weeks from documented clearance of candida from blood stream and resolutions of symptoms[4]
Prophylaxis fungal infection if on broad spectrum antibiotics eg Meropenem and Cefepime: 3 -6mg/kg 72hourly[4]

Can oralise to Oral Fluconazole once patient is tolerating feeding (1:1 conversion).</td></tr>
<tr><td>Stability</td><td>Freshly prepared. Discard after use</td></tr>
<tr><td>Contraindications</td><td>Cardiac rhythm problems – may increase QT interval. Hypersensitivity to fluconazole or other constituents.
Concurrent therapy with other drugs known to prolong the QT interval and those drugs which are metabolized via the enzyme CYP3A4 e.g., cisapride, erythromycin.</td></tr>
<tr><td>Precautions</td><td>Use with caution in hepatic impairment. May precipitate or worsen hyperbilirubinaemia, use with caution. May increase QT interval.</td></tr>
<tr><td>Monitoring</td><td>Measure serum creatinine prior to starting therapy. Monitor liver function, renal function and full blood count.</td></tr>
<tr><td>Adverse effects</td><td>Rare: Rash, elevated LFTs, leucopaenia including neutropaenia,agranulocytosis and thrombocytopaenia.</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Fluconazole (2021)
4) Neofax Neonatal Drug Database (Fluconazole)
Product Insert Fluconol</td></tr>
</table>

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FOLIC ACID (ORAL)

Drug Type	Vitamin B9
Indication	1) Prevention and treatment of folic acid deficiency including megaloblastic anaemia. 2) Nutritional treatment of anaemia when folic acid intake may be inadequate.
Action	Folate (Vitamin B9) is necessary for the synthesis of purines and thymine required for DNA formation. It is necessary for red cell maturation and promotion of cellular growth. The active form of folate is tetrahydrofolate. Supplemental folate is more bioavailable than folate normally present in food (85% versus 50%).
Presentation	1mg/ml suspension (Extemporaneous Pharmacy preparation)
Storage	Store at room temperature. Protect from light.[11]
Administration	Oral
Dose	**0.1mg OD** [3]
Stability	Stable for 60 days at room temperature [11,13]
Adverse Effects	Toxicity from over dosage is not reported in newborns. In preterm infants, high folate concentrations have been associated with low zinc. Weight loss, neurological, gastrointestinal and psychological symptoms were also reported in adults on high doses
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Folic Acid (2019) 3) Paediatric Protocol 4th Edition 2019. Chapter 11 The Premature Infant page 91 11) MOH Formulary Extemporaneous 2015 page 34 13) X-Temp Master Formulation 2018 , page 39

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FRUSEMIDE (IV)

Drug Type	Diuretic
Indication	Heart failure Fluid overload. Oliguric renal failure.
Action	Inhibits chloride transport in the ascending loop of Henle. There is increased renal blood flow and increased synthesis of prostaglandin E2. Frusemide induced diuresis results in enhanced excretion of sodium chloride, potassium, calcium, bicarbonate, hydrogen and possibly phosphate. Duration of action - 2-4 hours.
Presentation	20mg/2ml ampoule. (Preservative free)
Storage	Store below 30°C. Protect from light.
Administration	Slow IV bolus over 1-2 mins, rate do not exceed 0.5mg/kg/min12. Transient and permanent ototoxicity has been associated with administration rates >0.5mg/kg/min.12 IV Infusion over 30 minutes, Continuous Infusion
Dose	**IV Bolus, IV Infusion** [2,4] Dose: **1 - 2mg/kg/ dose** Premature infant: every 24 hour Full term: every 12 hour Full term older than 1 month: every 6 - 8 hour **Continuous infusion**[2] **0.05 to 0.2 mg/kg/hour increased to maximum 0.4 mg/kg/hour** if urine output <1 mL/kg/hour.
Dilution	**IV Bolus**[2] Give undiluted. Concentration is 10mg/ml[12] **Continuous infusion dilution**[2] Dilute 10mg/kg of Frusemide in 10ml D5% or NS — 1ml /hr = 1mg/kg/hour
Stability after reconstitution	Pharmaniaga Does not require reconstitution
Stability after dilution	Pharmaniaga Stable for 24 hours at room temperature after dilution (HSB Dilution Protocol)[9]
Compatibility	Fluids: D5%, D10%, D20%, NS Y-Site: Amikacin, Heparin Sodium, Hydrocortisone Sodium Succinate, Piperacillin-Tazobactam (EDTA-Free), Potassium Chloride
Incompatibility	Fluids: No Information. Variable Compatibility with Parenteral Nutrition Solutions. Y-Site: Azithromycin, Caffeine Citrate, Ciprofloxacin, Erythromycin, Fluconazole, Gentamicin, Midazolam, Milrinone, Pethidine, Vancomycin
Contraindications	Known hypersensitivity to Furosemide. Severe hypokalaemia, hyponatraemia, hypovolaemia, dehydration or hypotension must be regarded as contraindications until serum electrolytes, fluid balance and blood pressure have been restored to normal levels. Severe jaundice at risk of bilirubin encephalopathy.
Monitoring	Urine output, weight, serum sodium and potassium. Screening for nephrocalcinosis may be required for preterm infants on prolonged therapy.
Drug interactions	Avoid concomitant usage of aminoglycosides to avoid ototoxicity.
Adverse effects	Water and electrolyte imbalances are common - especially hyponatremia, hypokalemia, and hypochloride alkalosis. Hypercalcinuria and development of renal calculi occur with long term therapy. Potentially ototoxic May inhibit albumin binding of bilirubin
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Frusemide (2021)

	4) Neofax Neonatal Drug Database (Furosemide) 9) HSB Dilution Protocol 2020 12) Pediatric Injectable Drugs (11th Edition) The Teddy Bear Book. ASHP Product insert Pharmaniaga

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FRUSEMIDE (ORAL)

Drug Type	Diuretic
Indication	Heart failure. Fluid overload. Short-term treatment in infants with or developing chronic lung disease. Oliguric renal failure
Action	Inhibits chloride transport in the ascending loop of Henle. There is increased renal blood flow and increased synthesis of prostaglandin E2. Frusemide induced diuresis results in enhanced excretion of sodium chloride, potassium, calcium, bicarbonate, hydrogen and possibly phosphate. Duration of action - 2-4 hours.
Presentation	10mg/ml
Storage	Store below 30°C. Protect from light.
Administration	Oral
Dose	**1 – 2 mg/kg/dose** [2,4] (Premature infant: 24 hourly Term infant: 12 hourly Term infant > 30 days old: 6 – 8 hourly)
Stability after opening	**Vusimide** Stable for 90 days at room temperature.
Monitoring	Urine output, weight, serum sodium and potassium. Screening for nephrocalcinosis may be required for preterm infants on prolonged therapy.
Drug Interaction	Avoid concomitant usage of aminoglycosides to avoid ototoxicity.
Side effects	Water and electrolyte imbalances are common - especially hypoNa, hypoK, and hypoCl alkalosis. Hypercalcinuria and development of renal calculi occur with long term therapy Potentially ototoxic May inhibit albumin binding of bilirubin
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Furosemide (2021) 4) Neofax Neonatal Drug Database Product leaflet Vusimide

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FUCIDIC ACID/ FUCITHALMIC® (GUTT)

Drug Type	Narrow spectrium antibacterial
Indication	Bacterial eye infections caused by susceptible organisms in conjunctivitis, blepharitis, sty, keratitis, dacryocystitis and in connection with removal of foreign bodies.
Action	Active against Staphyloccocci, Streptococci, Neisseria, Haemophilus, Moraxella, Corynebacteria.
Presentation	Fucithalmic acid 1% viscous eye drops (5g tube) (sustained released formulation of fusidic acid) Preservative: Benzalkonium chloride
Storage	Below 30°C
Administration	Avoid contact between the tip of container and infant's eyes. Gutt: After administering eye drops, gently press against the lacrimal duct (inner corner of eye) to reduce systemic absorption. The eye pouch will be full after a single drop. If other eye drop(s) need to be administered, wait 5 minutes between drops.
Dose	**1 drop 2x a day.**[8] Treatment should be continued for at least 2 days after eye appears normal.
Stability	Stored at room temperature after opening. Discard after 4 weeks of opening.
Contraindications	Hypersensitivity to any component.
Adverse Effects	Common: Dry eye, eye discomfort, vision blurred. Transient stinging may occur. Uncommon: Crying on application, skin reactions, watering eye. Angioedema, eye inflammation. Fucithalmic has a very low allergenic potential.
References	8) British National Formulary for Children 2022-2023. Chapter 11, Bacterial Eye Infection page 770 Product leaflet Fucithalmic®

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GENTAMICIN (IV)

Drug Type	Antibacterial
Indication	Used in combination with a beta-lactam antibiotic as empiric therapy for presumed sepsis in the newborn up to 2 doses only in NICU HSB.
Action	Bactericidal agent which inhibits protein synthesis in susceptible bacteria.
Presentation	80mg/2ml vial.
Storage	Store below 30°C.
Administration	IV infusion over 30 minutes
Dose **Renal dose** **Refer page 135**	**Presumed sepsis:** only for 2 doses in NICU.[4]

PMA (weeks)	Postnatal (days)	Dose (mg/kg/dose)	Interval (hour)
≤ 29	0 - 7	**5**	48
	8 - 28	**4**	36
	≥ 29	**4**	24
30 — 34	0 - 7	**4.5**	36
	≥ 8	**4**	24
≥ 35	ALL	**4**	24

Dilution	Add 1ml (40mg) of gentamicin to 20ml NS or D5% to make up to concentration of 2mg/ml.[2,4] Syringe out required dose. IV infusion over 30 minutes
Stability after reconstitution	**Garasent** Does not require reconstitution.
Stability afterdilution	**Garasent** No data. Single use only
Compatibility	Fluids: D5%, D10%, Hartmann's, Ns Y-Site: Amino Acid Solutions, Amiodarone, Calcium Gluconate, Caspofungin, Ciprofloxacin, Cisatracurium, Clindamycin, Digoxin, Dobutamine, Fentanyl, Fluconazole, Linezolid, Magnesium Sulfate, Meropenem, Methylprednisolone, Metronidazole, Midazolam, Morphine Sulfate, Phenobarbital Sodium, Potassium Chloride, Rocuronium, Vancomycin.
Incompatibility	Fluids: Fat Emulsions. Y-Site: Azithromycin, Chloramphenicol, Dexamethasone, Frusemide, Heparin Sodium, Indomethacin. Note: Do Not Mix with Penicillins or Cephalosporins.
Side Effects	Ototoxicity (irreversible) and nephrotoxicity (reversible). Particularly when used in conjunction with frusemide, vancomycin. Neuromuscular blockade. Hypersensitivity.
Monitoring	Monitor urine output, renal profile. Therapeutic drug monitoring for gentamycin is indicated if given for longer than 48 hours – take sample 30 mins prior to 3rd dose. (TDM Pharmacy guidelines)
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Gentamicin (2024) 4) Neofax Neonatal Drug Database (Gentamicin) Product Insert Garasent

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GENTAMICIN (GUTT)

Drug Type	Aminoglycoside antibiotic
Indication	Infections of the anterior pole of the eye caused by germs sensitive to gentamicin: corneal ulcers and corneal bacterial abscesses. Conjunctivitis. Keratitis. Staphyloccocia. Blepharitis. Dacryocystitis.[3] Preoperative sterilization of the conjunctiva.
Action	Bactericidal antibiotic which acts by inhibiting protein synthesis. It has greater antibacterial activity than streptomycin, neomycin, or kanamycin.
Presentation	Gutt Gentamicin 0.3% (10ml bottle) Preservative: Benzalkonium chloride
Storage	Below 30°C
Administration	**Instil one drop in each eye.** Apply pressure to the lacrimal sac during and for 2 minutes after instillation of eye drop to minimise systemic absorption. Wipe away excess medication
Dose	1- 2 drops every 4 hours.[8] Severe infections: 1 drop every hour
Stability	Stored at room temperature after opening. Discard after 4 weeks of opening
Side effects	Hypersensitivity to the active substance of to any of the excipients
Contraindications/ Precautions	Common: photophobia, eye pruritus, ocular discomfort, irriatation, pain, stinging, burning, ocular hyperaemia, hypersensitivity (ocular). Uncommon: keratitis
References	3)Malaysian Paediatric Protocol 4th Edition, 2019. Ophtalmia Neonatorum (page 168) 8)British National Formulary Children 2022-2023: Chapter 11 Bacterial Eye Infection (page 768) Product leaflet Colircusi gentamicin 0.3%

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GLUCAGON(IV)

Drug Type	Polypeptide hormone –hyperglycaemic agent
Indication	Management of neonatal hypoglycaemia: 1) Refractory to intravenous glucose infusions. 2) When glucose infusion is unavailable. Management of hyperinsulinaemic hypoglycaemia (congenital hyperinsulinism)
Action	Glucagon stimulates hepatic gluconeogenesis and glycogenolysis. Glucagon has a positive inotropic action.
Presentation	1 mg (powder for vial) and 1ml solvent 1 unit of glucagon = 1 mg (1000 microgram) glucagon
Storage	Stored in fridge 2 - 8°C. Protect from light (store in original package)
Dose	**0.5 - 1mg stat, then 5-10 mcg /kg /hr[3]** Doses > 20mcg / kg / hr can cause parodoxical insulin secretion and rebound hypoglycemia[3.]
Dilutions	**IV slow bolus:** Reconstitute 1 vial of glucagon vial with 1ml of solvent to make a concentration 1mg/ml. (Product insert). Draw the required dose and give over 3 -5 minutes. **Continuous IV Infusion [2]:** Dilute 0.25mg/kg of glucagon in 25ml D10% | 1ml /hr = 10microgram/ kg /hr
Stability after reconstitution	**Glucagen** Single use only. (Product insert)
Stability after dilution	**Glucagen** Stability after dilution is 24 hours.[2]
Compatibility	Fluids: D5% D10%, NS Y-site: Naloxone
Incompatibility	Fluids: Solutions that contain calcium. Y-site: No information.
Side Effects	Well tolerated. Transient increase in blood pressure and pulse rate[.2] Hyponatraemia and thrombocytopenia have been reported.[4]
Monitoring	Blood glucose concentrations (watch for rebound hypoglycaemia). Electrolytes (for continuous infusion). Consider cardiorespiratory and blood pressure monitoring[.2]
Contraindications/ Precautions	Hypersensitivity to the active substance or to any of the excipients listed in list of excipients. Phaeochromocytoma
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Glucagon (2020) 3)Paediatric Protocol 4th Edition, 2019, Chapter 16 Neonatal Hypoglycemia, page 110. 4) Neofax Neonatal Drug Database (Glucagon) Product Insert Glucagon

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HEPATITIS B VACCINE (PAEDS)/ EUVAX B (IM)

Drug Type	Recombinant vaccine
Indication	Immunization against infection caused by all known subtypes of Hepatitis B virus.
Presentation	0.5ml vial
Storage	Store at 2 - 8°C. DO NOT FREEZE.
Administration	Intramuscular only. Euvax B should not be administered in the gluteal region, and it must not be administered intravenously. Shake before administration, since a fine white deposit with a clear colorless supernatant may form during storage
Dose	Neonates, infants, children up to 15 years old: **0.5ml stat at birth or elected date** 0.5ml of vaccine contains HBsAg 10mcg
Stability after opening	Single use only. Discard any remaining balance.
Contraindication/ Precautions	Should be postponed in patients suffering from acute severe febrile illness. In patients suffering from multiple sclerosis, any stimulation of the immune system can induce exacerbation of their symptoms. Therefore, for these patients the benefits of vaccination against Hepatitis B should be weighed against the risks of exacerbation of multiple sclerosis.
Adverse Reaction	Common: abdominal pain, diarrhea, vomiting, Injection site pain: fever, induration, oedema, tenderness inflammation. Crying abnormal, somnolence, rash erythematous, erythema, irritability, nervousness, insomnia, hematoma
References	Product leaflet Euvax B

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HYDROCHLOROTHIAZIDE (ORAL)

Drug Type	Thiazide diuretic.
Indication	Chronic lung disease. Heart failure. Fluid overload. Hypertension. In conjunction with diazoxide to counter fluid retention
Action	Inhibition of sodium reabsorption in distal nephron, leading to loss of water, sodium, potassium, magnesium, chloride, phosphate and bicarbonate
Presentation	5mg/ml suspension (Extemporaneous Pharmacy preparation)
Storage	At room temperature Protect from light
Administration	Oral. Adminster with feeds to improve absorption[2]
Dose	**1 – 2 mg/kg/dose 12 hourly** [2,3] Used in conjunction with oral diazoxide
Stability	Stable for 120 days in room temperature [14.]
Monitoring	Urine output and weight. Serum sodium, potassium, calcium, phosphorous and glucose
Precautions	Hypokalaemia. Hyponatraemia. Displaces bilirubin so caution required in jaundiced infants
Side Effects	Hypokalaemia; hyponatraemia; hyperglycaemia; hyperuricaemia; hypercalcaemia. Cumulative effects of the drug may develop in patients with impaired renal function. If increasing azotaemia and oliguria occur during treatment of severe progressive renal disease, the diuretic should be discontinued
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Hydrochlorothiazide (2021) 3) Paediatric Protocol 4th Edition 2019. Chapter 96. Approach to Recurrent Hypoglycaemia (page 547) 14) X-Temp Master Formulation 2018 page 42

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HYDROCORTISONE (IV)

<table>
<tr><td>Drug Type</td><td>Anti-inflammatory</td></tr>
<tr><td>Indication</td><td>1. Treatment of hypotension does NOT respond to inotrope.
2. Short term adjunctive therapy for persistent hypoglycaemia.</td></tr>
<tr><td>Action</td><td>Glucocorticoid hormone from the adrenal cortex.</td></tr>
<tr><td>Presentation</td><td>100 mg vial</td></tr>
<tr><td>Storage</td><td>Store below 30°C.</td></tr>
<tr><td>Administration</td><td>IV slow bolus over 1 minute</td></tr>
<tr><td>Dose</td><td>Pressor & volume resistant hypotension: Test dose: 1mg/kg/dose, if response with rise of blood pressure within 2 - 4 hours increase dose to:
<table>
<tr><th>PMA (weeks)</th><th>Dose (mg/kg/dose)</th><th>Interval (hour)</th><th>Range</th></tr>
<tr><td>< 35</td><td rowspan="2">1</td><td>6 - 12</td><td rowspan="2">range 1–2 mg/kg/dose</td></tr>
<tr><td>≥ 35</td><td>6 - 8</td></tr>
</table>
Hypoglycemia: 1 - 2.5 mg/kg/dose 6 hourly[2]
Wean down gradually if duration of treatment >3 days.
Can discontinue hydrocortisone without weaning if total duration of treatment is ≤ 3 days.[5]</td></tr>
<tr><td>Dilution</td><td>Add 2ml water for injection to 100mg vial to give 50 mg/ml solution. Syringe out the required dose and further dilute with NS to concentration of 10mg/ml.[2]</td></tr>
<tr><td>Stability after reconstitution</td><td>Zycort
Stability after reconstitution is 24 hours at room temperature (protect from light and freezing).</td></tr>
<tr><td>Stability after dilution</td><td>Zycort
No data. (Product leaflet)</td></tr>
<tr><td>Compatibility</td><td>Fluids: D5%, D10%, Hartmann’s, NS
Y-Site: Amino Acid Solutions. Aciclovir, Aminophylline, Atracurium, Atropine, Aztreonam, Calcium Gluconate, Caspofungin, Dexamethasone, Digoxin, Dopaminefentanyl, Frusemide, Magnesium Sulfate, Morphine Sulfate, Noradrenaline, Pethidine, Piperacillin-Tazobactam (Edta-Free), Sodium Bicarbonate</td></tr>
<tr><td>Incompatibility</td><td>Fluids: No Information.
Y-Site: Adrenaline Hydrochloride, Calcium Chloride, Dobutamine, Midazolam, Phenobarbitone</td></tr>
<tr><td>Contraindication</td><td>Hydrocortisone is contraindicated in systemic fungal infections and patients with known hypersensitivity to the product and its constituents</td></tr>
<tr><td>Monitoring</td><td>Untreated systemic bacterial infections.
Use with caution in patients with renal impairment, hypothyroidism or cardiac disease. Prolonged use of corticosteroids (> 14 days) may cause prolonged adrenal suppression requiring a tapering dose of hydrocortisone.
Caution should be used when using hydrocortisone for treatment of hyperinsulinaemic hypoglycaemia given the lack of evidence, potential for adrenal suppression and side effects
Use of hydrocortisone in preterm infants in the first week is associated with intestinal perforation, particularly when treating concurrently with indomethacin.</td></tr>
<tr><td>Adverse effects</td><td>Measure blood pressure and blood glucose frequently during acute illness.
In infants with primary adrenal insufficiency, monitor glucocorticoid replacement by clinical assessment, including growth velocity, body weight, blood pressure and energy levels.</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Hydrocortisone (2022)
5) Ashraf M Aly. Neonatal Hypotension, the Role of Hydrocortisone and Other Pharmacological Agents in its Management JPediatr Child Care March 2016 Volume:2, Issue:1, page 5
16) Watterberg. Hydrocortisone Dosing for Hypotension in Newborn Infants: Less is More the Journal of Pediatrics. 2016
Product inserts Zycort</td></tr>
</table>

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IBUPROFEN (IV)

<table>
<tr><td>Drug Type</td><td>Non-steroidal anti-inflammatory drug (NSAID)</td></tr>
<tr><td>Indication</td><td>Patent ductus arteriosus</td></tr>
<tr><td>Action</td><td>Prostaglandin inhibitor. Prostaglandins are important in maintaining ductal patency in utero</td></tr>
<tr><td>Presentation</td><td>Ibuprofen 400mg/100ml</td></tr>
<tr><td>Storage</td><td>Store below 30°C</td></tr>
<tr><td>Administration</td><td>Intravenous</td></tr>
<tr><td>Dose</td><td>Patent Ductus Arteriosus:
<table>
<tr><th rowspan="2">Post-natal Age</th><th colspan="3">Dose (mg/kg/dose)</th></tr>
<tr><th>Day 1</th><th>Day 2</th><th>Day 3</th></tr>
<tr><td>Standard dose [2,3,4]
(≤ 14 days of life)</td><td>10</td><td>5</td><td>5</td></tr>
<tr><td>Standard dose [3]
(> 14 days of life)</td><td>14</td><td>7</td><td>7</td></tr>
<tr><td>Higher dose [2,4]</td><td>20</td><td>10</td><td>10</td></tr>
</table>
A full course of ibuprofen may not be necessary if ductal constriction or closure is demonstrated[2]
A repeat course of treatment may be considered depending on continuing haemodynamic significance of the ductus arteriosus and relative contraindications to treatment[2]. Data are insufficient to determine the efficacy of a 3rd course[2].</td></tr>
<tr><td>Dilution</td><td>Undiluted. Administer by intermittent infusion over 15 minutes (4mg/ml) [4]</td></tr>
<tr><td>Stability after opening</td><td>Discard after use</td></tr>
<tr><td>Compatibility</td><td>Dextrose 5%, Sodium Chloride 0.9%</td></tr>
<tr><td>Incompatibility</td><td>No information</td></tr>
<tr><td>Monitoring[3]</td><td>Urine output, renal function, cardiovascular status, serum biochemistry, hyperbilirubinemia and for signs of bleeding.
If urine output < 0.6 ml/kg/hr after a dose is given.
Withhold next dose until output is back to normal</td></tr>
<tr><td>Contraindications[3]</td><td>1) Infant is proven or suspected to have infection that is untreated
2) Bleeding, especially active gastrointestinal or intracranial
3) Platelet count < 60 x 10^9/ L
4) NEC or suspected NEC
5) Duct dependent congenital heart disease
6) Impaired renal function</td></tr>
<tr><td>Adverse Effects[2]</td><td>Ibuprofen for treatment of a PDA was associated with increased oliguria and increased creatinine. Pulmonary hypertension
Ibuprofen may displace bilirubin from albumin at high concentrations in vitro (200 micromol/L), although this does not appear to occur in vivo at the concentrations associated with recommended doses (up to 100 micromol/L)
Compared to Paracetamol (Acetaminophen), Ibuprofen was associated with a high rate of gastrointestinal bleeding, higher creatinine and bilirubin levels, and lower platelet counts and daily urine output.</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Ibuprofen (2021)
3) Paediatric Protocol 4th Edition 2019. Chapter 27, Patent Ductus Arteriosus in the Preterm Infant. (Page 162- 163)
4) Neofax Neonatal Drug Database (Ibuprofen)</td></tr>
</table>

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IBUPROFEN (ORAL)

<table>
<tr><td>Drug Type</td><td>Non-steroidal anti-inflammatory drug (NSAID)</td></tr>
<tr><td>Indication</td><td>Patent ductus arteriosus</td></tr>
<tr><td>Action</td><td>Prostaglandin inhibitor. Prostaglandins are important in maintaining ductal patency in utero</td></tr>
<tr><td>Presentation</td><td>Syrup Ibuprofen 100mg/5ml</td></tr>
<tr><td>Storage</td><td>Store below 30°C</td></tr>
<tr><td>Administration</td><td>Oral.
Give via intra-gastric tube, preferably with milk feed to minimize risk of gastrointestinal irritation</td></tr>
<tr><td>Dose</td><td>Patent Ductus Arteriosus:
<table>
<tr><th rowspan="2">Post-natal Age</th><th colspan="3">Dose (mg/kg/dose)</th></tr>
<tr><th>Day 1</th><th>Day 2</th><th>Day 3</th></tr>
<tr><td>Standard dose [2,3,4]
(≤ 14 days of life)</td><td>10</td><td>5</td><td>5</td></tr>
<tr><td>Standard dose [3]
(> 14 days of life)</td><td>14</td><td>7</td><td>7</td></tr>
<tr><td>Higher dose [2,4]</td><td>20</td><td>10</td><td>10</td></tr>
</table>
A full course of ibuprofen may not be necessary if ductal constriction or closure is demonstrated. [2]
A repeat course of treatment may be considered depending on continuing haemodynamic significance of the ductus arteriosus and relative contraindications to treatment[2]. Data are insufficient to determine the efficacy of a 3rd course[2].</td></tr>
<tr><td>Stability</td><td>6 months after open</td></tr>
<tr><td>Monitoring</td><td>Urine output, renal function, cardiovascular status, serum biochemistry, hyperbilirubinemia and for signs of bleeding.
If urine output < 0.6 ml/kg/hr after a dose is given. Withhold next dose until output is back to normal</td></tr>
<tr><td>Precautions[3]</td><td>Infants are proven or suspected to have infection that is untreated.
Bleeding, especially active gastrointestinal or intracranial
Platelet count < 60 x 109
NEC or suspected NEC
Duct dependent congenital heart disease.
Impaired renal function</td></tr>
<tr><td>Side Effects[2]</td><td>Ibuprofen for treatment of a PDA was associated with increased oliguria and increased creatinine.
Pulmonary hypertension
Ibuprofen may displace bilirubin from albumin at high concentrations in vitro (200 micromol/L), although this does not appear to occur in vivo at the concentrations associated with recommended doses (up to 100 micromol/L)
Compared to paracetamol (acetaminophen), ibuprofen was associated with a high rate of gastrointestinal bleeding, higher creatinine and bilirubin levels, and lower platelet counts and daily urine output</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Ibuprofen (2021)
3) Paediatric Protocol 4th Edition 2019. Chapter 27, Patent Ductus Arteriosus in the Preterm Infant. (Page 162- 163)
4) Neofax Neonatal Drug Database (Ibuprofen)</td></tr>
</table>

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IRON (III) POLYALTOSE COMPLEX/ MALTOFER® SYRUP (ORAL)

Drug Type	Iron preparation
Indication	Treatment of iron deficiency without anemia anaemia and iron deficiency anaemia. Prophylactic therapy of Iron deficiency.
Action	In the iron (III)-hydroxide polymaltose complex, the polynuclear iron (III)-hydroxide core is superficially surrounded by a number of non-covalently bound polymaltose molecules resulting in an overall average molecular weight of approximately 50 kDa. The polynuclear core of IPC has a structure similar to that of the physiological iron storage protein, ferritin. IPC is a stable complex and does not release large amounts of iron under physiological conditions. Because of its size, the extent of diffusion of IPC through the membrane of the mucosa is about 40 times less than that of the hexaquo-iron (II) complex. Iron from IPC is taken up in the gut via an active mechanism.
Presentation	10mg/ml (150ml oral solution bottle) 1 ml (10mg) contains 10 mg of elemental iron as 37mg iron (III)-hydroxide polymaltose complex (IPC).
Storage	Store below 30°C Protect from light.
Administration	Oral. Maltofer syrup should be taken during or immediately after a meal. Maltofer syrup can be mixed with fruit and vegetable juices or with bottle-feed. The slight discolouration of the mixture does not affect either the efficacy of the product or the taste of the drink to which it is added. Do not shake the bottle.
Dose	Treatment of iron deficiency with anaemia: **6mg/kg/day** (10mg/1ml) Prophylaxis: **2-3mg/kg/day**
Stability	Do not use after the expiry date stated on the label.
Precautions	Very common: Discolored stools Common: Diarrhea, nausea,dyspepsia Uncommon: vomitting, constipation, abdominal pain, tooth discoloration, rash, pruritis, headache.
References	Product leaflet Oral Maltofer®

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IMIPENEM + CILASTATIN (IV)

Drug Type	Antibacterial- Carbapenems
Indications	Non-CNS sepsis caused by susceptible organisms including enteric Gram-negative rods, extended-spectrum beta-lactamase [ESBL] organisms, Pseudomonas aeruginosa, anaerobic organisms (including Bacteroides fragilis) and many Gram- positive organisms.
Action	Inhibits cell wall synthesis. Cilastatin prevents renal metabolism of Imipenem. Meropenem is a better choice for central nervous system infections as it attains a higher concentration in the cerebrospinal fluid and has a lower incidence of seizures than Imipenem + Cilastatin.
Presentation	500mg powder vial
Storage	Store below 30°C. Protect from light.
Administration	Infusion over 30 minutes.
Dose[4] **Renal dose** **Refer page 135**	

Body weight	Post Natal Age	Dose (mg/kg/dose)	Interval(hour)
BW ≤ 2kg	1st week of life	**20**	**12**
	2nd week onwards	**25**	**12**
BW > 2kg	1st week of life		**12**
	2nd week onwards		**8**

Dilution	Reconstitute with 10 ml NS, then transfer to 100 ml NS container to make up to concentration of 5mg/ml. Syringe out the dose required and infuse over 30 minutes.
Stability after reconstitution	**Imipenem/ Cilastatin Kabi** The reconstituted/diluted solution is stable for 4 hours at room temperature and 24 hours if refrigerated. (Product insert)
Stability after dilution	**Imipenem/ Cilastatin Kabi** The reconstituted/diluted solution is stable for 4 hours at room temperature and 24 hours if refrigerated. (Product insert)
Compatibility	Fluids: D5%, D10%, NS Y-Site: Aciclovir, Zidovudine
Incompatibility	Fluids: Hartmann's. Y-Site: Amiodarone, Amoxycillin, Azithromycin, Ceftriaxone, Fluconazole, Ganciclovir, Midazolam, Milrinone, Sodium Bicarbonate.
Side Effects	Seizures, impaired renal function, impaired liver function, tachycardia, local phlebitis, urticaria, diarrhoea, pseudomembranous colitis (Clostridium difficile) and vomiting.
Monitoring	Monitor renal function. Dose may need to be reduced in impaired renal function (refer to renal dosing page 141). Monitor blood count and liver function
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Imipenem + Cilastatin (2021) 4) Neofax Neonatal Drug Database (Imipenem + Cilastatin) Product Insert Imipenem/Cilastatin Kabi

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HUMAN NORMAL IMMUNOGLOBULIN/ IVIG (IV)

Indication	Sepsis/infection –prevention and treatment
Action	Provides humoral immunity and is an immune modulator.
Presentation	3g /50ml (Intragam®P)
Storage	Store at 2 - 8°C. - do not use if product has been frozen. Allow to reach room temperature before use. Once removed from refrigeration, store below 25°C and use within 3 months. Do not use if product contains any sediment - may appear slightly yellow.
Dose	**Sepsis/infection: 0.5 - 1g/kg/dose**
Administration	Intragam P should be administered separately from other intravenous fluids or medications the patient may be receiving. IV infusion over 6 hours
Stability after reconstitution	**Intragam P** Does not require reconstitution.
Stability after dilution	**Intragam P** Does not require further dilution. Use immediately once opened and discard unused portion.
Compatibility	NS for priming and flushing. Other drugs not tested.
Side Effects	Severe reactions are uncommon especially in neonates. In older patients is most likely to occur during the first infusion but may occur subsequently. Anaphylactic reactions are rare: urticaria, angioedema, bronchospasm and hypotension. Anaphylactic reactions may require oxygen, adrenaline (epinephrine) and steroids depending on severity of the reaction. More common reactions are flushing, fever, headache, pallor, shivering and tachycardia. Other reported reactions: dyspnoea, chest tightness, tachycardia or hypotension without anaphylaxis, transient haemolytic anaemia, abdominal pain and renal failure. Milder reactions often resolve after the infusion has been stopped. If so, after discussion with medical staff, the infusion may be recommended at a slower rate after at least 15 minutes. Subsequent infusions should be commenced and escalated at a slower rate.
Drug Interaction	Concurrent use of immunoglobulin and live virus vaccines may result in interference with the immune response to the live vaccine. Following the receipt of IVIG for ITP treatment, an interval of 8–10months should elapse before vaccination with an MMR, MMRV or varicella vaccine. May result in false-positive Coombs test due to passive transmission of antibodies to erythrocyte antigens.
Monitoring	Monitor temperature, heart rate, SaO2 and blood pressure 15 minutes after commencing infusion and hourly thereafter. Observe for signs of phlebitis.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Intraveneous Immunoglobulin (2023) Product Insert Intragam P

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INSULIN SHORT-ACTING FOR HYPERGLYCEMIA (IV)

Drug Type	Hormone
Indication	Treatment of persistent hyperglycemia.
Action	Insulin is a polypeptide hormone that acts on cells throughout the body to stimulate uptake, utilization and storage of glucose resulting in a lowering of blood glucose. Insulin stimulates the liver to store glucose in the form of glycogen and facilitates the entry of glucose into muscle and adipose tissue. It inhibits lipolysis, proteolysis and gluconeogenesis, enhances protein synthesis and conversion of excess glucose into fat.
Presentation	1000 IU/ 10ml vial (100 IU /ml)
Storage	2-8°C in fridge. Protect from light and heat.
Administration	Continuous IV infusion: Insulin binds to the plastic of giving sets. Flush the plastic tubing with 20 mL of prepared insulin solution into a receptacle prior to connecting to the infant. This is to saturate the binding. Do not filter infusion. Insulin also binds to the filter. Do not bolus other drugs through this line.
Dose	Continuous IV Infusion: **0.01- 0.1 units/ kg/ hr**[4]
Dilution	1) Withdraw 1 ml (100 units) Actrapid and add to 9ml of NS (1ml = 10 units) 2) From the above dilution (1ml = 10 units), withdraw 1 ml and add to 9ml of NS (1ml = 1 unit) 3)Withdraw 5 units/kg and dilute to 50ml with NS (1ml /hr = 0.1 unit/kg/hr)
Stability after reconstitution	**Actrapid** Does not require reconstitution. After opening, stable for 6 weeks at room temperature. Do NOT refrigerate.
Stability after dilution	**Actrapid** Stable for 24 hours at room temperature after dilution.
Compatibility	D5%, D10%, NS, Amino Acid, Lipid Emulsion Y-Site Administration: Calcium Gluconate, Cefepime Hydrochloride; Cefotaxime; Ceftazidime; Ceftriaxone Sodium; Cefuroxime; Chloramphenicol Sodium Succinate; Dexamethasone Sodium Phosphate; Fentanyl Citrate; Fluconazole; Hydrocortisone Sodium Succinate; Imipenem-Cilastatin Sodium; Lidocaine Hydrochloride; Magnesium Sulfate; Meropenem; Methylprednisolone Sodium Succinate; Metronidazole; Milrinone Lactate, Penicillin G Sodium; Phenobarbital Sodium; Phytonadione; Piperacillin Sodium, Potassium Chloride; Sodium Bicarbonate; Vancomycin Hydrochloride
Incompatibility	Y-Site Administration: Diazepam; Dopamine; Isoprenaline; Ketamine; Labetalol; Noradrenaline (Norepinephrine); Phenytoin; Piperacillin Sodium-Tazobactam Sodium; Polymyxin; Propranolol; Sulfamethoxazole-Trimethoprim
Monitoring	Blood glucose concentration. Initiation: Every 30 minutes until stabilised. Stabilisation: 4–6 hourly. After cessation of infusion: At 30 minutes and at 1 hour. Monitor serum potassium concentration.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Insulin-Hyperglycaemia (2022) 4) Neofax Neonatal Drug Database (Insulin) Product insert Actrapid

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INSULIN SLIDING SCALE (FOR HYPOGLYEMIA)

Dextrostix (mmol/l)	Insulin infusion dose (unit/kg/hour)	Insulin infusion rate (ml / hr)
> 20	0.1 unit/kg/hour	1 ml/hour
> 18 - 20	0.08 unit/kg/hour	0.8 ml/hour
> 16 - 18	0.06 unit/kg/hour	0.6 ml/hour
> 14 - 16	0.04 unit/kg/hour	0.4 ml/hour
>12 - 14	0.02 unit/kg/hour	0.2 ml/hour
> 10 - 12	0.01 unit/kg/hour	0.1 ml/hour

INSULIN SHORT-ACTING FOR HYPERKALEMIA (IV)

Drug Type	Polypeptide hormone- reduces glucose and K
Indication	Treatment of hyperkalaemia, infants with serum potassium (K+) ≧7.0 mmol/L -Infants with hyperkalaemia and abnormal ECG -Management of severe cardiotoxicity or cardiac arrest due to hyperkalaemia
Action	Insulin and glucoseactivate cellular sodium-potassium ATPase resulting in a potassium shift into the intracellular space.
Presentation	1000 IU/ 10ml vial (100 IU / ml)
Storage	2-8°C in fridge. Protect from light and heat.
Administration	Continuous IV infusion Insulin binds to the plastic of giving sets. Flush the plastic tubing with 20 mL of prepared insulin solution into a receptacle prior to connecting to the infant. This is to saturate the binding. Do not filter infusion. Insulin also binds to the filter. Do not bolus other drugs through this line. Change infusion 24th hourly.
Dose	**Hyperkalaemia (Coactail)** [3] Insulin**: 0.05 – 0.2 units/kg/ hour** IV Glucose 10%: **5ml/kg/hr (or 20% at 2.5ml/kg/hr),** Once blood sugar level > 10mmol/L and K+ level is not failing, add IV Insulin 0.05unit/kg/hr and titrate according to glucose level. IV Calcium Gluconate: **0.1mmol/kg**
Dilution	1) Withdraw 1 ml (100 units) Actrapid and add to 9ml of NS (1ml = 10 units) 2) From the above dilution (1ml = 10 units), withdraw 1 ml and add to 9ml of NS (1ml = 1 unit) 3)Withdraw 5 units/kg and dilute to 50ml with NS (1ml /hr = 0.1 unit/kg/hr)
Stability after reconstitution	**Actrapid** Does not require reconstitution. After opening, stable for 6 weeks at room temperature. Do NOT refridgerate.
Stability after dilution	**Actrapid** Stable for 24 hours at room temperature after dilution.
Compatibility	D5%, D10%, NS, Amino Acid, Lipid Emulsion Y-Site Administration: Calcium Gluconate, Cefepime Hydrochloride; Cefotaxime; Ceftazidime; Ceftriaxone Sodium; Cefuroxime; Chloramphenicol Sodium Succinate; Dexamethasone Sodium Phosphate; Fentanyl Citrate; Fluconazole; Hydrocortisone Sodium Succinate; Imipenem-Cilastatin Sodium; Lidocaine Hydrochloride; Magnesium Sulfate; Meropenem; Methylprednisolone Sodium Succinate; Metronidazole; Milrinone Lactate, Penicillin G Sodium; 55tabilized55al Sodium; Phytonadione; Piperacillin Sodium, Potassium Chloride; Sodium Bicarbonate; Vancomycin Hydrochloride
Incompatibility	Y-Site Administration: Diazepam; Dopamine; Isoprenaline; Ketamine; Labetalol; Noradrenaline (Norepinephrine); Phenytoin; Piperacillin Sodium-Tazobactam Sodium; Polymyxin; Propranolol; Sulfamethoxazole-Trimethoprim
Monitoring	Blood glucose concentration. Initiation: Every 30 minutes until stabilized. Stabilisation: 4–6 hourly. After cessation of infusion: At 30 minutes and at 1 hour. Monitor serum potassium concentration within 30–60 minutes of commencing glucose/insulin infusion. Serum potassium should be closely monitored to monitor response to treatment and avoid hypokalaemia.
Adverse Effects	High rate of hyperglycaemia and hypoglycaemia during infusion and hypoglycaemia during weaning (insulin has a longer half-life than glucose) Hypokalaemia if infusion continued. Hypertonic solution –potential for extravasation
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Insulin-Hyperkalaemia (2019)

	3) Paediatric Protocol 4th Edition 2019, Chapter 3: Paediatric Fluids and Electrolyte Guidelines, page 34 4) Neofax Neonatal Drug Database (Insulin) Product insert Actrapid

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CONTROLLED ITEM:
STRICTLY 1 VIAL PER PATIENT.

LEVETIRACETAM (IV/ORAL)

Drug Type	Anticonvulsant
Indication	Treatment of neonatal seizures
Action	The exact mechanism of action is unclear. It appears to act by modulation of synaptic neurotransmitter release (GABA, glutamic acid) through binding to the synaptic vesicle glycoprotein 2A and by effects on calcium entry and release pathways in the brain.
Presentation	IV: 500 mg/5 mL vial Oral: 500mg tab (Extemporaneous Pharmacy preparation)
Route of Administration	Intravenous infusion over 15 minutes. Diluted IV solution may be given centrally or peripherally Oral: May be given with or without feed (although feed delays the absorption of levetiracetam – this is not a problem if the infant is on maintenance doses). May be given at the same time as other medications.
Storage	Store below 25°C
Dose	Loading dose: **40mg/kg/dose**[3] Maintenance dose: **20 mg/kg 12 hourly**, increased every 2-3 days at the discretion of the neurology team. The normal maximum in the neonatal period is 60mg/kg/day. Use a 1:1 conversion which switching between intravenous and enteral doses
Dose Adjustment	Renal impairment – dosage adjustment may be necessary. Discuss with paediatric neurologist. Hepatic impairment – No dose adjustment is required.
Dilution	For intravenous infusion, dilute concentrate to 10mg/mL prior to administration. Take 1mL (100mg) of 100mg/mL Levetiracetam concentrated injection and add to 9mL of glucose 5%, mix well. This creates a solution containing 100mg in 10mL (10mg/mL). Draw up dose and administer over 15 minutes.
Administration	Infuse over 15 minutes
Stability after reconstitution	IV: Discard after use
Stability after dilution	IV: 24 hours after dilution (HSGB Local consensus)
Compatibility	Glucose 5%, sodium chloride 0.9%
Incompatibility	No info provided
Monitoring	Seizure frequency, duration and severity. Watch for hypotension, respiratory suppression, sedation. Renal function. Therapeutic drug monitoring – Routine monitoring of trough serum concentrations is not necessary. Monitoring may be considered in neonates with seizures resistant to high dose therapy or exhibiting adverse reactions. The reference range for serum levetiracetam concentrations has not been well established and may vary from 6-20 microgram/mL.
Precautions	Do not stop levetiracetam therapy abruptly in infants on prolonged therapy. Use with caution in renal impairment. Preterm neonates - Although similar dosing has been used, there are minimal pharmacokinetic data in this population.
Contraindications	Hypersensitivity to levetiracetam or any of the ingredients.
Drug Interaction	Increased clearance by 30% was suggested with co-administration of phenobarbital and phenytoin in children and adults and similar association may explain increased clearance in neonates
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus: Levetiracetam (2021) 3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 21: Neonatal Seizures (page 133)

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LEVOTHYROXINE (ORAL)

Drug Type	Levothyroxine sodium previously known as thyroxine sodium, is the monosodium salt of the levo-isomer of thyroxine, the principal secretion of the thyroid gland
Indication	Thyroid hormone deficiency
Action	Levothyroxine exerts effects on most organ systems and is particularly important in the development of the central nervous system. Increases the metabolic rate of body tissues. Also involved in the regulation of cell growth and differentiation
Presentation	25mcg, 50mcg tablet
Storage	Store below 30°C
Administration	Oral. Tablet freshly dispersed in water immediately prior to administration is recommended Can be administered in the morning or evening, preferably before feeding. Should be administered in the same way, at the same time every day. Levothyroxine should not be mixed with substances that interfere with gastrointestinal absorption, such as soy protein formula, concentrated iron or calcium [ensure at least a 2-hour interval]
Dose	Dosage should be individualized and adjusted based on factors including patient age, body weight, cardiovascular status, concomitant medical conditions, co-administered food, and the specific nature of the condition being treated. Peak therapeutic effect may not be attained for 4 to 6 weeks. Initial dose :**10-15mcg/kg/day** [2,4] Maintenance dose: 8- 10mcg/ kg/day Round up to the nearest half or whole tablet
Stability	Freshly prepared.
Monitoring	The goal of initial therapy is to raise free T4 concentration to the upper end of the normal range within 2 weeks of starting therapy and decrease the TSH to <20 mU/L within the first month. The goal of maintenance therapy is to normalise the TSH and aim for free T4 in the upper half of the normal range. The baby is re-examined and repeat thyroid tests are performed at two weeks after starting therapy, at 6 weeks, at 3 months and 2–3-monthly for the first year of life.[2] Thereafter, clinical examination and thyroid function testing occurs three-monthly unless there has been a significant dose change, a change to or from soy-based formula or there is a clinical indication. Reviews can be done at about four-monthly intervals after the age of three years and in older children four- to six-monthly.[2]
Precautions	In pre-existing cardiac insufficiency, introduce levothyroxine at 50% of the target replacement dose and increase after 2 weeks based on free T4 levels
Adverse effects	Uncommon. Too high a replacement dose can cause manifestations of thyrotoxicosis. Overtreatment with levothyroxine may cause craniosynostosis, accelerated growth and maturation, disturbed sleep patterns and effects on temperament. Behavioural problems (social withdrawal, hyperactivity, conduct problems, and anxiety) in children treated with initial starting doses of > 10mcg/ kg/day. Overtreatment should be avoided by careful monitoring.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Levothryorine (2021) 4) Neofax Neonatal Drug Database (Levothyroxine)

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LINEZOLID IS AN 'ID ADULT AND ANEST DEPARTMENT' ITEMS. KINDLY CALL THEIR SPECIALIST TO ASK PERMISSION TO USE BEFORE STARTING ANTIBIOTIC

LINEZOLID (IV/ORAL)

Drug Type	Oxazolidinone Antibiotic
Alert	Linezolid is not the standard first-line therapy for treatment of methicillin-resistant Staphylococcus aureus (MRSA) or coagulase-negative staphylococci (CoNS).[2]
Indication	Treatment of Gram-positive infections either refractory to vancomycin or where vancomycin is contraindicated.
Action	Oxazolidinone class of antibiotic that act as a protein synthesis inhibitor on the ribosomal 50S subunit of the bacteria. This prevents the formation of the 70S initiation complex which is a prerequisite for bacterial reproduction. Linezolid possesses antimicrobial activity against a wide variety of Gram-positive pathogens, with bactericidal effects against most strains of Streptococcus spp. and bacteriostatic action against Enterococcus spp. and Staphylococcus spp., including VRE, MRSA and methicillin-resistant CoNS. Linezolid is also active against anaerobes, atypical microbes such as Chlamydia and Mycoplasma spp., some rapidly growing mycobacteria and selected Gram-negative bacilli.2
Presentation	IV: 600 mg in 300 mL infusion preparation (2 mg/mL) Oral: 600mg tablet
Dose	Standard dosing IV or Oral Intermittent regimen[2-4]

GA (weeks)	Post Natal Age (days)	Dose (mg/kg/dose)	Interval (hour)
≤34	0 - 7	**10**	12
	7 - 28		8
>34	0 - 28		8

IV continuous infusion: **30mg/kg/day**
Higher dosing (for pathogens with MIC ≥2 mg/L) 12 mg/kg/dose 8-hourly. Watch for thrombocytopenia and lactic acidosis.

Dosing Adjustment	Renal impairment: No dose adjustment is required Hepatic impairment: No dose adjustment is required
Maximum dose	600 mg daily
Route	IV or Oral
Preparation	IV infusion: Use undiluted, supplied as ready-to-use infusion Oral: Freshly prepared
Administration	IV: Infuse over 30 to 120 minutes or administer as a continuous infusion. Oral: May be given at any time with regards to feeds.
Stability	IV injection may exhibit yellow colour that can intensify over time without affecting potency. Store at 25°C. Protect from light. Suspension is stable for 21 days after reconstitution. Store at 25°C (before and after reconstitution). Protect from light.
Storage	Store at room temperature, do not freeze. Protect from light.
Compatibility	Sodium Chloride 0.9%, Glucose 5%, Ringer's Lactate (Hartmann's) Y-Site: Aciclovir, Adrenaline (Epinephrine), Alfentanil, Allopurinol, Amikacin, Aminophylline, Amiodarone, Amphotericin B Lipid Complex/Liposome, Ampicillin, Anidulafungin, Atenolol, Atracurium, Azithromycin, Aztreonam, Calcium Chloride, Calcium Gluconate, Cefazolin, Cefotaxime, Ceftriaxone, Chloramphenicol, Ciprofloxacin, Clindamycin, Dexamethasone Sodium Phosphate, Dexmedetomidine, Digoxin, Diltiazem, Dobutamine, Fentanyl Citrate, Fluconazole, Furosemide (Frusemide), Gentamicin, Haloperidol, Heparin Sodium, Hydralazine, Hydrocortisone, Insulin, Labetalol, Lidocaine (Lignocaine), Lorazepam, Magnesium Sulfate, Meropenem, Metronidazole, Midazolam, Morphine Sulfate, Naloxone, Noradrenaline (Norepinephrine), Phenobarbital, Piperacillin/Tazobactam, Potassium Chloride, Remifentanil. Rocuronium, Sodium Bicarbonate, Sufentanil, Tobramycin, Vancomycin, Vecuronium, Verapamil, Zidovudine

Incompatibility	Amphotericin B Conventional, Ceftriaxone, Chlorpromazine, Diazepam, Erythromycin, Pantoprazole, Pentamidine, Phenytoin, Thiopentone Sodium, Trimethoprim/Sulfamethoxazole
Adverse effects	Thrombocytopenia and anaemia occur in 2-5%. Lactic acidosis – rare. Elevated transaminases and diarrhoea occur in 5% Cataracts are reported in preterm infants Peripheral and optic neuropathy and convulsions have been reported, mainly in patients treated for longer than 28 days
Monitoring	Periodic full blood count, lactate and liver function test for any development of thrombocytopenia, lactic acidosis and elevated transaminases, particularly if linezolid is used for >2 weeks[2,4] For use >4 weeks, monitor for cataracts and neuropathy[2,4]
Contraindications	Hypersensitivity to linezolid or any component of the formulation (MIMS online) Monoamine oxidase inhibitors: Linezolid should not be used in patients taking any medicinal product which inhibits monoamine oxidases A or B or within two weeks of taking any such medicinal product.[2,4] Potential interactions producing elevation of blood pressure: Unless patients are monitored for potential increases in blood pressure, linezolid should not be administered to patients with uncontrolled hypertension, pheochromocytoma, thyrotoxicosis and/or patients taking any of the following types of medications: directly and indirectly acting sympathomimetic agents (e.g. pseudoephedrine), vasopressor agents (e.g. adrenaline [epinephrine], noradrenaline [norepinephrine]), dopaminergic agents (e.g. dopamine, dobutamine)[2,4]
Special Comments	Based on email on 15/12/2022, consensus on Injection Linezolid use in NICU and General Paediatrics as per agreement between Paediatrics clinical pharmacists with Dr Syamhanin and AMS team Hsgb. Based on ASHP Injectable Drug Information (Linezolid AHFS 8:12.28.24), Linezolid (Pfizer) 2mg/ml remained stable without noticeable degradation for 72H when stored at 70C. Linezolid was found to be compatible with common types of intravenous administration sets including DEHP, plasticised PVC, TOTM plasticised PVC and polyolefin set. Thus, it is agreeable for TPN Unit to aseptically syringe out Injection Linezolid for paediatric doses and stable up to 72H. (Neonatal and Paediatric dose: 10mg/kg/dose 8H).
References	2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Linezolid (2020) 4)Neofax Neonatal Drug Database (Linezolid) ASHP Injectable Drug Information (Linezolid)

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MAGNESIUM SULPHATE 50% (IV)

<table>
<tr><td>Drug Type</td><td>Electrolyte</td></tr>
<tr><td>Indication</td><td>Hypomagnesaemia (acute and chronic).
Pulmonary hypertension when inhaled nitric oxide is not available.</td></tr>
<tr><td>Action</td><td>Magnesium is an intracellular cation. Calcium and NMDA receptor antagonist. Magnesium is necessary for several steps in glycolysis, the Krebs cycle and in protein and nucleic acid synthesis. It is vital for normal energy storage and transfer. Magnesium plays an important role in neurochemical transmission, and is essential for proper neurochemical functioning. Magnesium has an anticonvulsant effect</td></tr>
<tr><td>Presentation</td><td>IV magnesium sulphate 50% 2.47 g in 5 mL ampoule
(2.47g Magnesium sulphate = 10mmol = 20mEq) in 5ml
(493mg/ml or 2mmol/ml)</td></tr>
<tr><td>Storage</td><td>Store below 30°C.</td></tr>
<tr><td>Administration</td><td>IV Infusion over 30- 60 minutes, Continuous IV Infusion</td></tr>
<tr><td>Dose & Dilution</td><td>Hypomagnesaemia
IV Magnesium Sulphate 50%: 25- 50mg/kg (0.05-0.1ml/kg) over 10 - 60 minutes.[2,4]
Dilution: Dilute up to 5ml with D5% or NS. (Concentration of 25mg/ml).[2]
Target Mg level: 0.7 -1.2mmol/L

Pulmonary hypertension:
Loading dose: IV Magnesium Sulphate 50%: 200mg/kg over 60 minutes.
Dilute 10ml of IV Mg Sulphate 50% with 40ml D5% or Normal Saline to make up a final concentration of 100mg/ml. [2]
Continuous IV infusion: 20–50 mg/kg/hour, using the above dilution.[2]

<table><tr><th>Dose of MgSO4</th><th>Infusion rate</th></tr><tr><td>20 mg/ kg/ hour</td><td>0.2ml/ kg/ hour</td></tr><tr><td>30 mg/ kg/ hour</td><td>0.3ml/ kg/ hour</td></tr><tr><td>40 mg/ kg/ hour</td><td>0.4ml/ kg/ hour</td></tr><tr><td>50 mg/ kg /hour</td><td>0.5ml/ kg/ hour</td></tr></table>
Target serum magnesium between 3.5 and 5.5 mmol/L
Do NOT give undiluted!!</td></tr>
<tr><td>Stability after reconstitution</td><td>DBL Magnesium Sulfate 50%
Does not require reconstitution</td></tr>
<tr><td>Stability after dilution</td><td>DBL Magnesium Sulfate 50%
Stable for 24 hours in room temperature after dilution. No data in the fridge.</td></tr>
<tr><td>Compatibility</td><td>NS, HS /Glucose 4%, D5%, Parenteral Nutrition Glucose Amino Acid Solution.
Y Site: Aciclovir, Amikacin, Ampicillin, Cefotaxime, Chloramphenicol, Gentamicin, Heparin Sodium, Hydrocortisone Sodium Succinate, Metronidazole, Milrinone, Morphine Sulfate, Piperacillin-Tazobactam (EDTA-Free), Potassium Chloride, Trimethoprim-Sulfamethoxazole, Vancomycin.</td></tr>
<tr><td>Incompatibility</td><td>Fat Emulsion. Incompatible With Soluble Phosphates and With Alkaline Carbonates and Bicarbonates.
Y Site: Aminophylline, Amiodarone, Calcium Salts, Cefepime, Ceftriaxone, Ciprofloxacin, Clindamycin, Dexamethasone, Methylprednisolone Sodium Succinate, Phosphate Salts, Sodium Bicarbonate.</td></tr>
<tr><td>Contraindications</td><td>Heart block or myocardial damage</td></tr>
<tr><td>Side Effects</td><td>Hypotension, bradycardia and circulatory collapse with rapid infusion. ECG changes (prolonged AV conduction time, sino-atrial block, AV block). Calcium gluconate should be available to reverse adverse effects. Flushing, sweating, respiratory depression (particularly with higher plasma concentrations), abdominal distension, diarrhoea, urinary</td></tr>
</table>

	retention, CNS depression, muscle relaxation, hyporeflexia
Monitoring	ECG and continuous or frequent blood pressure. Monitor magnesium concentrations
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Magnesium (2018) 4) Neofax Neonatal Drug Database (Magnesium Sulphate) Product insert Magnesium Sulphate 50%

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MEROPENEM (IV)

<table>
<tr><td>Drug Type</td><td>Carbapenem antibiotic.</td></tr>
<tr><td>Indication</td><td>Severe infections (e.g. Sepsis or meningitis) caused by Gram-negative organisms resistant to other conventional antibiotics but susceptible to meropenem (e.g. ESBL).</td></tr>
<tr><td>Action</td><td>Broad spectrum carbapenem that penetrates CSF & most body tissues.
Meropenem attains a higher concentration in the cerebrospinal fluid particularly with inflamed meninges and has a lower incidence of seizures than Imipenem.</td></tr>
<tr><td>Presentation</td><td>1g vial (powder)</td></tr>
<tr><td>Storage</td><td>Store below 30°C.</td></tr>
<tr><td>Administration</td><td>May be given over 30 minutes if longer infusion not feasible due to line access issues from other infusions.
Extended dosing interval over 4 hours to achieve higher MIC[2].</td></tr>
<tr><td>Dose
Renal dose
Refer page 135</td><td>Non-CNS :20-30mg/kg/dose[2,4]
<table>
<tr><th>GA (weeks)</th><th>Postnatal (days)</th><th>Dose (mg/kg/dose)</th><th>Interval (hour)</th></tr>
<tr><td>< 32</td><td>0-13
≥ 14</td><td>20</td><td>12
8</td></tr>
<tr><td>≥ 32</td><td>0-13
≥ 14</td><td>20
30</td><td>8
8</td></tr>
</table>
Meningitis and Pseudomonas Sepsis: 40mg/kg/dose 8 hourly[2,4]</td></tr>
<tr><td>Dilution</td><td>Reconstitute 1 vial of meropenem 1g with 20ml water for injection to produce 50mg/ml.
Then withdraw the required dose and further dilute with NS to make up to a concentration of 1- 20mg/ml.[4]</td></tr>
<tr><td>Stability after reconstitution</td><td>Meropenem Kabi
After reconstituting with WFI: Stability is 3 hours at room temperature and 12 hours in fridge (2- 8°C)</td></tr>
<tr><td>Stability after dilution</td><td>Meropenem Kabi
After dilution with NS: Stability is 3 hours at room temperature or 24 hours in fridge (2-8°C)</td></tr>
<tr><td>Compatibility</td><td>Fluids: NS (Preferred), D5%, D10%,
Y- Site: Amino Acid Solutions, Dexamethasone Sodium, Gentamicin, Heparin Sodium, Metronidazole.</td></tr>
<tr><td>Incompatibility</td><td>Fluids: No Information
Y- Site: Zidovudine.</td></tr>
<tr><td>Side Effects</td><td>Injection site inflammation, diarrhoea (up to 6% in children), anaemia, eosinophilia</td></tr>
<tr><td>Precautions</td><td>Sodium Valproate– Meropenem may result in clinically significant reduction in concentration of sodium valproate, which may cause seizures.</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Meropenem (2023)
4) Neofax Neonatal Drug Database (Meropenem)
Product insert Meropenem Kabi</td></tr>
</table>

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METRONIDAZOLE (IV)

Drug Type	Antibacterial — nitromethylimidazole
Indication	Treatment of anaerobic bacteria (including meningitis) and protozoal infections. Treatment of necrotising enterocolitis
Action	Bactericidal agent against anaerobic bacteria and an antiprotozoal agent.
Presentation	500mg / 100ml vial
Storage	Store below 30°C. Protect from light.
Administration	IV Infusion: Over 30 minutes with a syringe pump.
Dose **Renal dose** **Refer page 135**	**Loading dose: 15 mg/kg then**, maintenance dose follows the dosing interval below[2]

PMA (Weeks)	Dose (mg/kg/dose)	Interval (Hour)
< 27	**7.5**	24
27 - 33		12
34 - 40		8
≥ 41		6

Stability after reconstitution	**Metronol** Does not require reconstitution. Single use only. Discard any remaining solution
Stability after dilution	**Metronol** Single use only. Discard any remaining solution.
Compatibility	Fluids: D5%, D 10% (Not Recommended Due to High Osmolarity Of The Resulting Solution), NS, Glucose/Sodium Chloride Fluids. Y-Site: Amino Acid Solution, Aciclovir, Dopamine, Fluconazole, Lipid Emulsion, Magnesium Sulfate, Midazolam, Morphine Sulfate, Piperacillin-Tazobactam (EDTA-Free)
Incompatibility	Amphotericin, Cefepime, Ganciclovir
Adverse Effects	More common: GI upset, stomatitis and candida overgrowth. Drug metabolite may cause brownish discolouration of urine. Rare: Convulsive seizures and peripheral neuropathy characterised mainly by numbness or paraesthesia of an extremity has been reported in adults. May cause reversible leucopenia and/or thrombocytopenia.
Monitoring	Full blood count if patient is on therapy > 1 week. Liver and renal function tests.
References	2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Metronidazole 2020 Product insert Metronol

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MIDAZOLAM (IV)

Drug Type	Short-acting benzodiazepine
Indication	Sedation during ventilation or procedure. Treatment of refractory seizure
Action	Intensify the physiological inhibitory mechanisms mediated by gamma-aminobutyric acid (GABA)by accumulation and occupation of benzodiazepine receptors. Anti-anxiety properties are related to increasing the glycine inhibitory neurotransmitter
Presentation	15mg / 3ml ampoule, 5mg/ml ampoule
Storage	Store below 30°C.
Administration	IV infusion: As a continuous infusion via a syringe pump. IV bolus: Give as a slow push over 10 minutes.
Dose[2]	IV bolus: 0.05- 0.15mg/kg /dose Continuous IV Infusion: Sedation: 0.2 - 1mcg /kg /min Seizures: 1 - 7mcg /kg /min
Dilution	Dilute 3mg/kg Midazolam in 50ml D5% or NS — 1ml /hr = 1microgram/ kg /min
Stability after reconstitution	**Midaz 15mg/3mL; Midaz 5mg/ml** Does not require reconstitution
Stability after dilution	**Midaz 15mg/3mL; Midaz 5mg/ml** After dilution, stable for 24 hours at room temperature and in the fridge (2-8°C).
Compatibility	Fluids: D5%, D10%, NS Y-Site: Amino Acid Solutions. Amikacin, Amiodarone, Calcium Gluconate, Cefotaxime Cephazolin, Ciprofloxacin, Clindamycin, Digoxin, Dopamine, Erythromycin, Fentanyl, Fluconazole, Gentamicin, Methylprednisolone, Metronidazole, Milrinone, Morphine Sulfate, Noradrenaline (Norepinephrine), Potassium Chloride, Ranitidine, Vancomycin, Vecuronium.
Incompatibility	Fluids: No information. Y-Site: Fat Emulsion. Aciclovir, Albumin, Amoxicillin, Ampicillin, Azithromycin, Cefepime, Ceftazidime, Chloramphenicol, Dexamethasone, Furosemide (Frusemide), Ganciclovir, Hydrocortisone Sodium Succinate, Imipenem - Cilastatin, Omeprazole, Phenobarbital (Phenobarbitone), Piperacillin-Tazobactam (EDTA-Free), Sodium Bicarbonate, Trimethoprim-Sulfamethoxazole.
Precautions	In preterm,midazolam half-life is increased from 4–6 hours in term neonates up to 22 hours in premature infants. Caution in neonates with renal and hepatic impairment − increased sensitivity to central nervous system (CNS) effects; use doses at lower end of the range. Rapid IV infusion may result in hypotension, respiratory depression or seizure. Caution when concurrently used with opioids − midazolam interacts with other central nervous system depressants and may increase the risk of drowsiness, respiratory depression and hypotension. Withdraw slowly after chronic administration as abrupt discontinuation may precipitate withdrawal seizures.
Adverse Effects	Hypotension and reduced cardiac output, particularly when used in combination with fentanyl. Respiratory depression and apnoea. Hypersalivation. Nasal discomfort (with intranasal route). **Seizure-like myoclonus (more common in premature neonates receiving via intravenous route)**
Monitoring	Apnoea, respiratory depression Blood pressure Level of sedation
Special comment	Flumazenil is a specific benzodiazepine antagonist and may be used (very limited experience in the neonate) to rapidly reverse respiratory depression − 10 microgram/kg/dose. IV push. May repeat every minute for up to 4 more doses.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Midazolam (2020). Product insert Midaz 5mg/ml, 15mg/3ml

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MILRINONE (IV)

Drug Type	Inotrope and vasodilator
Indication	Short term treatment of low cardiac output states and as an adjunct to inhaled nitric oxide in neonates with persistent pulmonary hypertension of the neonate
Action	Selective inhibitor of type 3 cAMP phosphodiesterase in cardiac and vascular muscle.
Presentation	10 mg/ 10ml vial (1mg/ ml = 1000 microgram/ml)
Storage	Store below 30°C.
Administration	Continuous IV infusion
Dose	Term infants Loading dose**: 75 mcg/kg over 1 hour** Continuous IV infusion: **0.33 – 0.75 microgram/kg/minute**[2]
Dilution	Dilute 1.5mg/kg milrinone in 50ml D5% or NS (1ml /hr = 0.5 mcg/ kg /min) Term infants: Run at 2.5ml for 1 hour then 1-1.5ml/ hr = 0.5- 0.75 mcg/ kg /min
Stability after reconstitution	**Primacor 10mg/10 ml** Does not require reconstitution.
Stability after dilution	**Primacor 10mg/10 ml** Used within 24 hours at room temperature.
Compatibility	Fluids: D5%, NS Y-Site: Amino Acid Solutions, Adrenaline (Epinephrine) Hydrochloride, Amiodarone, Calcium Gluconate Monohydrate, Digoxin, Dobutamine, Dopamine, Fentanyl, Glyceryl Trinitrate, Heparin Sodium, Insulin (Shortacting), Magnesium Sulfate Heptahydrate, Midazolam, Morphine Sulphate Pentahydrate, Noradrenaline (Norepinephrine), Potassium Chloride,
Incompatibility	Fluids: Sodium Bicarbonate. Y-Site: Furosemide, Imipenem + Cilastatin,
Side Effects	Ventricular arrhythmias in cardiac patients. Patent ductus arteriosus has been reported. May cause hypotension
Monitoring	Continuous heart rate, ECG and blood pressure monitoring preferable. Assess urine output and peripheral perfusion frequently. Monitor fluid and electrolytes. Liver profile. Platelet.
Precautions	Loading dose: May cause hypotension. Monitor BP and heart rate closely and ensure adequate volume replacement. Prematurity: Long half-life reported (10 hours) in very preterm infants. Avoid prolonged higher rate infusion in preterm infants (≥0.2 microgram/kg/min) Renal impairment: Significantly increases half-life of milrinone. A reduction in the infusion rate in patients with renal impairment to prevent drug accumulation is advised. Potassium loss due to excessive diuresis may predispose digitalised patients to arrhythmias
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Milrinone (2021) 4) Neofax Neonatal Drug Database (Milrinone) Product insert Primacor

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MORPHINE SULPHATE (IV)

Drug Type	mu-opioid analgesic
Indication	Analgesia / sedation: 1. Pre-medication prior to intubation or other procedure 2. During assisted ventilation Procedures and post-surgery
Action	mu-opioid analgesic – stimulates brain opioid receptors.
Presentation	10mg/ml ampoule
Storage	Store below 30°C Protect from light.
Administration	IV bolus over 5 minutes, Continuous IV infusion
Dose	PRE-MEDICATION FOR INTUBATION: **0.1 mg/kg/dose (up to 0.2 mg/kg)** CONTINUOUS IV INFUSION: **5–40microgram/kg/hour[2]**
Dilution	**IV bolus:** Draw up 1 mL (10 mg morphine) and add 9 mL NS to make a final volume of 10 mL with a concentration of 1mg/mL. **Continuous IV Infusion:** Dilute 5mg/kg morphine to 50ml D5% or NS | 1ml/hr = 100mcg/kg/hr, Maximum rate: 40mcg/kg/hr
Stability after reconstitution	**CCM Morphine Sulphate Inj 10 mg/ml (Preservative free)** Does not require reconstitution
Stability after dilution	**CCM Morphine Sulphate Inj 10 mg/ml (Preservative free)** After dilution, stability is 7 days in room temperature and fridge (2-8°C). (HSB Dilution Protocol).
Compatibility[2,4]	Fluids: D5%, D10%, Hartmann's, HS, And NS. Y Site: Adrenaline Hydrochloride, Amikacin, Amiodarone, Ampicillin, Cefotaxime, Ceftazidime, Ceftriaxone, Cephazolin, Chloramphenicol, Dexamethasone, Digoxin, Dopamine, Erythromycin, Fluconazole, Gentamicin, Hydrocortisone Sodium Succinate, Insulin (Short-Acting), Magnesium Sulfate, Methylprednisolone Sodium Succinate, Metoclopramide, Metronidazole, Midazolam, Milrinone, Noradrenaline, Piperacillin-Tazobactam (EDTA-Free), Potassium Chloridetrimethoprim-Sulfamethoxazole, Vancomycin,
Incompatibility[2,4]	Fluids: Morphine May Precipitate Out of Solution When the Final Ph Is Greater Than 6.4. Y-Site: Aminophylline, Azithromycin, Folic Acid, Pethidine, Phenytoin
Side Effects	Respiratory depression - decreased response to CO2 tension; apnoea. Urinary retention. Hypotension. Seizures. Reduced gut mobility. Prolonged use >5-7 days may be associated with dependence.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Morphine (2021) 4) Neofax Neonatal Drug Database (Morphine) Product Insert CCM Morphine Sulphate

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NALOXONE (IV/IM)

Drug Type	Semisynthetic opioid antagonist
Indication	At birth – Reversal of respiratory depression secondary to maternal opioid administration.
Action	Opioid antagonist. Little or no agonistic activity
Presentation	0.4mg/ml amp
Storage	Store below 30°C Protect from light.
Administration	IV bolus IM suitable if the IV route is not available.
Dose	Newborn infants with respiratory depression secondary to maternal opioid administration: **0.1mg/kg/dose.** Repeat dose as required. DO NOT USE IN INFANTS BORN TO MOTHERS SUSPECTED OR KNOWN TO BE ADDICTED TO OPIOIDS
Stability after reconstitution	**Mapin 0.4 mg/ml** Use undiluted
Stability after dilution	**Mapin 0.4 mg/ml** Single use.
Compatibility	D5%, NS
Incompatibility	Do not mix in an alkaline solution. Solutions that contain Bisulfites Or Sulfites, Calcium Folinate
Side Effects	Do not give to infants of narcotic dependent mothers due to risk of seizures and withdrawal. Tachycardia Tachypnoea Hypertension Tremors Vomiting.
Monitoring	Continuous cardiorespiratory monitoring is required. Resuscitation facilities must be readily available
Other Considerations	Always establish and maintain adequate respiration before administration of naloxone to a newborn infant. Most infants born following intrapartum maternal opioid administration do not require administration of an opioid antagonist. Opioid antagonists should not be used as a substitute for provision of usual methods of clinical care and resuscitation of the newly born infant
Precautions	Naloxone should not be administered to babies whose mothers are known or suspected to be addicted to opioids. The duration of action of naloxone is short, particularly after intravenous administration, and subsequent observation of the infant should be instituted.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Naloxone (2018) Product insert Mapin

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NEVIRAPINE (ORAL)

<table>
<tr><td>Drug Type</td><td>Antiretroviral</td></tr>
<tr><td>Indication</td><td>As stated in the Paediatric Protocol 4th Edition, Management of HIV exposed infants, page 463, for the prevention of maternal-fetal HIV transmission[3]
Scenario 2: Infant at higher risk of HIV acquisition e.g. infant born to HIV-infected mother who:
• Has not received intrapartum/antepartum ARV
• Has received only intrapartum ARV
• Has received antepartum ARV but does not have viral suppression near delivery</td></tr>
<tr><td>Action</td><td>A non-nucleoside anti-retroviral agent that inhibits HIV-1 replication by selectively interfering with viral reverse transcriptase without requiring intracellular metabolism. It also activates cell-free virions in the genital tract and breastmilk. Synergistic when used with zidovudine.[4]</td></tr>
<tr><td>Presentation</td><td>200mg tablet</td></tr>
<tr><td>Storage</td><td>Store below 30°C</td></tr>
<tr><td>Administration</td><td>Oral.
ARV should be served as soon as possible (preferably within 6- 12 hours of birth) and no later than 48 hours after birth[3]</td></tr>
<tr><td>Dose[3]</td><td>Under Scenario 2 as indicated in the Paediatric Protocol 4th Edition, Zidovudine for 6 weeks and 3 doses of Nevirapine is required.
PLEASE BE ALERT! THE DOSE IS A FIXED DOSE BASED ON WEIGHT (8MG OR 12MG) DO NOT COUNT AS ‘MG/KG/DOSE’
Nevirapine is used in conjunction with Zidovudine
<table>
<tr><th>Birth weight</th><th>Number of doses</th><th>Dosing</th><th>Interval</th></tr>
<tr><td rowspan="3"><2kg</td><td>Dose 1</td><td rowspan="3">8mg PER DOSE</td><td>At birth</td></tr>
<tr><td>Dose 2</td><td>48 hours after the 1st dose</td></tr>
<tr><td>Dose 3</td><td>96 hours after the 2nd dose</td></tr>
<tr><td rowspan="3">>2kg</td><td>Dose 1</td><td rowspan="3">12mg PER DOSE</td><td>At birth</td></tr>
<tr><td>Dose 2</td><td>48 hours after 1st dose</td></tr>
<tr><td>Dose 3</td><td>96 hours after 2nd dose</td></tr>
</table></td></tr>
<tr><td>Stability</td><td>Freshly prepared. Discard after use</td></tr>
<tr><td>Contraindications</td><td>Hypersensitivity to nevirapine inflammation of liver(hepatitis), severe liver impairment4</td></tr>
<tr><td>Monitoring</td><td>Monitor liver function tests.</td></tr>
<tr><td>Precautions</td><td>Hypersensitivity reactions, including severe rash, blisters, oral lesions, conjunctivitis, facial edema, muscle or joint aches, and significant hepatic abnormalities have been reported. Risk of hepatic events or skin reactions are greatest in the first 6 weeks of therapy.</td></tr>
<tr><td>Adverse Effects</td><td>Common in children: Rash, fever, nausea, headache, diarrhea, abdominal pain, fatigue and abnormal hepatic transaminases.
Hepatotoxicity.</td></tr>
<tr><td>References</td><td>3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 84 Paediatric HIV, page 463
4) Neofax Neonatal Drug Database (Nevirapine)
Product leaflet Nevirex</td></tr>
</table>

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NORADRENALINE (IV)

Drug Type	Inotrope and vasopressor.	
Indication	Treatment of hyperdynamic shock secondary to sepsis. Second line inotrope for treatment of fluid-refractory hypotensive shock in the setting of low systemic vascular resistance (SVR). Circulatory failure in the setting of pulmonary hypertension refractory to nitric oxide	
Action	Catecholamine with strong vascular alpha and cardiac beta-adrenergic action, moderate cardiac alpha-adrenergic actions. Noradrenaline increases blood pressure, urine output and reduces lactate in newborns with septic shock refractory to volume expansion and other inotropes. Noradrenaline increases systemic and pulmonary pressures, increases pulmonary blood flow and improves systemic oxygen saturation in newborn infants with pulmonary hypertension and circulatory failure.	
Presentation	Noradrenaline acid tartrate 8 mg/4 mL is equivalent to noradrenaline base 4 mg/4 mL (1:1000)	
Storage	Store below 25°C Protect from light.	
Administration	Noradrenaline should be given via a **CENTRAL VENOUS CATHETER (UVC OR PICC)** using a continuous infusion. **STRICTLY NO PERIPHERAL LINE!** Do not use discoloured (pink, brown, yellow) solutions or those containing precipitate. (Product insert) Infuse through a dedicated line where possible	
Dose	**0.05 - 1mcg/kg/min** of noradrenaline base	
Dilution	Dilute 1.5mg/kg noradrenaline to 50ml D5% (Normal saline alone is not recommended)	Then 1ml/hr = 0.5mcg/kg/min Maximum rate: 1mcg/kg/min
Stability after reconstitution	**Cardiamed Inj** Does not require reconstitution	
Stability after dilution	**Cardiamed Inj** Use immediately after dilution.	
Compatibility	Fluids: D5%, NSD5% lactated Ringer's solution. Y-site: Amiodarone, dobutamine, dopamine, heparin sodium, hydrocortisone sodium succinate, labetalol, midazolam, milrinone, morphine sulfate, potassium chloride.	
Incompatibility	Fluids: No information. D10% not tested. Y-site: aminophylline, benzylpenicillin, folic acid, insulin (short-acting), phenobarbitone, sodium bicarbonate. Incompatible with alkalis and oxidising agents. No information: Adrenaline HCL is compatible with noradrenaline bitartrate, but no stability data is available for Adrenaline acid tartrate and noradrenaline acid tartrate.	
Side Effects	Systemic hypertension especially at higher doses. Reflex bradycardia and arrhythmia. Tissue necrosis at infusion site with extravasation. Renal and digital ischaemia may occur. Prolonged administration of any potent vasopressor may result in plasma volume depletion which should be continuously corrected by appropriate fluid and electrolyte replacement therapy.	
Monitoring	Continuous heart rate, ECG and blood pressure. Assess urine output and peripheral perfusion frequently. Observe IV site closely for blanching and extravasation. Extravasation may cause local ischemia and tissue necrosis	
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Noradrenaline (2023) Product insert Cardiamed	

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NYSTATIN (ORAL)

Drug Type	Polyene antifungal
Indication	Prophylaxis in infants at high risk for invasive fungal infections. Criteria for prophylaxis should be determined by local policy. Indications may include: 1) Infants ≤32 weeks gestation at birth or <1500g birth weight or larger infants with risk factors including use of broad-spectrum antibiotics, having a central venous access device (PICC/UVC/CVC), receiving parenteral nutrition, inhaled steroids. 2) Treatment of mucocutaneous candidiasis.
Action	Fungicidal agent which works by combining with the sterol elements of fungal cell membranes causing cell death by producing increased cell wall permeability
Presentation	100,000 Units/ ml Suspension
Storage	Store below 30°C Protect from light. Shake well before use.
Administration	Oral. Apply half of the dose in each side of mouth (buccal).
Dose	Prophylaxis against invasive fungal infection: **100,000U 8 hourly**[4] Treatment for oral candidiasis: **100,000U 6 hourly**
Stability after opening	**Tystatin** Stable for 7 days < 30°C[15]
Side Effects	Generally, well tolerated. Large doses may produce gastrointestinal upset (vomiting, diarrhoea). Rarely, may lead to rashes e.g. urticaria. Type 4 hypersensitivity reactions have been reported in adults
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Nystatin (2022) 4) Neofax Neonatal Drug Database (Nystatin) 15) Stability of Oral Suspensions or Syrups after Opening or Reconstitution 2020 Product leaflet Tystatin

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OMEPRAZOLE (IV)

Drug Type	Proton pump inhibitor (PPI).
Indication	Short- and long-term safety data in infants are limited. Treatment of gastroesophageal reflux disease (GERD). Prophylaxis in congenital tracheoesophageal fistula and oesophageal atresia (role unclear).
Action	Omeprazole is a proton pump inhibitor (PPI).
Presentation	Omeprazole 40 mg vial (powder) with 10ml solvent vial (citrate buffer)
Storage	Store below 30°C Protect from light. Vials that have been taken out of their original box can be kept in normal indoor light up to 24 hours.
Administration	IV infusion over 30 minutes
Dose	**0.5-1.5 mg/kg/dose daily.**[4]
Dilution	Reconstitute 1 vial 40mg with 10ml solvent given (concentration 4mg/ml). Syringe out required dose. Further dilute up to 5ml NS and infuse over 30minutes. Final concentration does not exceed 0.4mg/ml.[2]
Stability after reconstitution	**Vaxcel Omeprazole Inj** Stable for 4 hours after reconstitution. (Product insert)
Stability after dilution	**Vaxcel Omeprazole Inj** No data.
Compatibility	N/A
Incompatibility	N/A
Side Effects	Common Dermatologic: Rash Gastrointestinal: Increased risk of Clostridium difficile-associated diarrhea (CDAD), Abdominal pain, constipation, diarrhea, flatulence, vomiting Respiratory: Upper respiratory infection (adults) Other: Fever (1 to less than 2 years, 33%) Serious Dermatologic: Erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis Endocrine: Hypomagnesaemia Gastrointestinal: Atrophic gastritis, Clostridium difficile diarrhea, pancreatitis Haematological: Haemolytic anaemia Hepatic: Hepatic encephalopathy, hepatic necrosis, liver failure Immunological: Anaphylaxis Musculoskeletal: Fracture of bone, hip fracture, rhabdomyolysis
Monitoring	Serum magnesium, in patients on prolonged therapy or who use digoxin or drugs that may cause hypomagnesaemia (e.g. diuretics) concomitantly. Serum vitamin B12 — every 1 to 2 years in patients on prolonged therapy
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Omperazole (2022) 4) Neofax Neonatal Drug Database (Omeprazole) Product insert Vaxcel

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OMEPRAZOLE (ORAL)

Drug Type	Proton pump inhibitor (PPI).
Indication	Short- and long-term safety data in infants are limited. Treatment of gastroesophageal reflux disease (GERD). Prophylaxis in congenital tracheoesophageal fistula and oesophageal atresia (role unclear).
Action	Omeprazole is a proton pump inhibitor (PPI).
Presentation	Available in 20 mg capsule. Strength is 2mg/ml (prepared by Inpatient pharmacy)
Storage	Refrigerate (2–8°C) the prepared suspension.
Dose	**0.4-0.8mg/kg/dose BD**[1]
Stability	14 days
Side Effects	Common Dermatologic: Rash Gastrointestinal: Increased risk of Clostridium difficile-associated diarrhea (CDAD), Abdominal pain, constipation, diarrhea, flatulence, vomiting Respiratory: Upper respiratory infection (adults) Other: Fever (1 to less than 2 years, 33%) Serious Dermatologic: Erythema multiforme, Stevens-Johnson syndrome, toxic epidermal necrolysis Endocrine: Hypomagnesaemia Gastrointestinal: Atrophic gastritis, Clostridium difficile diarrhea, pancreatitis Haematological: Haemolytic anaemia Hepatic: Hepatic encephalopathy, hepatic necrosis, liver failure Immunological: Anaphylaxis Musculoskeletal: Fracture of bone, hip fracture, rhabdomyolysis
Monitoring	Serum magnesium, in patients on prolonged therapy or who use digoxin or drugs that may cause hypomagnesaemia (e.g. diuretics) concomitantly. Serum vitamin B12 — every 1 to 2 years in patients on prolonged therapy
References	1) Frank Shann Paediatric Drug Doses. 17th Edition, 2017 2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Omeprazole (2022)

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PARACETAMOL (ORAL)

Drug Type	Non-narcotic analgesic and antipyretic
Indication	Analgesia Antipyretic Adjunct to post- operative analgesia Treatment of patent ductus arteriosus (PDA)
Action	Centrally acting analgesic and antipyretic with minimal anti-inflammatory properties. Paracetamol in reducing pain is not completely defined. Potential mechanisms include inhibition of central prostaglandin synthesis and inhibition of the cyclooxygenase (COX) isoenzyme, particularly the COX-2 isoform.
Presentation	120mg/ 5ml syrup
Storage	Store below 30°C Protect from light.
Administration	Oral. Can be given with or without feeds. Shake bottle well before measuring dose.
Dose	**Analgesia: 10 mg/kg 8 hourly PRN** (NICU Consensus) **Patent Ductus Arteriosus: 15mg/kg/dose[4,] 6 hourly for 3-7 days[3,4]** A second course may be required
Stability after opening	**Fepril** Stable for 30 days at room temperature.
Monitoring	Monitor hepatic and renal function
Adverse Reaction	Vomiting, fever, rash, neutropenia, leucopoenia, thrombocytopenia. May cause liver toxicity at high plasma concentrations
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Paracetamol (2022) 3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 27 Patent Ductus Arteriosus, page 162 4)Neofax Neonatal Drug Database (Paracetamol) Product insert Fepril

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PARACETAMOL (IV)

Drug Type	Non-narcotic analgesic and antipyretic
Indication	Analgesia Antipyretic Adjunct to post- operative analgesia Treatment of patent ductus arteriosus (PDA)
Action	Centrally acting analgesic and antipyretic with minimal anti-inflammatory properties. Paracetamol in reducing pain is not completely defined. Potential mechanisms include inhibition of central prostaglandin synthesis and inhibition of the cyclooxygenase (COX) isoenzyme, particularly the COX-2 isoform.
Presentation	IV: 1000 mg/100 mL
Storage	V: Do not store above 30°C. Do not refrigerate or freeze
Dose	Patent Ductus Arteriosus: **15mg/kg/dose [4,] 6 hourly for 3-7 days [3,4]** Post- Operation Analgesic: **15mg/kg/dose** A second course may be required
Stability after reconstitution	Discard after use
Compatibility	Sodium chloride 0.9%, glucose 5%
Incompatibility	Do not mix with any other intravenous fluids or medications.
Side Effects	Vomiting, fever, rash, neutropenia, leucopoenia, thrombocytopenia. May cause liver toxicity at high plasma concentrations
Monitoring	Monitor hepatic and renal function. If signs of acute liver injury (example, raised ALT >50 IU/L) – refer to TDM Services.
Contraindications/	Hypersensitivity to paracetamol, active liver disease.
Precautions	Hepatic impairment, renal impairment, sepsis, dehydration
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Paracetamol (2022) 3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 27 Patent Ductus Arteriosus, page 162 4)Neofax Neonatal Drug Database (Paracetamol)

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PIPERICILLIN + TAZOBACTAM/ TAZOCIN® (IV)

<table>
<tr><td>Drug Type</td><td>Antibiotic</td></tr>
<tr><td>Indication</td><td>Broad spectrum semi-synthetic penicillin, useful for gram-negative, gram-positive and anaerobic organisms. A second line drug. Effective against Pseudomonas aeruginosa and many strains of Klebsiella, Serratia, E coli, Enterobacter, Citrobacter, and Proteus. Also effective against group B Streptococcus. No activity against Staph aureus.</td></tr>
<tr><td>Action</td><td>Bactericidal activity by inactivation by B-lactamase producing bacteria. Synergistic with aminoglycosides. Good penetration into bone. CSF penetration is similar to that of other penicillins. Primarily excreted renally unchanged.</td></tr>
<tr><td>Presentation</td><td>4g Piperacillin, 500mg Tazobactam powder</td></tr>
<tr><td>Storage</td><td>Protect from light and moisture. Below 25°C.</td></tr>
<tr><td>Method</td><td>IV Infusion</td></tr>
<tr><td>Dose</td><td>100mg/kg/dose (as piperacillin component)[4]
<table>
<tr><th>PMA (weeks)</th><th>Post-natal age (days)</th><th>Interval (hr)</th></tr>
<tr><td rowspan="2">≤29</td><td>0-28</td><td>12</td></tr>
<tr><td>≥29</td><td>8</td></tr>
<tr><td rowspan="2">30-36</td><td>0-14</td><td>12</td></tr>
<tr><td>≥15</td><td>8</td></tr>
<tr><td rowspan="2">37-44</td><td>0-7</td><td>12</td></tr>
<tr><td>≥8</td><td>8</td></tr>
<tr><td>≥45</td><td>All</td><td>8</td></tr>
</table></td></tr>
<tr><td>Reconstitution</td><td>Reconstitute into 10ml NS (400mg/ml)</td></tr>
<tr><td>Stability after Reconstitution</td><td>Solution stable up to 24 hours at room temperature and 7 days refrigerated.</td></tr>
<tr><td>dilution</td><td>Take 1 ml of 400mg/ml, and dilute in 3ml NS to make it 100mg/ml. Then, take the required dose.</td></tr>
<tr><td>Stability after dilution</td><td>Solution stable up to 24 hours at room temperature and 7 days refrigerated.</td></tr>
<tr><td>Administration</td><td>Infuse over 30 minutes</td></tr>
<tr><td>Compatible</td><td>D5%, D10%, NS, WFI</td></tr>
<tr><td>Incompatible</td><td>Acyclovir, Amiodarone, Amphotericin B, Azithromycin, Dobutamine, Aminoglycosides, Fluconazole, Vancomycin. (Tazocin can inactivate aminoglycoside)</td></tr>
<tr><td>Side effects</td><td>Diarhea (7-11%), Constipation (1-8%), Eosinophilia, hyperbilirubinemia, elevation of ALT, AST, BUN, and serum creatinine.</td></tr>
<tr><td>Other consideration/ Remarks</td><td>If aminoglycosides are also prescribed, flush the line well with
Sodium Chloride 0.9% before and after giving each medication. Monitoring IV site for signs of extravasation.</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Tazocin (2022)
4) Neofax Neonatal Drug Database (Pipericillin+ Tazobatam)
Product Insert: Tapicin. Malaysia: YSP.</td></tr>
</table>

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PHENOBARBITONE (IV)

Drug Type	Anticonvulsant Sedative
Indication	Treatment of neonatal seizures
Action	Enhances inhibitory neurotransmission via activation of GABA receptor.
Presentation	200mg/ml ampoule
Storage	Store below 30°C Protect from light.
Administration	IV Infusion over 20 - 30 mins Max infusion rate 1mg/kg/min2,4
Dose **Renal dose** **Refer page 135**	Loading dose: **20 mg/kg** (Additional doses of 10mg/kg may be given after 30 mins interval, up to a cumulative total dose of 40mg/kg)[2,3] Maintenance dose: **3 - 5mg/kg/dose 24 hourly** (start 24 hours after loading dose). Doses can be given in 1-2 divided doses.[2,4]
Dilution	Dilute 1ml (200 mg) of Phenobarbitone up to 20ml of NS, D5% giving a 10mg/ml solution. Maximum concentration is 10mg/ml.[4,12] Then withdraw the required dose and infuse over 20- 30 mins.
Stability after reconstitution	Phenobarbital Sodium Injection 200mg in 1 ml Does not require reconstitution
Stability after dilution	Phenobarbital Sodium Injection 200mg in 1 ml Single use only. No stability data after dilution.
Compatibility	Fluids: HS, NS, D5%, D10% Y-Site: Amino Acid Solutions. Amikacin, Atropine, Fentanyl, Furosemide, Magnesium Sulfate, Milrinone, Phenytoin, Piperacillin/Tazobactam.
Incompatibility	Fluids: Lipid Emulsions. Y-Site: Adrenaline (Epinephrine) Hydrochloride, Aminophylline, Benzylpenicillin, Cefotaxime, Dobutamine, Ephedrine, Erythromycin, Hydrocortisone Sodium Succinate, Ketamine, Lidocaine (Lignocaine), Midazolam, Noradrenaline (Norepinephrine), Pethidine, Ranitidine,
Side Effects	Drowsiness, lethargy – sucking reflex may be impaired, and feeding may be poor. Respiratory depression, apnoea. Hypotension, laryngospasm, bronchospasm, apnoea - if IV administration is too rapid. Phlebitis, tissue necrosis if extravasation occurs.GI intolerance. Physical dependence and tolerance. May occur with prolonged use: Folate deficiency, hepatitis, hypocalcaemia.
Precautions	Use with caution in renal or hepatic impairment. Dependence may develop with prolonged use – consider weaning instead of abrupt withdrawal
Contraindications	Hypersensitivity to phenobarbitone in any ingredients. Any forms of acute porphyria
Monitoring	Liver function
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Phenobarbitone (2021) 3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 21 Neonatal Seizure, page 133 4) Neofax Neonatal Drug Databas (Phenobarbitone) 12) Pediatric Injectable Drugs (11th Edition) The Teddy Bear Book. ASHP Product insert Phenobarbital Sodium Injection 200mg in 1 ml

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PHENOBARBITONE (ORAL)

Drug Type	Anticonvulsant
Indication	Seizures, Neonatal abstinence syndrome
Action	Anticonvulsant, Induction of hepatic microsomal enzymes
Presentation	10mg/ml suspension (Extemporaneous Pharmacy preparation)
Storage	Store below 30°C Protect from light.
Administration	Oral.
Dose	Start maintenance dose 12-24 hours after loading dose **3-5mg/kg/dose 24 hourly in 1-- 2 divided doses** [2,4]
Stability after reconstitution	Stable for 6 months at room temperature.[14]
Side Effects	Drowsiness, lethargy – sucking reflex may be impaired, and feeding may be poor. Folate deficiency, hepatitis, hypocalcaemia.
Precautions	Use with caution in renal or hepatic impairment. Dependence may develop with prolonged use – consider weaning instead of abrupt withdrawal
Monitoring	Liver function tests.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Phenobarbitone (2021) 3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 21 Neonatal Seizure, page 133 4) Neofax Neonatal Drug Databas (Phenobarbitone) 14) X-Temp Master Formulation 2018-page 73

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PHENYTOIN SODIUM (IV)

<table>
<tr><td>Drug Type</td><td>Hydantoin derivative anticonvulsant</td></tr>
<tr><td>Indication</td><td>Treatment of neonatal seizures</td></tr>
<tr><td>Action</td><td>Phenytoin exerts its activity by inhibition of neuronal sodium influx, suppression of sodium action-
potentials, inhibition of neuronal calcium influx, enhancement of GABA neurotransmission, and blockade of inotropic receptors for glutamic acid.</td></tr>
<tr><td>Presentation</td><td>250mg/5ml vial</td></tr>
<tr><td>Storage</td><td>Store below 30°C Protect from light.
Do not freeze. Retain in carton until time of use.</td></tr>
<tr><td>Administration</td><td>Infuse over 30 minutes.
Do NOT exceed 1-3mg/kg/ minute (Product insert Phenytoin)</td></tr>
<tr><td>Dose</td><td>Loading dose: 20 mg/kg (up to a cumulative total dose of 40mg/kg)[2,3]
Maintenance dose: start 12 hours after LD[2,3]
<table>
<tr><th>PMA (Weeks)</th><th>Postnatal (Days)</th><th>Dose (mg/kg)</th><th>Interval (Hours)</th></tr>
<tr><td>Preterm</td><td>0 - 7
8 - 30
> 30</td><td>2.5</td><td>24
12
8</td></tr>
<tr><td rowspan="2">Term</td><td rowspan="2">0 - 7
8 - 30
> 30 [1]</td><td>2.5</td><td>12
8</td></tr>
<tr><td>3</td><td>8</td></tr>
</table>
Dose range: 4-8mg/kg/day</td></tr>
<tr><td>Dilution</td><td>Withdraw 1 ml (50 mg) phenytoin and dilute with 10ml normal saline, giving a solution of 5mg/ml. Maximum concentration is 5mg/ml.[2]
If the final volume is < 3ml, then further dilute the final volume up to 5ml normal saline.
Incompatible with Dextrose solution, so needs to be infused through a line not used for Dextrose infusion.</td></tr>
<tr><td>Stability after reconstitution</td><td>Phenytoin (Pharmaniaga)
Does not require reconstitution.</td></tr>
<tr><td>Stability after dilution</td><td>Phenytoin (Pharmaniaga)
Stable up to 1 hour at room temperature. Do NOT refridgerate. Discard unused portion.</td></tr>
<tr><td>Compatibility</td><td>Fluids: NS
Y-site: Do not mix with other drugs.</td></tr>
<tr><td>Incompatibility</td><td>Fluids: D5%, D10%
Y-site: Amino acid and lipid solutions. Do not mix with other drugs.</td></tr>
<tr><td>Side Effects</td><td>Administration-related reactions: Extravasation causes tissue inflammation and necrosis due to high pH and osmolality.
May cause bradycardia, arrhythmias, hypotension during infusion (more common if administration is too rapid).
Pharmacological adverse reactions: Cardiac arrhythmias, hypotension, hyperglycaemia, constipation, interstitial nephritis, hepatitis, macrocytosis,
Rare but potentially fatal skin reaction eg DRESS -stop phenytoin immediately.
Signs of phenytoin overdose: Nystagmus, cardiovascular collapse and/or CNS depression and dyskinesias. High serum concentrations are associated with seizures</td></tr>
<tr><td>Contraindications</td><td>Hypersensitivity to phenytoin or inactive ingredients, or other hydantoins. Contraindicated in sinus bradycardia, sino-atrial block, second- and third-degree A-V block, and in patients with Adams- Stokes syndrome</td></tr>
<tr><td>Precautions</td><td>Hypotension
If impaired hepatic or renal function, may require decreased dosage. Hypoalbuminaemia, hyperbilirubinemia, renal impairment, or uraemia may cause higher concentration of free drug</td></tr>
</table>

Monitoring	ECG, blood pressure, respiratory function continuously during infusion and for 15 mins to 1 hour after infusion. Monitor for extravasation.
References	1) Frank Shan Drug Doses 17th Edition, 2017. 2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Phenytoin (2021) 3) Paediatric Protocol 4th Edition, 2019. Chapter 21 Neonatal Seizure, page 133. Product leaflet Phenytoin (Pharmaniaga)

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PHENYTOIN SODIUM (ORAL)

<table>
<tr><td>Drug Type</td><td>Anticonvulsant</td></tr>
<tr><td>Indication</td><td>Anticonvulsant generally used to control seizures that are not controlled by phenobarbitone</td></tr>
<tr><td>Action</td><td>Anticonvulsant agent that raises seizure threshold of the motor cortex to electrical or chemical stimuli. Half-life is 18-60 hours.
Metabolised by the liver.</td></tr>
<tr><td>Presentation</td><td>30mg capsule</td></tr>
<tr><td>Storage</td><td>Store below 30°C</td></tr>
<tr><td>Administration</td><td>Oral
May be given with or without feeds but administration with respect to feeds should be consistent.</td></tr>
<tr><td>Dose</td><td>Maintenance dose: Start 12 hours after LD[2,3]
<table>
<tr><th>PMA (Weeks)</th><th>Postnatal (Days)</th><th>Dose (mg/kg)</th><th>Interval (Hours)</th></tr>
<tr><td>Preterm</td><td>0 - 7
8 - 30
> 30</td><td>2.5
2.5
2.5</td><td>24
12
8</td></tr>
<tr><td>Term</td><td>0 - 7
8 - 30
> 30[1]</td><td>2.5
2.5
3</td><td>12
8
8</td></tr>
</table>
Dose range: 4-8mg/kg/day
Oral Maintenance: start same as for IV maintenance. Average oral bioavailability 75%. Monitor concentrations and adjust dose accordingly</td></tr>
<tr><td>Stability after reconstitution</td><td>Freshly prepared.</td></tr>
<tr><td>Precautions</td><td>Hypotensive, impaired renal or hepatic function, hypoalbuminemia, hyperbilirubinemia, uraemia. If therapy cessation is necessary, consider weaning instead of abrupt cessation of drug.</td></tr>
<tr><td>Adverse Effects</td><td>Cardiac arrhythmias, hypotension, hyperglycaemia, constipation, interstitial nephritis, hepatitis, macrocytosis, megaloblastic anaemia (usually responds to folic acid supplementation) and blood dyscrasias.
Lethargy, drowsiness, irritability with increased levels
Sign of overdose: Nystagmus, cardiovascular collapse and/or CNS depression and dyskinesias. High serum concentrations are associated with seizures.
Skin rashes, increased temperature and vomiting</td></tr>
<tr><td>Monitoring</td><td>Monitor blood pressure and continuous ECG during stabilisation
Renal function, liver function, blood glucose, full blood count.</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Phenytoin (2021)
3) Paediatric Protocol 4th Edition, 2019. Chapter 21 Neonatal Seizure, page 133.</td></tr>
</table>

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POTASSIUM DIHYDROGEN PHOSPHATE (IV)

Drug Type	Mineral
Indication	Treatment of Metabolic Bone Disease. Treatment of hypophosphataemia. Supplementation to meet the recommended daily intakes.
Action	Phosphorus is a major intracellular mineral and is important in bone mineralisation and energy production.
Presentation	Potassium dihydrogen phosphate 10 mL ampoule Each 1 mL ampoule corresponds to 1 mmol phosphate, 1 mmol potassium and 2 mmol hydrogen.
Storage	Store below 25°C.
Administration	IV: As part of parenteral nutrition fluid – refer to individual parenteral nutrition formulations. IV infusion for treatment of acute hypophosphataemia: Potassium dihydrogen phosphate: Infuse over at least 6 hours.
Dose	IV infusion for treatment of acute hypophosphataemia: Preterm or term infants younger than 12 months[4]

PO4 level	Dose (mmol/kg)
< 0.32mmol/l	**0.44 to 0.64**
0.32mmol/l – 0.54mmol/l	**0.32 to 0.43**
0.54mmol/l – 1.29mmol/L	**0.16 to 0.31**

	Run over at least 6 hours [4]
Dilution	IV infusion (potassium dihydrogen phosphate): Draw up 1 mL (1 mmol phosphate) and add 24 mL sodium chloride 0.9% or glucose 5% to make a final volume of 25 mL with a concentration of 0.04 mmol/mL. Maximum concentration 0.1mmol/ml (central line) [2]
Stability after reconstitution	Discard after use
Stability after dilution	Fluids: Sodium Chloride 0.9%, Water for Injection, Glucose 5%. Y-Site: No Information.
Compatibility	Fluids: Glucose 5%, Glucose 10%, Glucose in Sodium Chloride Solutions, Sodium Chloride 0.45%, Sodium Chloride 0.9%, Sodium Chloride 3%. Y-Site: No Information.
Incompatibility	Fluids: No Information Drugs: Aciclovir, Amiodarone, Calcium Salts, Ketamine, Lorazepam, Magnesium Salts, Rocuronium. Solutions That Contain Other Cations Such as Calcium, Magnesium, Iron and Aluminium May Also Precipitate.
Side Effects	Diarrhoea (oral use only), hypocalcaemia, nephrotoxicity, prolonged QT interval, hypotension, hypomagnesaemia. Hyperphosphataemia – carpopedal spasm, seizures.[2]
Monitoring	Phosphate, calcium, magnesium, alkaline phosphatase concentrations are required at least fortnightly or more often if required. Once these concentrations normalise, serum analysis may be performed once monthly for 6 months or at the discretion of the clinician.[2] Urinary calcium and phosphate and Tubular Reabsorption Phosphate (TRP)%, parathormone, and vitamin D concentrations may be useful under certain circumstances.
Contraindications/	Hyperphosphataemia, dehydration, severe renal insufficiency, shock.
Precautions	Hypernatraemia (avoid sodium dihydrogen phosphate). Hyperkalaemia (avoid potassium dihydrogen phosphate)
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus: Phosphorus (2021) 4) Neofax Neonatal Drug Database (Potassium Phosphate)

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POLYMYXIN B IS AN ITEMS ID ADULT AND ANEST DEPARTMENT. KINDLY CALL THEIR SPECIALIST TO ASK PERMISSION TO USE BEFORE STARTING ANTIBIOTIC

POLYMYXIN B (IV)

Drug Type	Antibiotic
Indication	Multidrug resistant gram-negative bacterial infections, severe bacterial meningitis
Action	It is an antibiotic active against most gram-negative bacteria except Proteus, Serratia and Neisseria species.
Presentation	500,000 IU/mL vial (50mg)
Storage	Store below 25°C
Dose	Severe bacterial infections: **40,000u/kg/day divided every 12 hourly (Max: 45,000u/kg/day)**[16]
Dose Adjustment	Renal impairment – No dose adjustment is required Hepatic impairment – No dose adjustment is required.
Dilution	1 vial (50mg) in 50ml D5% (1mg/ml). Withdraw required dose (Max conc: 1mg/ml)
Administration	Infuse over 60-90 minutes
Stability after reconstitution	IV: 72 hours refrigerated (2-8'C)
Stability afterdilution	No info provided
Compatibility	Glucose 5%, Sodium Chloride 0.9%
Incompatibility	No info provided
Monitoring	Renal profile
Contraindications/	Local reaction
Precautions	Hypersensitivity to Polymyxin B
References	16)Lexicomp Paediatric Drug Information. (Polymycin B) Product Insert

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PROPRANOLOL (ORAL)

Drug Type	Beta-adrenergic blocker
Indication	Must refer to Paediatric Dermatologist to start. For potentially complicated infantile haemangiomas: Indications for treatment: rapid growth, functional impairment, ulceration, significant cosmetic deformity
Action	The exact mechanism of action is unclear. Suggested actions include pericyte-mediated vasoconstriction, inhibition of vasculogenesis, catecholamine-induced angiogenesis and downregulation of the renin–angiotensin– aldosterone axis.
Presentation	0.5mg/ml suspension (Extemporaneously Pharmacy preparation)
Storage	Store below 30°C Protect from light.
Administration	To reduce the risk of hypoglycaemia, administer orally during or immediately after a feed.
Dose	**Hypertension and Tachyarrhythmias** **0.25 – 1mg/kg/dose QID** (max 3.5mg/kg/dose QID) **Hypercyanotic Spell** **0.2 – 1mg/kg/dose BD – QID** **Haemangioma** Patient less than 6 months: 0.17mg/kg/dose every 8 hours for 24 hours then (Total daily dose 0.5mg/kg/day) 0.33mg/kg/dose every 8 hours for 24 hours then (Total daily dose 1mg/kg/day) 0.5mg/kg/dose every 8 hours for 24 hours then (Total daily dose 1.5mg/kg/day) 0.67mg/kg/dose every 8 hours for 24 hours (Total daily dose 2mg/kg/day (goal) May increase up to 3mg/kg/day if clinically indicated Stopping treatment: Propranolol should be stopped by halving the dose for 2 weeks then further halving the dose for the next 2 weeks then stop Duration of therapy: 6- 9 months until at least 1 year old depending on severity of haemangioma and response to propranolol. Adjust dose for increase in weight during the first 9 months of life, if needed.
Stability after reconstitution	Stable for 30 days at room temperature[11].
Precautions	Parental consent required (Off label used) If patient has history of asthma, heart disease or concern there may be a heriditary condition, obtain speciality consultation.
Adverse Effects	May cause transient worsening of heart failure symptoms (e.g. in too fast up-titration). The manifestations of beta-blocker overdose include bradycardia, atrioventricular (AV) blockade, hypotension, left ventricular failure and cardiogenic shock. Common (>1%) adverse reactions include bradycardia, hypotension, orthostatic hypotension, transient worsening of heart failure (when treatment starts), nausea, diarrhoea, bronchospasm, dyspnoea, cold extremities, exacerbation of Raynaud's phenomenon, fatigue, dizziness, abnormal vision, alteration of glucose and lipid metabolism

Monitoring	Prior to commencement of therapy ·Cardiovascular and respiratory examination by a competent practitioner is required before starting propranolol (auscultation, peripheral pulses, abdominal examination for potential liver enlargement) · Pre-treatment ECHO needed in selected cases (e.g. segmental haemangioma) Blood pressure, heart rate half hourly for 2 hours after starting and after each increment of dose. BP and HR 1 hr after each dose and 4 hourly Blood glucose 1 hour after each dose If patient is less than 6 months, must be fed every 4 hours at least
Contraindications	Absolute contraindications Sick sinus syndrome Hypoglycaemic episodes, recent or ongoing 2nd or 3rd degree AV block Relative contraindications Impaired cardiac function (when this is secondary to hemangioma, appropriate treatment is advisable) Sinus bradycardia, first degree AV block Diabetes mellitus, chronic renal insufficiency
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Propranolol (2019) 11) MOH Formulary Extemporaneous 2015 page 55 Protocol for treatment of potentially complicated infantile haemangiomas with Propranolol (Hospital Selayang)

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ROCURONIUM (IV)

Drug Type	Muscle relaxant
Indication	Skeletal muscle relaxation or paralysis in mechanically ventilated infants. For elective endotracheal intubation.
Action	Non-depolarising muscle relaxant that competitively antagonises nicotinic acetylcholine receptors at the neuromuscular junction. Also competitively antagonises autonomic nicotinic acetylcholine receptors and may result in increased heart rate and reduced blood pressure.
Presentation	50mg/5ml vial
Storage	Store in fridge (2- 8° C)
Administration	Rapid IV bolus over 5–10 seconds IV infusion Line should be adequately flushed to avoid unintended paralysis during later use of the line.
Dose	**INTUBATION** IV bolus: **0.6 mg/kg/dose** (0.4 –1 mg/kg /dose) **MUSCLE RELAXATION** Intermittent IV bolus: **0.6 mg/kg** (0.4-1 mg dose) every 30 to 60 minutes as needed Continuous infusion: OPTIONAL LOADING DOSE: IV loading dose of **0.6 mg /kg/dose** Continuous infusion of **0.6 mg/kg/hour** (0.4-1mg/kg/hour). Titrate until desired neuromuscular blockade is achieved.
Dilution	**Bolus** Draw up 1ml (10mg of rocuronium) and add 4mL of sodium chloride 0.9% to make a final volume of 5mL with a concentration of 2 mg/mL **Continuous infusion** Dilute 30mg/kg (3ml/kg) of Rocuronium into 50ml of D5% or NS — 1ml/hr = 0.6mg /kg/hr
Stability after reconstitution	**Recuronium Kabi** Does not require reconstitution.
Stability after dilution	**Recuronium Kabi** Stable for 24 hours in room temperature after dilution.
Compatibility	Fluids: D5%, NS, Water for Injection, Hartmann's. Compatible Via Y-Site: Milrinone
Incompatibility	Fluids: Lipid Emulsion Y Site: Amoxicillin, Amphotericin B (Amphotericin), Azathioprine, Cefazolin, Cloxacillin, Dexamethasone, Diazepam, Erythromycin, Furosemide, Hydrocortisone Sodium Succinate, Insulin, Lorazepam, Methylprednisolone, Prednisolone, Piperacillin-Tazobactam, Potassium Phosphates, Trimethoprim and Vancomycin.
Side Effects	Hypoxaemia/hypercarbia may occur because of inadequate ventilation and deterioration in pulmonary mechanics Hypotension and bradycardia, particularly when used in combination with opioids Prolonged paralysis after long-term use Rare — anaphylactic reaction.
Monitoring	Continuous cardiorespiratory and pulse oximetry monitoring. Close monitoring of neuromuscular function, sedation and blood pressure (invasive or non-invasive) is essential. Monitor electrolytes and renal function
Precautions	Factors which can increase duration of neuromuscular blockade: Acidosis, hypothermia, neuromuscular disease, hepatic disease, hypokalaemia, hypermagnesaemia, renal failure and younger age. Factors which can decrease duration of neuromuscular blockade: Alkalosis and hyperkalaemia Use cautiously in neonates with hepatic or renal impairment and in neonates with fluid and

	electrolyte imbalance. Assess regularly (at least every 24 hours) the need for ongoing use of muscle relaxant and neuromuscular function/blockade. Consider “drug holiday” in case of prolonged usage of >24 hours.
Special Comments	Muscle relaxation is reversed by neostigmine (60 microgram/kg) and atropine (20 microgram/kg) Sensation remains intact; sedation should be used in all patients and analgesia should be used for painful procedures. Provide eye protection and instil lubricating eye drops every 2 hours. Rocuronium produces significantly less tachycardia and hypotension when compared with Pancuronium although more commonly than with vecuronium. The neuromuscular blockade of rocuronium is more rapid in onset than that of Pancuronium and Vecuronium. The duration of action is dose dependent and like Vecuronium. Its action is prolonged in neonates compared to children and adults and therefore is like long-acting NMBAs in this population.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Rocuronium (2021) Product insert Rocuronium Kabi

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SODIUM GLYCEROPHOSPHATE (IV)

Drug Type	Mineral
Indication	Treatment of Metabolic Bone Disease. Treatment of hypophosphataemia. Supplementation to meet the recommended daily intakes.
Action	Phosphorus is a major intracellular mineral and is important in bone mineralisation and energy production.
Presentation	Glycophos 20 mL ampoule Each 1 mL of Glycophos® corresponds to 1 mmol phosphate and 2 mmol sodium.
Storage	Store below 25°C.
Dose	Treatment of acute hypophosphataemia **IV: 1-1.5mmol/kg/day no less than 8 hours**. Repeat as necessary. [4] Aim to maintain normophosphataemia of 1.8–2.6 mmol/L (5.6–8.1 mg/dl). (Max dose 1.5mmol/kg/day)
Dilution	IV infusion for treatment of acute hypophosphataemia: Draw up 1 mL (1 mmol phosphate) and add 9 mL sodium chloride 0.9% or water for injection to make a final volume of 10 mL with a concentration of 0.1 mmol/mL. Infuse for at least 8 hours
Administration	As part of parenteral nutrition fluid – refer to parenteral nutrition formulations. Infusion for treatment of acute hypophosphataemia: Infuse over at least 8 hours.
Stability after opening	To be used within 24 hours after reconstitution.
Compatibility	Fluids: Sodium chloride 0.9%, water for injection, glucose 5%. Y-site: No information.
Incompatibility	No information
Monitoring	Phosphate, calcium, magnesium, alkaline phosphatase concentrations are required at least fortnightly or more often if required. Once these concentrations normalize, serum analysis may be performed once monthly for 6 months or at the discretion of the clinician Urinary calcium and phosphate and Tubular Reabsorption Phosphate (TRP)%, parathormone, and vitamin D concentrations may be useful under certain circumstances
Contraindications	Hyperphosphataemia, dehydration, severe renal insufficiency, shock.
Side Effects	Hypocalcaemia, nephrotoxicity, prolonged QT interval, hypotension, hypomagnesaemia. Hyperphosphataemia – carpopedal spasm, seizures.2
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Phosphorus (2021) 5) Neofax Neonatal Drug Database (Glycophos)

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SPIRONOLACTONE (ORAL)

Drug Type	Potassium-sparing diuretic
Indication	Diuretic primarily prescribed for its potassium-sparing effect. For heart failure, in conjunction with furosemide. For chronic lung disease, in conjunction with a thiazide diuretic. Bartter syndrome and Gitelman Syndrome
Action	Competitive aldosterone receptor antagonist, so inhibits sodium reabsorption and spares potassium. It is aweak diuretic. It also inhibits the interaction between dihydrotestosterone and the intracellular androgen receptorresulting in moderate antiandrogenic activity.
Presentation	2.5mg/ml Suspension (Extemporaneous Pharmacy preparation)
Storage	In fridge (2 - 8°C) Protect from light.
Dose	**1-1.5 mg/kg 12 hourly.**[2,4] Maximum daily dose 3mg/kg/day.
Administration	Oral or intragastric route, preferably with milk feeds
Contraindications	Hyperkalaemia, significant renal impairment, anuria, adrenal insufficiency
Stability	Stable for 60 days in fridge (2 - 8°C)11
Precautions	Use with caution in infants with renal or hepatic impairment.
Adverse Effects	Hyperkalaemia and metabolic acidosis. Antiandrogenic effects include reduced hirsutism and gynecomastia. Reduced clearance of digoxin.
Monitoring	Monitor more frequently if infant is given potassium
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Spironolactone (2021) 4) Neofax Neonatal Drug Database (Spironolactone) 11) MOH Formulary Extemporaneous 2015 page 63

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SILDENAFIL (ORAL)

Drug Type	Phosphodiesterase type 5 (PDE5) inhibitor
Indication	Persistent Pulmonary Hypertension of the Neonate (PPHN): -refractory to inhaled nitric oxide (iNO) and other conventional therapies or -those who are persistently unable to be weaned off inhaled nitric oxide or -in situations where inhaled nitric oxide and high frequency ventilation are not available
Action	Selective phosphodiesterase type 5(PDE5) inhibitor. PDE5 is found in the smooth muscle of the pulmonary vasculature, where it is responsible for the degradation of cyclic guanosine monophosphate (cGMP). cGMP produces smooth muscle relaxation. Sildenafil increases cGMP within pulmonary vascular smooth muscle cells resulting in relaxation. In patients with pulmonary hypertension, this can lead to selective vasodilatation of the pulmonary vascular bed and, to a lesser degree, vasodilatation in the systemic circulation
Presentation	2.5mg/ml (Extemporaneous Pharmacy preparation).
Storage	In fridge (2 - 8°C) Protect from light.
Administration	Oral. Give via intragastric tube, preferably with feed to minimise risk of gastrointestinal irritation. If not able to tolerate feeds, to flush with 0.5ml water for injection.
Dose	**0.5 – 2mg/kg/dose 6 hourly** [2,3] Maximum dose: 2mg/kg/dose 6Hly[3.] Should be weaned gradually to prevent withdrawal[2].
Stability	Stable for 91 days in fridge (2 - 8°C)[14]
Monitoring	Heart rate, blood pressure and oxygenation. Renal and hepatic function. Consider monitoring with echocardiogram
Precautions	Use with caution in neonates with sepsis or uncontrolled hypotension. Sildenafil clearance (in adults) is reduced in hepatic and severe renal impairment.
Adverse Effects	Worsening oxygenation and systemic hypotension. Epistaxis, respiratory symptoms (cough and nasal congestion), diarrhoea and vomiting, gastroesophageal reflux and abdominal pain, headaches, tremors, erections, facial flushing, dizziness, irritability and (rarely)fever, skin disorders, pain in limbs and oedema have been reported in children on sildenafil. Sildenafil has the potential to adversely affect vision. Impaired liver function tests.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Sildenafil (2021) 3)Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 28 Persistent Pulmonary Hypertension of the Newborn, page 166 14)X- Temp Master Formulation 2018 page 78

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SODIUM DIHYDRODEN PHOSPHATE (ORAL)

Drug Type	Mineral
Indication	Treatment of Metabolic Bone Disease Commence supplementation of phosphate when levels are 1.3 mmol/L to 1.8 mmol/L[2]
Action	Phosphate is a major intracellular mineral and is important in bone mineralization and energy production.
Presentation	1 sachet contains 4.17 mmol of Sodium and Phosphate ions
Storage	Store below 30°C
Administration	Oral. 1 sachet of Sodium Dihydrogen Phosphate contains 4.17mmol of Phosphate. Dilute into 5ml WFI. Concentration is 0.8mmol/ml. Draw out the required dose. Recommended to separate oral doses from calcium and antacids containing agents such as aluminium hydroxide, calcium or magnesium salts, as these may reduce the bioavailability of phosphate[2.] Oral phosphate preparation has high osmolality and administration with feeds may have theoretical benefit of reducing the osmolality (consensus opinion)[2]
Dose	Treatment of metabolic bone disease: **1 - 2 mmol/kg/day in 1-2 divided dose**[4]
Stability after reconstitution	Freshly prepared.
Monitoring	Phosphate, calcium, magnesium, alkaline phosphatase concentrations are required at least fortnightly or more often if required. Urinary calcium and phosphate and Tubular Reabsorption Phosphate (TRP)%, parathormone, and vitamin D concentrations may be useful under certain circumstances
Contraindications	Hyperphosphatemia, dehydration, severe renal insufficiency, shock.
Precautions	Hypernatremia (avoid sodium dihydrogen phosphate).
Adverse Effects	Diarrhea (oral use only), hypocalcemia, nephrotoxicity, prolonged QT interval, hypotension, hypomagnesaemia. Hyperphosphatemia –carpopedal spasm, seizures.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Phosphorus (2021) 4) Neofax Neonatal Drug Database: Phosphate

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SODIUM BICRABONATE (IV)

Drug Type	Electrolyte, alkalinising agent
Indication	Metabolic acidosis. Chronic renal failure. Renal tubular acidosis. Prolonged resuscitation
Action	Decreases pulmonary vascular resistance, Improves myocardial function. Corrects metabolic acidosis by raising the pH of the blood and provides some volume expansion.
Presentation	8.4% (10mmol/10mEq /10 ml) vial
Storage	Store below 30°C Protect from light.
Administration	Infuse over 30 minutes. (Max rate of infusion 10mmol/min)[2] Sodium bicarbonate should be infused slowly in neonates to decrease possible hypernatremia that may decrease cerebrospinal fluid, pressure and result in intracranial haemorrhage. The manufacturer recommends an infusion rate not to exceed 0.33mEq/kg/hr in infants and children up to 2 years of age to reduce the risk of intracranial haemorrhage. However, in cardiac arrest, faster infusion rates may be warranted.[12]
Dose	**Administer half of the calculated dose**, then assess need for remainder** **Usual dose: 1–2 mmol/kg[2]** To calculate dosage required based on base deficit: **Sodium bicarbonate dose (mmol) = 0.3 x weight (kg)x base deficit (mmol/L)[2,3]** Severe intractable metabolic acidosis: 1 mmol/kg/ dose [7]
Dilution	Dilute with 1:1 of WFI to make up to concentration of 0.5mmol/ml. Maximum concentration is 0.5mmol/ml in neonates [2,12]
Stability after reconstitution	**Pharmaniaga 8.4% w/v Injection** Does not require reconstitution
Stability after dilution	**Pharmaniaga 8.4% w/v Injection** Diluted IV solution should be used as soon as possible. Discard unused portion.
Compatibility	Fluids: D5%, D10%, NSD5%, NSD10%, NS, 1/2NS Y Site: Aciclovir, Amikacin, Atropine, Ceftazidime, Dexamethasone, Digoxin, Fentanyl, Fluconazole, Furosemide, Gentamicin, Heparin Sodium, Hydrocortisone Sodium Succinate, Insulin, Linezolid, Metronidazole, Morphine, Penicillin G, Phenobarbitone, Potassium Chloride, Ranitidine, Vancomycin.
Incompatibility	Amino Acid Solution, Adrenaline (Epinephrine) Hydrochloride, Amiodarone, Amoxicillin, Amphotericin B, Ampicillin, Calcium Salts, Cefotaxime, Clindamycin, Diazoxide, Dobutamine, Dopamine, Ganciclovir, Glycopyrrolate, Imipenem- Cilastatin, Labetalol, Lipid Emulsion, Magnesium Salts, Metoclopramide, Midazolam, Noradrenaline (Norepinephrine), Pethidine
Side Effects	Hypernatraemia, hyperosmolality, hypocalcaemia, hypokalaemia. May increase intracellular acidosis. If administered during inadequate ventilation, PaCO2may rise —thereby exacerbating acidosis. Rapid correction may be associated with IVH. Local tissue necrosis —thrombosis at site of administration Metabolic alkalosis and tetany. Abdominal cramping, nausea, vomiting
Monitoring	Monitor acid-base balance. Monitor local infusion site for signs of extravasation
Precautions	Patients with renal insufficiency, congestive heart failure, or edema and sodium retention
References	2)Australian Neonatal Medicines Formulary (ANMF): Sodium Bicarbonate (2021) 3)Malaysian Paediatric Protocol 4th Edition. Chapter 65 Acute Kidney Injury, page 343 7) Advanced Paediatric Life Support. UK. 12) Pediatric Injectable Drugs (11th Edition) The Teddy Bear Book. ASHP Product leaflet Pharmaniaga 8.4% w/v Injection

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SODIUM BICRABONATE (ORAL)

Drug Type	Electrolytes, Alkalinizing agent
Indication	Metabolic acidosis. Chronic renal failure. Renal tubular acidosis. Prolonged resuscitation
Action	Neutralizes excess hydrogen ion and raises pH of the blood. Increases the excretion of free bicarbonate ions in urine, raising urinary pH
Presentation	1 sachet contains 1g Sodium and Bicarbonate ions
Storage	Store below 30°C
Administration	Oral. 1g Sodium Bicarbonate contains 11.9mmol of Bicarbonate and Sodium Dilute in 12ml of WFI Final concentration is 1mmol/ml. Administer 1–3 hours after feeds
Dose	**Usual dose: 1- 2mmol/kg**[2] To calculate dosage required based on base deficit: **Sodium bicarbonate dose (mmol) = weight (kg) x base deficit x 0.3** [2] Administer half of the calculated dose, then assess need for remainder
Stability after reconstitution	Freshly prepared.
Side Effects	Hypernatremia, hyperosmolality, hypocalcemia, hypokalemia. May increase intracellular acidosis. If administered during inadequate ventilation, PaCO2may rise —thereby exacerbating acidosis. Rapid correction may be associated with IVH. Metabolic alkalosis and tetany. Abdominal cramping, nausea, vomiting
Monitoring	Monitor acid-base balance.
References	2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Sodium Bicarbonate (2021) 3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 65 Acute Kidney Injury, page 343

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SULFAMETHOXAZOLE + TRIMETHOPRIM/ BACTRIM® (IV)

Drug Type	Antibacterial
Indication	Treatment of mild–severe infections including UTI and acute otitis media.
Action	Sulfamethoxazole is a sulfonamide that prevents the formation of dihydrofolic acid, a bacterial compound necessary for survival. Trimethoprim is a synthetic antibiotic that interferes with the production of folic acid by dihydrofolate reductase.
Presentation	Trimethoprim [TMP] 80mg and Sulphamethoxazole [SMZ] 400mg / 5ml vial
Storage	Store below 30°C
Administration	IV infusion over 60-90 minutes. Mix well before use, observe and discard if turbidity or crystallization appears.
Dose **Renal dose** **Refer page 135**	Not be used in infants < 4 weeks of age. Dosage is based on TMP component. Severe infections **IV: 4mg TMP/kg/dose 12 hourly**[1]
Dilution	Add 1ml [16mg TMP] to 25ml D5% to give a concentration of TMP 0.64mg/ml solution (1:25).2 Discard the balance medication from the original ampoule.
Stability after reconstitution	Roche Bactrim, Deva Does not require reconstitution.
Stability after dilution	Roche Bactrim, Deva Stable for 6 hours at room temperature with 1:25 dilution with D5%. Do not store in fridge as precipitation may occur. Protect from light.
Compatibility	Fluids: D5%, D10%, NS, Y site: Aciclovir, amino acid solutions, amphotericin B liposomal, lipid emulsions, metronidazole, milrinone, morphine, piperacillin-tazobactam, zidovudine.
Incompatibility	Y site: Amikacin, aminophylline, amiodarone, amphotericin b lipid complex, ampicillin, atropine, calcium gluconate, cefotaxime, ceftazidime, ceftriaxone, chloramphenicol, clindamycin, dexamethasone, diazepam, diazoxide, digoxin, dobutamine, dopamine, adrenaline (epinephrine), erythromycin, fentanyl, fluconazole, folic acid, furosemide, ganciclovir, gentamicin, heparin, hydrocortisone, insulin, lactated ringer's, lidocaine (lignocaine), methylprednisolone, midazolam, multiple vitamins injection, noradrenaline (norepinephrine), benzylpenicillin, phenobarbital (phenobarbitone), phenytoin, piperacillin, potassium chloride, propranolol, pyridoxine, ranitidine, sodium bicarbonate, vancomycin.
Contraindications	Acute porphyrias, **G6PD deficiency (risk of haemolytic anaemia).**
Precautions	Asthma Avoid in blood disorders (unless under specialist supervision). Avoid in infants under 6 weeks (except for treatment or prophylaxis of pneumocystis pneumonia) because of the risk of kernicterus. Predisposition to folate deficiency Renal impairment. Renal adjustments needed.
Side Effects	Gastrointestinal upset (vomiting, diarrhoea). Severe dermatologic reactions, blood dyscrasias, hepatotoxicity. Prolonged use may result in fungal or bacterial superinfection. Electrolyte imbalance Discontinue immediately if blood disorders (including leucopenia, thrombocytopenia, megaloblastic anaemia, eosinophilia) or rash (including Stevens-Johnson syndrome or toxic epidermal necrolysis) develop.
Monitoring	Watch for skin reactions and blood dyscrasias. Monitor renal function and full blood count.
References	1) Frank Shann Paediatric Drug Doses. 17th Edition, 2017 2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Sulfamethoxazole + Trimethoprim (2021) 3)Malaysian Paediatric Protocol 4th Edition 2019 Chapter 84 Paediatric HIV Page 463

	8) British National Formulary (BNF) for Children 2022-2023. Chapter 5 : Bacterial Infection (page 401) Product insert Roche Bactrim, Deva

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SULFAMETHOXAZOLE + TRIMETHOPRIM/ BACTRIM® (ORAL)

Drug Type	Antibacterial - Sulfonamide with antifolate
Indication	Prophylaxis of urinary tract infections (UTI). Treatment of mild–moderate infections including UTI and acute otitis media. Prophylaxis in HIV-exposed infants
Action	Sulfamethoxazole is a sulfonamide that prevents the formation of dihydrofolic acid, a bacterial compound necessary for survival. Trimethoprim is a synthetic antibiotic that interferes with the production of folic acid by dihydrofolate reductase.
Presentation	(Sulfamethoxazole 200 mg + Trimethoprim 40 mg)/5ml Suspension
Storage	Store below 30°C
Administration	Oral.
Dose **Renal dose** **Refer page 135**	UTI prophylaxis [1] **2mg/kg/dose TMP ON** Treatment of mild–moderate infections (e.g. UTI, acute otitis media)[1] **4 mg TMP/kg/dose 12 hourly** PCP prophylaxis start at 6 weeks age, till HIV status determined[3] **4mg TMP/kg/dose 24 hourly**
Stability after opening	Dynaprim Stable for 6 months after opening at room temperature15 (Stability of Syrups 2020)
Contraindications	Acute porphyrias**, G6PD deficiency (risk of haemolytic anaemia)**
Precautions	Hypersensitivity to sulfonamides or trimethoprim. Asthma Avoid in blood disorders (unless under specialist supervision) . Avoid in infants under 6 weeks (except for treatment or prophylaxis of pneumocystis pneumonia) because of the risk of kernicterus Predisposition to folate deficiency Renal impairment. Renal adjustments needed.
Monitoring	Watch for skin reactions and blood dyscrasias. Monitor renal function and full blood count
Side Effects	Gastrointestinal upset (vomiting, diarrhoea). Severe dermatologic reactions, blood dyscrasias, hepatotoxicity. Prolonged use may result in fungal or bacterial superinfection. Eletrolyte imbalance Discontinue immediately if blood disorders (including leucopenia, thrombocytopenia, megaloblastic anaemia, eosinophilia) or rash (including Stevens-Johnson syndrome or toxic epidermal necrolysis) develop.
References	1) Frank Shann Paediatric Drug Doses. 17th Edition, 2017 2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Sulfamethoxazole + Trimethoprim (2021) 3)Malaysian Paediatric Protocol 4th Edition 2019 Chapter 84 Paediatric HIV Page 463

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SUXAMETHONIUM (IV)

Drug Type	Neuromuscular blocking agent (depolarising)
Indication	For elective endotracheal intubation.
Action	Short-acting, depolarising neuromuscular blocker. It mimics acetylcholine and acts at cholinergic receptors, depolarising the motor end plate resulting in neuromuscular blockade.
Presentation	100 mg/2 ml ampoule.
Storage	Refrigeration at 2°C to 8°C. DO NOT FREEZE. Protect from light.
Dose	IV (preferred): **2 mg/kg** (up to 3 mg/kg) IM (only if IV is not accessible): 3–4 mg/kg[2] (onset of action can be delayed up to 3 minutes and duration of action is up to 15 minutes) Maximum dose: IV: 3 mg/kg/dose; IM: 4 mg/kg/dose
Administration	IV: Rapid injection at proximal cannula site. IM: Administer in anterior thigh muscle.
Dilution	Draw up 2 mL (100 mg of Suxamethonium) and add 8 mL sodium chloride 0.9% to make final volume 10 mL with a concentration of 10 mg/mL.[2]
Stability after reconstitution	Discard any unused product
Stability after dilution	Infusion solution: use within 24 hours
Compatibility	Dextrose 5%, Dextrose 10%, Sodium Chloride 0.9%, Dextrose 5% In Sodium Chloride 0.9%, Dextrose 5% In Sodium Chloride 0.45%, Sodium Chloride 0.45%.
Incompatibility	Y-Site Administration: Amino Acid Solution, Lipid Emulsion, Heparin, Alkaline Solutions with Ph > 8.5, other solutions.
Adverse Effects	Bradycardia is common in neonates and children, especially after a second dose of Suxamethonium. May be prevented by administration of atropine prior to administration of Suxamethonium. Hyperkalaemia Prolonged paralysis in infants with deficiency of pseudocholinesterase. Hypersensitivity reactions Malignant hyperthermia Management of Suxamethonium overdose and/or toxicity is supportive.
Monitoring	Continuous cardiorespiratory monitoring. Monitor temperature, blood pressure, oxygenation and assisted ventilator status.
Contraindications	Hyperkalaemia Family history of malignant hyperthermia Skeletal muscle myopathy Hypersensitivity to Suxamethonium
Precaution	Anaphylaxis: Severe anaphylactic reactions (some life-threatening and fatal) have been reported. Cross-sensitivity with other neuromuscular-blocking agents may occur; use extreme caution in patients with previous anaphylactic reactions. Bradycardia: May increase vagal tone. Risk of bradycardia may be increased with a second dose and may occur more often in children. Occurrence may be reduced by pre-treating with anticholinergic agents (e.g. atropine). May Increase intraocular pressure. May cause a transient increase in intracranial pressure. May increase intragastric pressure, which could result in regurgitation and possible aspiration of stomach contents. Malignant hyperthermia: Use may be associated with acute onset of malignant hyperthermia; risk may be increased with concomitant administration of volatile anaesthetics.
Special comments	Poorly absorbed from gastrointestinal tract – must be given IM or IV. Rapidly and completely hydrolysed by hepatic and plasma pseudocholinesterase. Very rapid onset (30–60 seconds) and short duration of action (3–5 minutes) with IV administration. Continuous administration over a prolonged period may result in irreversible blockade (phase II block). Should not be used without additional sedation
References	2)Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Suxamethonium (2021)

	Product leaflet Suxamethonium Fresenius			
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TETANUS TOXOID VACCINE/ ATT (IM)

Drug Type	Vaccine
Indication	For the prevention of Tetanus
Action	Adsorbed Tetanus Vaccine stimulates active immunity of human body to promote the development of antibodies against tetanus toxin produced by Clostridium tetani.
Description	A sterile, white turbish liquid, free from evident clumps after shaking. Contains purified tetanus toxoid, absorbed onto 3mg/ml aluminium phosphate. Thimerosal 0.01%w/v is used as a preservative.
Presentation	Multidose 10ml vial
Storage	Store at 2- 8° C – Do not freeze. Protect from light.
Administration	Intramuscular. The vaccine should be shaken well to homogenize before use. Should not be administered to those with febrile illness. A solution of 1:1000 adrenaline should be readily available for immediate injection in case of anaphylactic reaction
Dose	**One dose: 0.5ml** 1ml contains purified Tetanus Toxoid 20 Lf
Stability after opening	**TT Vaccine** Once opened, can be kept up to 4 weeks in fridge (2- 8° C) (please check vaccine vial monitor- refer to product leaflet)
Compatibility	Compatibility with other drugs not established
Side Effects	Side effects are rare and mild which include temporary tenderness, pain, swelling, erythema, and nodule at injection site. Occasional rashes and fever may occur.
Monitoring	ATT can be given safely and effectively at the same time as BCG, Measles, Rubella, Mumps, Polio (OPV and IPV), Hepatitis B, Haemophilus Influenzae type b, and Yellow Fever vaccines and Vitamin A supplement.
References	Product leaflet TT Vaccine

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TETANUS HUMAN 250U IMMUNOGLOBULIN (IM)

Drug Type	Immunoglobulin
Indication	For the prophylaxis and treatment of Tetanus
Action	Tetanus is caused by Clostridium tetani (bacteria commonly found in dirt or stool) that enters the body through wound. Characterized by generalized rigidity and convulsive spasms of skeletal muscles that usually begins in the jaw & neck and then becomes generalized. Tetanus Human 250u Immunoglobulin provides passive immunity towards tetanus by supplying antibodies to neutralize the free form of toxins produced by Clostridium Tetani.
Presentation	1ml/ vial (250 IU)
Storage	Store at 2- 8° C – Do not freeze. Protect from light.
Administration	Intramuscular.
Dose	Prophylaxis of tetanus: **250 units** (1ml), if more than 24 hours, recommended giving 500units (2ml).[18] Treatment of tetanus: **500units STAT** (2ml)[18]
Stability after opening	**Sero-tet** Discard after use
Compatibility	Compatibility with other drugs not established
Side Effects	Side effects are rare and mild which include temporary tenderness, pain, swelling, erythema, and nodule at injection site.
References	18)Bradley, J. S. et al. (2021). Nelson's Paediatric Microbial Therapy. 2nd Edition. American Academy of Pediatrics. Product leaflet Serotet

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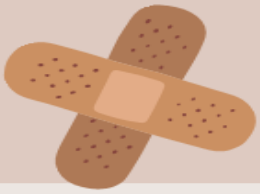

TETANUS [1]

By PRIC and PRP Wong Mun Yen

- Caused by *Clostridium tetani* (bacteria commonly found in dirt or stool) that enters the body through wound.
- Characterized by generalized rigidity and convulsive spasms of skeletal muscles that usually begins in the jaw & neck and then becomes generalized.

TETANUS TOXOID (TT VACCINE) [2]	COMPARISON	TETANUS IMMUNOGLOBULIN (SERO-TET) [3,8,9]
0.5ml/ vial	Strength/vial	1ml/ vial (250 IU)
C	Prescriber Category	B (ID)
Prophylaxis	Indication	Prophylaxis & Treatment
Prophylaxis 0.5ml *Refer table below for requirement of booster*	Dose (Adult & Children)	Prophylaxis 1ml given after injury If >24 hours, 2ml recommended Treatment 2ml (500 IU) stat *Given together with antibiotics* Preferred: IV Metronidazole 500mg q6-8h for 7-10 days Alternative: IV Benzylpenicillin 100,000-200,000 IU/kg/day divided into 4 doses for 7-10 days
IM	Route of Administration	IM Suggest to use: Adult: 21 gauge needle Children: 23 gauge needle
Safe	Pregnancy & Lactation	Safety not established
2-8°C	Storage	2-8°C
4 weeks*	Stability once Opened	-
Stimulates active immunity to promote development of antibodies	Mechanism of action	Passive protection by providing antibodies

*Within expiry date, stored under appropriate cold chain condition, aseptic technique, VVM has not reached discard point

Prophylaxis of Tetanus Vaccination & Immunoglobulin requirement [4, 5, 6]

IMMUNIZATION STATUS		TETANUS VACCINE		TETANUS IMMUNOGLOBULIN	
		Clean minor wounds	Other wounds	Clean minor wounds	Other wounds
≥3 doses Time since administration of last dose	<5 years	No	No	No	No
	5-10 years	No	Yes**	No	No
	>10 years	Yes**	Yes**	No	No
<3 doses or uncertain		Yes‡	Yes‡	No	Yes
Immunocompromised		Refer Above	Refer Above	No	Yes#

**Administer 1 dose.
‡ Not vaccinated/unknown vaccination status: Administer ≥2 doses at an interval of 4 weeks.
Incomplete vaccination : Administer 1 dose.
Regardless of the history of tetanus immunizations

Tetanus prone wounds [7]

Dirty wound
(contaminated with dirt, faeces, soil, saliva)

Trauma wound
(burn, frostbite, crushing)

Puncture wound
(nails, knife, sharp objects)

Reference:
1. CDC (2021). Tetanus. Available at https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/tetanus.pdf
2. Biofarma. TT Vaccine Product insert.
3. GC Pharma. Sero-Tet Product insert.
4. The Royal Children's Hospital Melbourne (2019). Management of tetanus-prone wounds CPG
5. Alberta Immunization Policy (2020). Tetanus post-exposure prophylaxis in injury/wound management.
6. Medecins sans frontieres (2021). Tetanus. Available at https://medicalguidelines.msf.org/viewport/CG/english/tetanus-16689919.html
7. HealthLink BC (2019). Tetanus Immune Globulin.
8. National Antimicrobial Guideline 2019, 3rd Edition
9. Malaysian Society of Infectious Disease & Chemotherapy. (2024). Tetanus. Available at https://adultimmunisation.msidc.my/tetanus/

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TRIMETHOPRIM (ORAL)

Drug Type	Antibacterial
Indication	Prophylaxis of urinary-tract infection (considered for recurrent infection, significant urinary-tract anomalies, or significant kidney damage)8
Action	Trimethoprim is a dihydrofolate reductase inhibitor, inhibiting the conversion of bacterial dihydrofolic acid to tetrahydrofolic acid, required for the synthesis of some amino acids.
Presentation	10mg/ml Suspension (Extemporaneous Pharmacy preparation)
Storage	Store below 30°C Protect from light.
Administration	Oral
Dose	UTI prophylaxis[1,3, 8] **2mg/kg/dose TMP ON**
Stability	Stable for 30 days at room temperature[11]
Contraindications	Blood dyscrasias[8]
Precautions	Acute porphyrias. Neonates (specialist supervision required). Predisposition to folate deficiency[8] **G6PD Deficiency (Risk is Medium @ g6pd.org Official G6PD Drug List.** **Medium risk means that for common G6PD variants these may be considered safe in most cases, when taken in normal therapeutic doses. However, it might provoke haemolysis when taken in large doses (accidental ingestion, poisoning, special treatments) or in period preceding birth, or in presence of other pathologies.[19]**
Adverse effects	Gastrointestinal upset (vomiting, diarrhoea). Severe dermatologic reactions, blood dyscrasias, hepatotoxicity. Prolonged use may result in fungal or bacterial superinfection. Eletrolyte imbalance [8]
Monitoring	Manufacturer recommends blood counts on long-term therapy (but evidence of practical value unsatisfactory
References	1)Frank Shann Paediatric Drug Doses. 17th Edition, 2017 3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 69: Antenatal Hydronephrosis, page 370 8) British National Formulary for Children 2022-2023. Chapter 5: Bacterial Infection, Trimethoprim (page 413) 11) MOH Formulary Extemporaneous 2015-page 65 19) Search All Drugs (g6pd.org)

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URSODEOXYCHOLIC ACID (ORAL)

Drug Type	Bile acid
Indication	Treatment of cholestasis associated with parenteral nutrition, biliary atresia, and cystic fibrosis. Also used to dissolve cholesterol gallstones.
Action	Ursodeoxycholic acid is a hydrophilic bile acid which alters bile acid composition, increases bile acid output and bile flow and decreases reuptake of bile products from the gut. May protect liver cells from damaging activity of toxic bile acids in chronic liver disease.
Presentation	50mg/ml (Extemporaneous Pharmacy preparation)
Storage	At room temperature
Administration	Oral or intragastric tube. Administer undiluted or mixed with a small amount of milk into infant's mouth through a feeding teat or via intragastric tube
Dose	**10-15mg/kg/dose 12 hourly**[2,4]
Stability	Stable for 14 days at room temperature.[14] Stability is shortened to 14 days instead of 60 days as stated in X-Temp Master Formulation due to capsule is being used instead of tablet as stated in the formula. Tablet has more excipient/stabiliser than capsule. (X-Temp Medical Advisor)
Monitoring	Monitor liver function tests and serum bilirubin. Observe stool colour
Contraindications	Hypersensitivity to ursodeoxycholic acid. Complete biliary obstruction
Adverse effects	Ursodeoxycholic acid is well tolerated. Diarrhoea, vomiting
References	1) Frank Shann Paediatric Drug Doses. 17th Edition, 2017 2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Ursodeoxycholic Acid (2021) 4) Neofax Neonatal Drug Database (Ursodeoxycholic Acid (Ursodiol)) 14)X- Temp Master Formulation 2018, page 91

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VANCOMYCIN (IV)

<table>
<tr><td>Drug Type</td><td>Antibacterial</td></tr>
<tr><td>Indication</td><td>Primarily active against gram positive bacteria. Sepsis from Staph epidermis and cloxacillin-resistant Staph aureus. Vancomycin in combination with an aminoglycoside is the treatment of choice for late-onset sepsis before the causative organism is known.</td></tr>
<tr><td>Action</td><td>Infections due to susceptible strains of Staphylococci (including MRSA), Streptococci, Enterococci, Diptheroids, Listeria monocytogenes, Actinomyces, Bacillus sp</td></tr>
<tr><td>Presentation</td><td>500 mg powder vial</td></tr>
<tr><td>Storage</td><td>Store below 30°C Protect from light.</td></tr>
<tr><td>Administration</td><td>IV infusion over 60 minutes.</td></tr>
<tr><td>Dose
Renal dose
Refer page 135</td><td>Usual dose: 10-15mg/kg/dose[4]
<table>
<tr><th>PMA (Weeks)</th><th>Postnatal (Days)</th><th>Interval (Hour)</th></tr>
<tr><td>≤29</td><td>0 - 14
≥ 14</td><td>18
12</td></tr>
<tr><td>30 - 36</td><td>0 -14
>14</td><td>12
8</td></tr>
<tr><td>37 - 44</td><td>0 - 7
>7</td><td>12
8</td></tr>
<tr><td>≥ 45</td><td>ALL</td><td>6</td></tr>
</table></td></tr>
<tr><td>Dilution</td><td>Reconstitute 1 vial vancomycin 500mg with 10ml of water for injection to make concentration of 50mg. Further dilute up to 100ml of D5% or NS to make up to final concentration of 5mg/ml. (Product Insert). Draw up the required dose. Infuse over 60 minutes</td></tr>
<tr><td>Stability after reconstitution</td><td>Celovan
No stability data after reconstitution</td></tr>
<tr><td>Stability after dilution</td><td>Celovan
Stable for 48 hours in room temperature and in the fridge 2-8 °C after dilution</td></tr>
<tr><td>Compatibility</td><td>Fluids: D5%, D10%, NS, Amino Acid Solution, Lipid Solution.
Y Site: Aciclovir, Adrenaline, Amiodarone, Dopamine, Dobutamine, Fluconazole, Granisetron, Magnesium Sulfate, Midazolam, Milrinone, Morphine Sulfate, Noradrenaline, Pethidine, Potassium Chloride, Vecuronium, Zidovudine.</td></tr>
<tr><td>Incompatibility</td><td>Fluids: No Information.
Y-Site: Albumin, Beta-Lactam Antibiotics (Eg. Penicillins, Cephalosporins, Chloramphenicol, Furosemide, Heparin Sodium, Methylprednisolone Sodium Succinate, Omeprazole, Sodium Bicarbonate, Sodium Valproate</td></tr>
<tr><td>Side Effects</td><td>Rapid infusion can cause an erythematous rash [Red man syndrome], systemic reaction and anaphylaxis. Potentially nephrotoxicity, ototoxicity, neurotoxicity.</td></tr>
<tr><td>Monitoring</td><td>Trough: 6.9- 13.8 umol/L (10-20mg/L)
*Aim for higher trough level: 13.8 umol/L in suspected severe sepsis e.g., MRSA, bone infection, meningitis, endocarditis.
*Trough level should be taken 30 minutes prior to the 4th dose.[2]
*In renal impairment, CGA < 29 weeks, therapeutic hypothermia, TDM should be taken prior to 2nd dose[2]</td></tr>
<tr><td>References</td><td>2) Australian Neonatal Medicines Formulary (ANMF) Consensus: Vancomycin (2022)
4) Neofax Neonatal Drug Database (Vancomycin)
Product insert Celovan</td></tr>
</table>

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VARICELLA ZOSTER IMMUNOGLOBULIN (IV/IM)

Drug Type	Immunoglobulin
Indication	Infants born to mothers who develop varicella between 7 days before delivery or 7 days after delivery.[3]
Presentation	125IU /2.5ml
Storage	Store at 2 - 8°C. DO NOT FREEZE.
Administration	Intramuscular: (Green Cross) Intravenous:(Varitect CP). **Please alert the brand before administrating.** **Refer page 132 for different type of brands.**
Dose	Given within 96 hours of exposure.[3] **For less than 2kg: 62.5IU (half vial)**[1] **For less than 10kg, give the 125IU as a single dose** via two different sites (1.25ml each site)
Stability after open	Ready to use. Strictly no dilution. Single use. Discard any balance.
Contraindication	Contraindicated in individuals who have exhibited previous systemic allergic to immune globulin and severe thrombocytopenia, should be administered with extreme care in individuals with IgA deficiency and blood coagulation disorder.
Precautions	Although systemic allergic reactions are rare, adrenaline should be available for the treatment of acute anaphylactic reaction if it occurs.
Adverse Effects	GI effects, malaise, headache, rash, respiratory symptoms may occur occasionally. Pain, swelling and redness at injection sites
Drug Interaction	Since VZIG-GCC may interfere with the immune response to live virus vaccines, (Eg MMR) therefore, these vaccines should not be administered for 3 months after use of VZIG-GCC administration. It may necessary to revaccinate with live virus vaccines to individuals who received VZIG-GCC inj.
References	3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 31 Perinatally Acquired Varicella and Postnatal Exposure to Varicella Infection, (page 171) 4) Neofax Neonatal Drug Database: Varicella Zoster Immunoglobulin Product leaflet VZIG (Green Cross), Varitect CP

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Know the Difference: Varicella Zoster Immune Globulin in Neonates

By PRIC Hospital Sg Buloh

JABATAN FARMASI
HOSPITAL SUNGAI BULOH

	Varitect CP	Varicella zoster GCC
		
Brand	Varitect CP	Varicella zoster GCC
Manufacturer	Biotest	Green cross
Appearance	Clear solution, slightly opalescent & transparent to pale yellow	Colourless/yellowish brown & clear/slightly opalescent solution
Excipients	Glycine, WFI	Glycine, Thimerosal 0.01% w/v, WFI
Unit per vial	125IU/5ml (25IU/ml)	125IU/2.5ml (50IU/ml)
Indication	Prophylaxis of varicella infection • after exposure in maternal infection (onset of rash) within 7 days before and 7 days after deliver • in postnatal exposure of Varicella in hospital* *Kindly refer to Paediatrics Protocols 4th Edition pg. 172 for the criteria included	
Route	Intravenous infusion	Intramuscular injection
Dose Administration	1ml (25IU)/kg BW; • Administer no later than 96h post exposure. 1st 15mins interval: 0.1ml/kg/hr 2nd 15mins interval: 0.2ml/kg/hr 3rd 15mins interval: 0.5ml/kg/hr 4th 15mins onwards: 1ml/kg/hr till finish	2.5ml (125IU) • Administer no later than 96h post exposure. • Administer at 2 different sites (1.25mL each site)
Reconstitution	Ready-to-use solution. Strictly no dilution. For single use only	
Storage	Temp: 2-8°C (protect from light) Shelf life: 3 years Once opened use immediately.	Temp: 2-8°C Shelf life: 2 years
Caution	Do not administer live vaccines (e.g: BCG, MMR, Rotavirus) for at least 3 months after administration of VZIG	

Reference:
1. Varitect CP Product Insert
2. VZIG-GCC Product Insert
3. Paediatrics Protocols 4th Edition
4. Bowden V.R, Greenberg C.S; Pediatric nursing procedures; Philadelphia:Wolters Kluwer; 2016

VITAMIN K / PHYTOMENADIONE (IV/IM)

Indication	Prophylaxis and treatment of vitamin K deficiency bleeding (VKDB) including haemorrhagic disease of the newborn
Action	Fat soluble vitamin which promotes the activation of blood coagulation Factors II, VII, IX and X in the liver
Presentation	1mg/ml. (Preservative benzyl alcohol free) If separation has occurred or if oil droplets have appeared, the injection should not be used.
Storage	Store below 30°C Protect from light.
Administration	IM: Inject into anterolateral aspect of thigh. IV Infusion: Infuse over 30 minutes (not to exceed 1mg/min) (Product insert) IV administration should be restricted due to the potential for severe adverse reactions12
Dose	Use 1mg/ml strength only Prophylaxis[3] **IM (BW <2.5kg): 0.5mg at birth** **(BW ≥ 2.5kg): 1mg at birth** Treatment of haemorrhage[1] **IV 0.3mg/kg/dose (maximum 1mg) for 3 days**
Dilution	IM: Administer undiluted. IV Infusion: Dilute with 3ml D5% or NS for 30 mins infusion
Stability after reconstitution	**Kisan** -
Stability after dilution	**Kisan** Use immediately. Protect from light.
Compatibility	Fluids: D5%, D10%, NS. Y site: Amikacin, Aminophylline, Ascorbic Acid, Atropine Sulfate, Aztreonam, Calcium Gluconate, Cefazolin, Cefotaxime, Ceftriaxone, Dexamethasone, Dopamine, Adrenaline (Epinephrine), Fentanyl, Furosemide (Frusemide), Gentamicin, Heparin Sodium, Hydrocortisone Magnesium Sulfate, Midazolam, Morphine, Phenobarbital (Phenobarbitone), Sodium Bicarbonate, Vancomycin.
Incompatibility	Fluids: Fat emulsion (intravenous) Y-site: Amphotericin (Conventional), Ampicillin, Diazepam, Diazoxide, Dobutamine, Haloperidol Lactate, Magnesium Sulfate, Methylprednisolone, Phenytoin, Sulfamethoxazole-Trimethoprim.
Monitoring	Monitor prothrombin time when treating clotting abnormalities (a minimum of 2 to 4 hours is needed for measurable improvement). Efficacy of treatment with Vitamin K1 is decreased in patients with liver disease. The risk of childhood cancer is not increased by IM administration of vitamin K1.
Side Effects	Pain, swelling and nodules at injection site Efficacy is decreased in patients with liver disease Severe reactions including anaphylaxis have been described with IV injections in adults.
References	1) Frank Shann Paediatric Drug Doses. 17th Edition, 2017 2) Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Vitamin K (2022) 3) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 11: Premature Infant, page 91. 12) Paediatric Injectable Drugs 11th Edition. The Teddybear Book. ASHP Publications, Product Insert Kisan

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ZIDOVUDINE (ORAL)

<table>
<tr><td>Drug Type</td><td>Antiviral</td></tr>
<tr><td>Indication</td><td>As stated in the Paediatric Protocol 4th Edition, Management of HIV exposed infants, page 463, for the prevention of maternal-fetal HIV transmission3</td></tr>
<tr><td>Action</td><td>Zidovudine reduces the risk of maternal-infant transmission by possibly reducing the maternal viral load and subsequent exposure of the foetus in utero, of the infant at delivery or both.</td></tr>
<tr><td>Presentation</td><td>50mg/5ml solution</td></tr>
<tr><td>Administration</td><td>Oral
ARV should be served as soon as possible (preferably within 6- 12 hours of birth) and no later than 48 hours after birth[3]</td></tr>
<tr><td>Storage</td><td>Room temperature</td></tr>
<tr><td>Dose[3]</td><td>
<table>
<tr><th>PMA (Weeks)</th><th>Dose (mg/kg/dose)</th><th>Interval (hours)</th><th>Duration</th></tr>
<tr><td rowspan="2"><30</td><td>2</td><td>12</td><td>Birth to 4 weeks</td></tr>
<tr><td>3</td><td>12</td><td>4 to 6 weeks</td></tr>
<tr><td rowspan="2">≥30</td><td>2</td><td>12</td><td>Birth to 2 weeks</td></tr>
<tr><td>3</td><td>12</td><td>2 to 6 weeks</td></tr>
<tr><td>≥37</td><td>4</td><td>12</td><td>4 weeks (Scenario 1)
6 weeks (Scenario 2)</td></tr>
</table>
Scenario 1: Infant of HIV –infected pregnant mother who is on ART and has sustained viral suppression: Oral zidovudine for 4 weeks
Scenario 2: Infant at higher risk of HIV acquisition e.g. infant born to HIV- infected mother who:
- Has not received intrapartum/antepartum ARV
- Has received only intrapartum ARV
- Has received antepartum ARV but does not have viral suppression near delivery
Oral zidovudine for 6 weeks + Oral nevirapine 3 doses: at birth, 48hrs later and 96hrs after 2nd dose
</td></tr>
<tr><td>Stability after opening</td><td>Retrovir
Stable for 30 days in room temperature.[15]</td></tr>
<tr><td>Side Effects</td><td>Anaemia and neutropenia are common. If haemoglobin falls to between 7.5 g/dl and 9 g/dl or the neutrophil count falls to between 0.75 - 1 x 109 the daily dosage may be reduced until there is evidence of marrow recovery, alternatively, recovery may be enhanced by brief interruption of zidovudine by 2 - 4 weeks. Marrow recovery may be observed within 20 weeks after which zidovudine may be restarted back at a reduced dosage. (Product insert)

Transient lactic acidemia, vomiting, headache, insomnia, hepatomegaly with hepatic steatosis, lipodystrophy, lipoatrophy, myopathy, cardiomyopathy and myositis. In most cases the adverse events are mild and self-limiting. Prolonged use increases the risk of adverse events. (Product insert)</td></tr>
<tr><td>Contraindications/</td><td>Hypersensitive to zidovudine or to any of the components of the formulations.
Should not be given to abnormally low neutrophil counts (< 0.75 x 109/l) or abnormally low hemoglobin levels (<7.5g/dl or 4.65mmol/l)</td></tr>
<tr><td>References</td><td>3) Paediatric Protocol 4th Edition, 2019. Chapter 84 Paediatric HIV, page 463
15) Stability of Oral Suspensions or Syrups after Opening or Reconstitution Product leaflet Retrovir</td></tr>
</table>

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RENAL DOSAGE ADJUSTMENT (REFERENCE FROM PAEDIATRIC PROTOCOL 4TH EDITION 2019)

DRUG	CR CLEARANCE	DOSE	DOSE INTERVAL
Acyclovir (IV Infusion)	25 -50	Nil	12
	10- 25	Nil	24
Acyclovir (Oral)	10 -25	Nil	8
	< 10	Nil	12
Amphotericin B[2]	Reduce total daily dose by 50%, or the dose can be give EOD.		
Amikacin	Avoid if possible. If needed, give initial dose, take trough sample immediately before next dose, and peak 1-hour post-dose		
Amoxicillin + Clavulanicacid (Co-amoxiclav /Augmentin®)	10-30	Normal dose initially, then half-dose 12 hourly	
	< 10	Normal dose initially, then half-dose 24 hourly	
Ampicillin + Sulbactam (Unasyn®)	15 - 29	Nil	12
	5 - 14	Nil	24
Ampicillin[2] renal dose are based on dosesof 100-200mg/kg/day	30 -50	35 -50mg/kg/ dose	6
	10 - 29	35 -50mg/kg/ dose	8 -12
	< 10	35 -50mg/kg/ dose	12
Benzylpenicillin	10 - 50	Nil	8-12
	< 10	Nil	12
Cefotaxime	< 5	Normal dose initially, then half-dose, same frequency	
Cefuroxime	>20	Nil	8
	10 – 20	Nil	12
	< 10	Nil	24
Ceftriaxone	< 10	Dose not > 40mg/kg (maximum 2g/day)	
Ceftazidime	30 – 50	50 – 100%	12
	15 - 30	50 -100%	24
	5 -15	25 - 50%	24
	< 5	25 –50%	48
Cefepime	30 -50	50mg/kg	12
	11 – 29	50mg/kg	24
	<10	25mg/kg	24
Cefuroxime	10 -29	Nil	12
	< 10	Nil	24
Cloxacillin	< 10	Nil	8
Fluconazole	< 50	Loading dose, then half-dose, same frequency	
Gentamicin	Avoid if possible. If needed, give 5mg/kg/dose, check trough level24 hours later, and peak 1 hour post dose.		
Imipenem	40	75%	8
	10	25%	12
	Anuric	15%	24
Meropenem	25 -50	100%	12
	10 – 25	50%	12
	<10	50%	24

Ciprofloxacin	40	Nil	12
	10	50%	24
	anuric	33%	24
Metronidazole	< 10	Nil	12
Phenobarbitone[2]	< 10	50%	24
Sulfamethoxazole + Trimethoprim (Bactrim®)[2]	15 -30	Normal dose for 24- 48 hours, then half-dose24 hourly	
	< 15	Use is not recommended	
Vancomycin	Give initial/ loading dose, take trough sample immediately beforenext dose and peak, 1 hour after completion of infusion		

It is difficult to estimate GFR from serum creatinine levels in AKI. A rough estimate can be calculated from theformula below once the serum creatine remains constant for at least 2 days.

$$Calculated\ creatine\ clearance\ (ml/min/1.73m^2) = \frac{Height\ (cm) \times 40}{Serum\ creatine\ (micromol/l)}$$

Assume creatinine clearance of < 10ml/min/ 1.73m^{2}if patient is on dialysis or anuric.

REFERENCES

1) Paediatric Protocol 4th Edition 2019, Chapter 65 Acute Kidney Injury, page 346-247
2) Paediatric & Neonatal Dosage Handbook (Lexicomp Drug Reference)

	TPN A (48 hours)	TPN B (48 hours)	TPN C (48 hours)	Lipid (24 hours)
Volume (ml)	100	200	200	18
Energy (kcal)	57.12	106.17	106.17	32
Osmolarity (mOsmol/L)	1138	1221	1289	
Amino Acid (g)	3.5 (3.5%)	7 (3.5%)	7 (3.5%)	
Glucose (g)	10 (10%)	20 (10%)	20 (10%)	
Sodium (mmol)	1.86	6.57	12.89	
Potassium (mmol)	0	5	5	
Calcium (mmol)	0.83	1.65	1.65	
Magnesium (mmol)	0.24	0.56	0.56	
Phosphate (mmol)	0.93	1.86	1.86	
Nitrogen (g)	0.5	1	1	
Water Soluble Vitamin (ml)	1	1.86	1.86	
Peditrace (ml)	1	1.86	1.86	
Fat (g)				3.2
Shelf life: 7 days i.e: 5 days at 2-8°c, followed by 2 days at room temperature (20-25°c)				

TPN CALCULATION

$$Amino\ Acid\ (g/kg/day) = \frac{rate(ml/hr) \times 24hr}{BW(kg) \times 28.5}$$

Maximum Amino Acid per day: 3.5g/kg/day[2]
(can up to 4g/kg/day after discussion with specialist)[1]

LIPID CALCULATION

$$Lipid\ (ml/hr) = \frac{Target\ Lipid\ (g/kg/day) \times BW(kg) \times 5.6}{24hr}$$

Target Lipid[1]:
Day 1 of TPN: 1g/kg/day
Day 2 of TPN: 2g/kg/day
Day 3 of TPN: 3g/kg/day

Reference: 1) Malaysian Paediatric Protocol 4th Edition, 2019. Chapter 14: Total Parenteral Nutrition for Neonate. (page 100)
2) Johannes, B., V., G, *et al* (2018). ESPGHN/ESPEN/ESPR/CSPEN Guidelines on pediatric Parenteral Nutrition: Amino Acids. *Clinical Nutrition*, (37), 2315-2323.

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DOSING GUIDELINES FOR ELECTROLYTES

ROUTE	DRUG	DOSE	DILUTION
PO	**CALCIUM CARBONATE 500MG TAB ($CACO_3$)** (40% elemental Ca) 500mg tab = 200mg elemental Ca	12.5mg - 50mg/kg/dose TDS - QID of $CaCO_3$ [4] (50mg - 200mg/kg/day of $CaCO_3$ = 20mg – 80mg/kg/day of elemental Calcium)	Dose depends on clinical condition and serum calcium concentration. Freshly prepared
IV	**CALCIUM GLUCONATE 10 % INJ (10ML)** 1ml = 0.22mmol	0.5ml/kg to be dilute in 0.5ml/kg NS over 10-60mins (1:1) [1,2]	Incompatible with sodium bicarbonate and phosphate solutions [3,4]
PR	**CALCIUM POLYSTYRENE SULFONATE 5G SACHET (KALIMATE)**	0.3 – 0.6gm/kg QID PR [2] 0.25gm/kg/dose PR [1]	Not to give orally in neonate [1] Freshly prepared
IV	**MAGNESIUM SULPHATE 50% INJ (2465MG/5ML)** 1ml = 2 mmol Mg	**Hypomagnesemia** 0.05 - 0.1mL/kg/dose over 10-20 mins [3,6] (25mg - 50mg/kg/dose) **Persistent Pulmonary Hypertension of the Newborn [5,6]** Loading dose: 200 mg/kg for 30 minutes Maintenance dose: 20-50 mg/kg/hour	In neonates, dilute up to 5mL NS. Usual concentration of 60mg/mL. Max concentration is 200mg/ml. [3] PPHN: Dilute 10mL in 40mL NS. Withdraw 2mL/kg (200mg/kg) and run over 30 mins then run the remainder at 0.2-0.5mL/kg/hr
IV	**POTASSIUM CHLORIDE (KCL) 1GM/10ML (MIXTURE & INJ)** 1gm =13.3 mmol[1]	1) Loss: (Target K^+ level – present K^+ level) x 0.4 x weight (kg) 2) Maintenance: 1 – 2 mmol/kg/day [1] Mmol of potassium required = (1) + (2) Target K^+= 3.5-5mmol/L	Dilute with NS / D5 to maximum concentration ≤ 0.04mmol/ml for peripheral and ≤ 0.2mmol/ml for central venous infusions with usual rate of 0.2 - 0.4mmol/kg/hour.[4] **a)Concentration (mmol/ml) = (x)g of KCl x 13.3 mmol / Total volume of diluent (ml)** **b)Infusion rate (mmol/kg/hr) = (x)g of KCl x 13.3 mmol x Drip rate (ml/hr) / Total volume of diluent (ml) x BW (kg)** **Example: 1g KCL, BW 1.5kg, rate 5ml/hr** **a)0.02mmol/ml = 1g x 13.3 mmol / 500ml**

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<table>
<tr><td></td><td></td><td></td><td>b)0.08mmol/kg/hr = $\frac{\text{(1g) x 13.3 mmol x 5ml/hr}}{\text{500ml (1 pint) x 1.5kg}}$</td></tr>
<tr><td>IV</td><td>POTASSIUM DIHYDROGEN PHOSPHATE 1.361 G/10 ML
1ml = 1mmol PO4 = 1mmol K^+</td><td><table><tr><td>PO4 < 0.32mmol/l</td><td>0.44mmol/kg to 0.64mmol/kg</td></tr><tr><td>PO4 0.32mmol/l – 0.54mmol/l</td><td>0.32mmol/kg to 0.43 mmol/kg</td></tr><tr><td>PO4 0.54mmol/l – 1.29mmol/L</td><td>0.16mmol/kg to 0.31mmol/kg</td></tr></table>Run over at least 6 hours [4,6]</td><td>Dilute with NS or D5% to concentration 0.04mmol/ml (peripheral line) and 0.1mmol/ml (central line) [6]</td></tr>
<tr><td>IV</td><td>SODIUM BICARBONATE 8.4% (10ML)
1ml =1 mmol</td><td rowspan="2">Metabolic acidosis [1]
HCO3 needed (mmol)= BE X (0.3 X body weight (kg))
Administer half of calculated dose, then assess need for remainder.</td><td rowspan="2">1:1 dilution with WFI</td></tr>
<tr><td>PO</td><td>SODIUM BICARBONATE POWDER (PACK OF 1GM)
1gm = 12 mmol</td></tr>
<tr><td>PO</td><td>SODIUM CHLORIDE POWDER (PACK OF 2GM)
1gm = 17.1 mmol</td><td>1) Loss: (Target Na level – present Na level) × 0.6 × weight(kg) [1,2]
2) Maintenance: 2 – 3 mmol/kg/day [6]
Mmol of sodium required = (1) + (2)
Target Na^+= 135-145mmol/L
*Do not correct more than 10mmol/L per day</td><td>Dilute 2gm of NaCl in 20ml water (10% dilution). Take required dose.</td></tr>
<tr><td>IV</td><td>SODIUM CHLORIDE 3% INJ (10ML)
3gm = 513mmol/L</td><td>2ml/kg of NaCl 3% over 10 - 15 minutes.[1]
A further 2ml/kg of NaCl 3% over next 10 – 15 minutes if symptoms are still present after the initial bolus. [1]</td><td>Other strengths of Sodium Chloride Inj. In Hsgb [1]
0.18% = 31mmol/L
0.45% = 77mmol/L
0.9% = 154mmol/L
20% = 3420 mmol/L</td></tr>
<tr><td>PO</td><td>SODIUM DIHYDROGEN PHOSPHATE (PACK OF 500MG)
500mg = 4.16 mmol each</td><td>1-2 mmol/kg/day in divided doses [6]</td><td>Freshly prepared</td></tr>
<tr><td>IV</td><td>SODIUM GLYCEROPHOSPHATE (GLYCOPHOS) (20ML)</td><td>1-1.5mmol/kg/day, run no less than 8 hours. Repeat as necessary [4,5]</td><td>Dilute with NS or D5% with concentration of 0.1mmol/ml. [6]</td></tr>
</table>

	1ml = 1mmol PO4 = 2 mmol Na		

Disclaimer: This guideline is only for local use.

Reference:

1. Paediatric Protocols for Malaysian Hospitals 4rd Edition, 2019
2. Frank Shann, 17th Edition 2017
3. Paediatrix Micomedex Drug Database
4. Neofax Micromedex Neonatal Drug Database
5. BNF Children 2022-2023
6. Australian Neonatal Medicine Formulary Group Consensus: Newborn Services Drug Protocol
7. Michael, F. C., & Jennifer, W. C. (2013). The Clinical Use of Drugs 10th Edition: Pediatric Fluid, Electrolytes, and Nutrition. Koda-Kimble & Young's, 98, 2277-29\

PREMEDICATION FOR NON-EMERGENT INTUBATION IN NEONATES

1. INTRODUCTION

The use of pre-intubation medication has been shown to:

- **Decrease physiological disturbances** (such as hypoxemia, bradycardia, intracranial hypertension, systemic and pulmonary hypertension) by decreasing the time to successful intubation and number of intubation attempts
- **Minimise risk of airway trauma**
- Alleviate pain

All term and preterm neonates requiring elective intubation on the neonatal unit should receive pre-intubation medication.

Exclusion criteria:

- Emergency life-threatening conditions where intubation is time-critical or the delay in intubation to obtain IV access or prepare pre-intubation medication could be fatal e.g. a poorly perfuse, apneic infant not responding to mask ventilation.
- Intubation outside the neonatal unit – labour ward/theatre/postnatal wards. These are considered emergency intubations (not elective).
- Neonates with known or anticipated difficult airway or upper airway anomaly – extra caution/consideration should be made with clear escalation plans due to the loss of spontaneous respiratory drive once pre- intubation medications are given.

2. RESPONSIBILITIES

2.1. Medical personnel

- ALL intubations requiring pre-medication should be undertaken with the presence of a consultant or neonatal fellow.
- Occasionally, it can be done by a senior medical officer skilled in intubation and well versed with the medications used after discussion with the consultant/neonatal fellow in charge.

2.2. Nursing staff

- A staff nurse (SN) whose sole responsibility is to prepare and administer the pre-intubation medicationsshould be identified.
- Preparation of intubation procedure i.e. preparation of intubation equipment, positioning of the infant,preparation of suctioning equipment; should be delegated to nurses other than the one described above.

3. CONTRAINDICATIONS

- Pre-intubation drugs should not be used if there is a known allergy to any of the agents
- Suxamethonium should not be used in the presence of:
    - Significant hyperkalemia
    - Family history of malignant hyperthermia
    - Suspicion of muscular dystrophy
- Suxamethonium should be used with caution if there is concern that the neonate has abnormal upper airway anatomy, and that intubation may be technically extremely difficult.

4. PROCEDURE

4.1. Equipment

All the following equipment should be available, checked and working prior to intubation.

- T-piece resuscitator and correct sized face mask
- Suction
- Ventilator – set up with settings entered

- Drugs (*Table 1*)
- Intubation equipment
    - Laryngoscope handle with bright light
    - Laryngoscope blade of correct size (Miller 00, 0 or 1)
    - Endotracheal tube (ETT) of correct size
    - Stylet (if needed)
    - Adhesive tape to secure ETT
    - Stethoscope

For the patient, ensure the following:

- IV access – flushed and ready for use
- NG tube – aspirated ± removed
- Monitoring in place – ECG & saturation monitoring
- Baby positioned appropriately
- Measures to maintain temperature of baby

MEDICINE	DILUTION	FINAL CONCENTRATION	DOSE
MORPHINE 10 mg/ ml [4,6]	1 mL Morphine + 9 mL WFI	1mg/mL	**0.1mg/kg/dose** (up to 0.2 mg/kg) (**0.1ml/kg** of diluted Morphine)
ATROPINE 1 mg/mL [5]	1 mL Atropine + 9 mL WFI	0.1mg/mL	**0.01-0.02mg/kg** (**0.1 – 0.2mL/kg** of diluted Atropine)
SUXAMETHONIUM 100 mg/2 mL [4,7]	2 mL Suxamethonium + 8 mL WFI	10 mg/mL	**2 mg/kg (0.2 mL/kg** of diluted Suxamethonium)

Table 1. Pre-intubation medications, dose dilution and final concentration.

Drugs should be administered in the order of: Morphine, **then** Atropine, **then** Suxamethonium[4]
All these medications are available as NICU Floorstock items.

ORDER OF ADMINISTRATION:

1. Morphine: Administer over 60 seconds and flush with 1-2 mL of saline
2. Atropine: Administer over 60 seconds and flush with 1-2 mL of saline
3. Suxamethonium: Administer over 10 seconds and flush with saline
    * *If chest wall rigidity occurs after Morphine is administered, give Suxamethonium immediately*
    * *If intubation in unsuccessful, a repeat dose of Suxamethonium can be given [4] (maximum cumulative dose 3mg/kg) [7]. DO NOT repeat Atropine and Morphine.*

5. REFERENCES

1. Kumar P, Denson SE, Mancuso TJ, Committee on Fetus and Newborn, Section on Anesthesiology and Pain Medicine. Premedication for nonemergency endotracheal intubation in the neonate. *Pediatrics*. 2010;125(3):608-615.
2. Barrington KJ. Canadian Paediatric Society, Fetus and Newborn Committee Position Statement. Premedication for endotracheal intubation in the newborn infant. *Paediatr Child Health* 2011;16(3):159-64.
3. Allen KA. Premedication for neonatal intubation: which medications are recommended and why. *Adv Neonatal Care.* 2012 Apr;12(2):107-11
4. www.adhb.govt.nz/newborn/Guidelines/Respiratory/Intubation/Intubation.htm
5. Neofax Neonatal Drug Database (Atropine)
6. Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Morphine Sulphate (2021)
7. Australian Neonatal Medicines Formulary (ANMF) Consensus Group: Suxamethonium (2021)

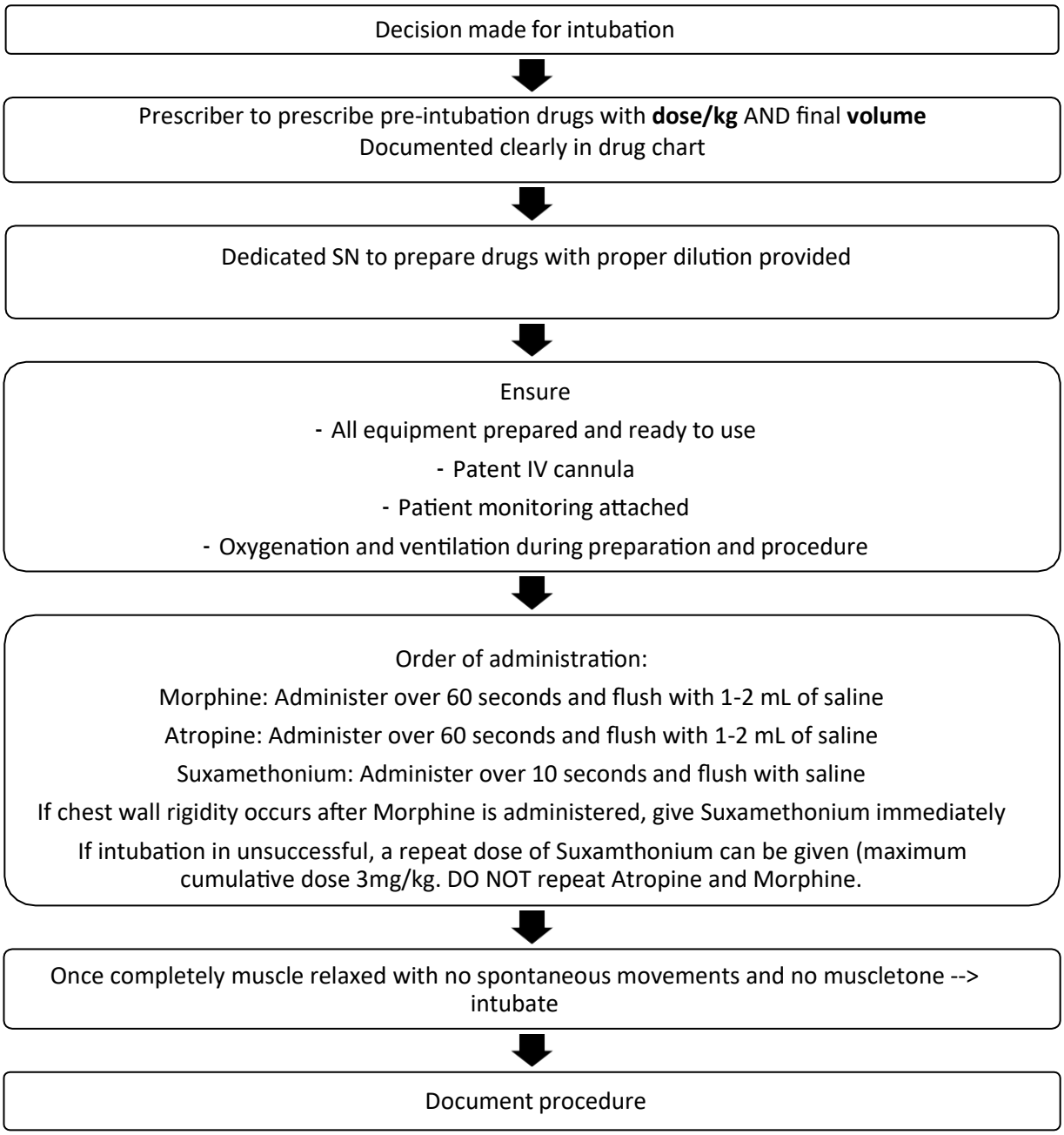

TABLE 2: PROCEDURE FLOWCHART

INTRAVENOUS DRIP CONVERSION AND CALCULATION

DRIP (500 ML) (A)	VOLUME (A) EXTRACTED FROM DRIP (ML)	VOLUME D50% BEING INSERTED TO DRIP	OUTCOME
1/5 NSD5%	27.7	27.7	1/5NSD7.5%
1/5 NSD10%	31.2	31.2	1/5 NSD12.5%
1/5 NSD10%	62.5	62.5	1/5 NSD15%
1/5 NSD10%	93.7	93.7	1/5 NSD17.5%
1/5 NSD10%	125	125	1/5 NSD20%
1/5 NSD10%	187.5	187.5	1/5 NSD25%
NSD5%	27.7	27.7	NSD7.5%
NSD5%	55.5	55.5	NSD10%
NSD5%	83.3	83.3	NSD12.5%
NSD5%	111.1	111.1	NSD15%
NSD5%	138.8	138.8	NSD17.5%
NSD5%	166.6	166.6	NSD20%
NSD5%	222.2	222.2	NSD25%
1/2 NSD5%	27.7	27.7	1/2 NSD7.5%
1/2 NSD10%	31.2	31.2	1/2 NSD12.5%
1/2 NSD10%	62.5	62.5	1/2 NSD15%
1/2 NSD10%	93.7	93.7	1/2 NSD17.5%
1/2 NSD10%	125	125	1/2 NSD20%
1/2 NSD10%	187.5	187.5	1/2 NSD25%

EXAMPLE OF CALCULATION: FROM D5% TO D10%

D50%		D5%	= D10%
50(X)	+	5(1-X)	= 10
50X	+	5 – 5X	= 10
		45X	= 5
		X	= 1/9

So, 1/9 of D50% = 55.6ml of D50%
8/9 of D5% = 444.4ml of D5%,
Take out 55.6ml of D5% and pour in 55.6ml of D50% in D5% to make it D10%

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SUMMARY OF ANTIBIOTIC DILUTION

ANTIBIOTICS DILUTION				
DRUG	**RECONSTITUTION**	**FURTHER DILUTION**	**ADMINISTRATION**	**BRAND**
IV Acyclovir 250mg	10ml WFI (25mg/ml)	Withdraw 1ml and dilute in up to 5ml NS/D5% (Max conc ≤5 mg/ml)	Administer over 1 hour (to minimise renal damage).	Vaxcel Acyclovir Zovirax
IV Amikacin 250mg/2ml	Already in solution.	Withdraw 1 ml (125mg) and dilute in up to 25mls of NS/D5% (Max conc = 5mg/ml)	Administer over 60 minutes.	Apalin
IV Amphotericin B 50mg	10ml WFI (5mg/ml)	Withdraw 1ml and dilute in 50ml D5% (0.1mg/ml) (Incompatible with NS)	Administer over 2 to 6 hours.	Amphotret 50 mg
IV Amoxicillin & Clavunic Acid 1.2g Inj	20ml WFI (60mg/ml)	Withdraw **WITHOUT DELAY** 1ml and dilute in up to 5ml NS/WFI (12mg/ml)	Administer over 3-4 minutes or infusion for 30 minutes	Clavicin 1.2g
IV Ampicillin 500mg	10ml WFI (50mg/ml)	Not required	Administer over 5-10 minutes	Kampibiotic 500mg Inj
IV Ampicillin & Sulbactam 1.5g	10ml WFI (150/ml)	Withdraw 1ml and dilute in up to 5ml (30mg/ml) (Max conc= 45mg/ml)	Administer over 30 minutes	Amsubac 1.5g
IV Azithromycin 500mg Inj	4.8ml WFI (100mg/ml)	Withdraw 1ml and dilute in up to 50ml NS/D5% (2mg/ml)	Administer over 1 hours.	Vaxcel Azithromycin Zithromax
IV C-Penicillin/ Penicillin-G, Benzylpenicillin 1MU/ 600g	1 mega vial in 5mls WFI (200,000 units/ml)	Dilute 2.5ml in up to 5ml NS/D5% (100,000 unit/mL)	Administer as an intravenous infusion over 30 – 60 minutes	Bepen Injection
IV Cefazolin 1g	10ml WFI or NS (100mg/ml)	Withdraw 1ml and dilute in up to 5ml NS/D5% (20mg/ml)	Administer over 3-5 minutes or intravenous infusion over 30 minutes	Cefazolin-AFT
IV Cefepime 1g	10ml WFI/ NS (90mg/ml) (*Product Insert)	Withdraw 1ml and dilute in up to 5ml NS/D5% (18mg/ml). (Max conc ≤ 40mg/ml)	Administer over 30 hours.	Vaxcel Cefepime 1g
IV Cefotaxime 500mg	2ml WFI (250mg/ml)	Withdraw 1ml and dilute in up to 5ml NS/D5% (50mg/ml). (Conc: 20-60mg/ml)	Administer over 30 minutes	Rekaxime
IV Ceftazidime 2g	10ml WFI (170mg/ml) (*Product Insert)	Withdraw 1ml and dilute in up to 2ml NS/D5% (85mg/ml) (Max conc:170mg/mL)	Administer over 3-5 minutes	Cefatum
		Withdraw 1ml and dilute in 5ml NS/D5% (34mg/ml) (Max conc : 40mg/ml)	Administer over 30 minutes	
IV Ceftriaxone 1g	9.6ml WFI/ NS (100mg/ml)	Withdraw 1ml and dilute in up to 5ml NS/D5% (20mg/ml) (Max conc: 40mg/ml)	Administer over 30 minutes	Unocef

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IV Cefuroxime 750mg	10ml WFI (75mg/ml)	Withdraw 1ml and dilute in up to 5ml NS/D5% (15mg/ml) (Max conc ≤ 30mg/ml)	Administer over 30 minutes	Anikef
IV Colistimethate Sodium 1m IU (Polymyxin E)	2ml WFI (500,000u/ml)	Withdraw 1ml and dilute in up to 50ml NS/D5% (10000u/ml)	Administer over 30 minutes	Colomycin
IV Cloxacillin 500mg	10ml WFI (50mg/ml)	Not required	Administer over 10 minutes.	Cloxabiotic Inj 500mg
		Withdraw 1ml and dilute in up to 5ml NS/D5% (10mg/ml)	Administer over 60 minutes	
IV Fluconazole 2mg/ml	Already in solution	Not required	Administer over 1-2 hours. Rate ≤ 200mg/hr If doses ≥ 6mg/kg, infuse over 2 hours	Fluconol
IV Ganciclovir 500mg	10ml WFI (50mg/ml)	Withdraw 1ml and dilute in up to 5ml NS/D5% (10mg/ml)	Administer over 1 hour	Cymevene
IV Gentamicin 80mg/2ml Inj	Already in solution	Withdraw 1ml and dilute in up to 5ml NS/D5% (Max conc: ≤10mg/ml)	Administer over 30 minutes	Garasent
IV Linezolid 600mg/300ml	Already in solution	Not required	Administer over 30-120 minutes	Zyvox
IV Imipenem-cilastatin 500mg/500mg	10ml NS (50mg/ml of Imipenem)	Withdraw 1 ml and dilute in up to 10ml of NS/D5 (Max conc: 5mg/ml)	Administer over 30 minutes up to 4 hours	Imipenem/Cilastin KABI
IV Meropenem 1g	20ml WFI (50mg/ml)	Withdraw 1 ml and dilute in up to 10ml of NS/D5 (Max conc: 20mg/ml)	Administer over 30 minutes up to 4 hours	Meropenem KABI
IV Metronidazole 500mg/100ml	Already in solution	Not required	Administer over 30 minutes	Metronol
IV Polymyxin B 500,000IU (50g)	1 vial (50mg) in 50ml D5% (1mg/ml)	Withdraw required dose (Max conc: 1mg/ml)	Administer over 60-90 minutes	Polymyxin B for Inj U.S.P
IV Piperacillin and Tazobactam 4.5g	20ml WFI (200mg/ml of Piperacillin)	Withdraw 1ml and dilute in up to 2ml NS/D5% (50mg/ml) (Max conc: 200mg/ml)	Administer over 30 minutes	Aurotaz-P
IV Trimethoprim [TMP] and Sulphamethoxazole [SMZ] (Bactrim) 480mg/5ml	Already in solution	Withdraw 1ml [16mg TMP] and dilute in up to 25 ml D5 (0.64mg/ml)	Administer over 60 minutes	Bactrim Cotrim-ratiopharm Ampullen SF
IV Vancomycin HCl 500mg	10ml of WFI (50mg/ml)	Withdraw 1ml of 50mg/ml solution and dilute in up to 10ml NS/D5% (5mg/ml)	Administer over 60 minutes	Vamocin

SUMMARY OF ANTIBIOTIC STABILITY AFTER OPEN

Medication	Stability after reconstitution	Stability after dilution	Brand
IV Acyclovir	Use immediately. Single use.	12 hours at room temperature (15-25°C)	Zovirax
	48 hours at room temperature. Protect from light. **Do not refrigerate.**	48 hours at room temperature. Protect from light	Vaxcel Acyclovir
IV Amikacin	Information not available (Recommend to use immediately)	24 hours at room temperature 60 days at (2-8°C)	Apalin
Amphotericin B Sodium Deoxycholate	7 days refrigerated. (2-8°C)	Information not available (Recommend to use immediately)	Amphotret
IV Amoxicillin & Clavunic Acid	**Used within 20 minutes of reconstitution.**	Discard after 20 minutes.	Clavicin 1.2g
IV Ampicillin	Use within 1 hour. Single use.	Single use.	Kampibiotic
IV Ampicillin & Sulbactam	Single use.	Single use.	Amsubac 1.5g
IV Azithromycin	24 hours at room temperature.	24 hours at room temperature or 7 days refrigerated. (2-8°C)	-Zithromax -Azomax -Vaxcel Azithromycin 500mg
IV C-Penicillin (Benzylpenicillin)	2 days at room temperature, 6 days refrigerated. (2-8°C)	Use immediately. Discard any unused solution.	-Benzyl Penicillin for Injection -Bepen Injection
IV Cefazolin	12 hours at room temperature,24 hours refrigerated. (2-8°C)	Use immediately. Discard any unused solution.	Cefazolin-AFT
IV Cefotaxime	To be used immediately	To be used immediately	Rekaxime
IV Ceftazidime	WFI: 12 hours at roomtemperature or 7 days refrigerated. (2-8°C)	NS/D5%: 12 hours at room temperature or7 days refrigerated.	Cefatum
IV Ceftriaxone	3 days at room temperature, 10 days refrigerated. (2-8°C)	3 days at room temperature 10 days refrigerated. (2-8°C)	Unocef
IV Cefepime	48hours refrigerated. (2-8°C)	48hours refrigerated. (2-8°C)	Cefmex
	Information not available (Recommend to use immediately)	24 hours at room temperature or 7 days refrigerated. (2-8°C)	Vaxcel Cefepime 1g
IV Cefoperazone	Information not available (Recommend to use immediately)	Information not available (Recommend to use immediately)	Bicafar
IV Cefuroxime	5 hours at room temperature or48 hours refrigerated. (2-8°C)	Use immediately. Discard any unused solution.	Anikef
IV Colistimethate Sodium 1m IU (Polymyxin E)	24 hours refrigerated. (2-8°C)	Information not available	Colomycin
IV Cloxacillin	Use immediately. Discard anyunused solution.	Use immediately. Discard any unused solution.	-Cloxacillin Sodium -Cloxabiotic Inj 500mg

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IV EES	Information not available (Use immediately after reconstitution)	Information not available (Use immediately after reconstitution)	-Erythromycin -Eritrotex Inj 500mg
IV Fluconazole	Single use. Discard any remaining solution.	Use immediately. Discard any unused solution.	Diflucan
	Information not available (Recommend to use immediately)	Information not available (Recommend to use immediately)	Fluconol
IV Ganciclovir	12hours at room temperature	24hours refrigerated (2-8°C)	Cymevene
IV Gentamicin	Information not available (Use immediately)	Use immediately. Discard any unused solution.	Garasent
IV Imipenem	4 hours at room temperature or 24 hours refrigerated. (2-8°C)	4 hours at room temperature or 24 hours refrigerated. (2-8°C)	Tienam
	4 hours at room temperature or 24 hours refrigerated. (2-8°C)	4 hours at room temperature or 24 hours refrigerated. (2-8°C)	Imipenem/Cilastin KABI
IV Linezolid	Use immediately. Discard any unused solution.	Use immediately. Discard any unused solution.	Zyvox
IV Meropenem	Recommended to use freshly prepared. Do not freeze.	Discard any unused drug after solution.	Nuronem
	WFI: 3 hours at room temperature or 12 hours refrigerated. (2-8°C)	NS: 3 hours at room temperature or 12 hours refrigerated. (2-8°C)	Meropenem Kabi
IV Metronidazole	Information not available (Use immediately)	Discard any unused drug after solution.	Metronol
IV Pipericillin and Tazobactam	24 hours at room temperature and 7 days refrigerated (2-8°C)	Use immediately. Discard any unused solution.	Tapicin
	24 hours refrigerated (2-8°C)	Use immediately. Discard any unused solution.	Aurotaz-P
IV Polymyxin B	72 hours refrigerated (2-8°C)	Information not available	Polymyxin B for Inj U.S.P
IV Trimethoprim [TMP] and Sulphamethoxazole [SMZ] (Bactrim) 480mg/5ml	Information not available (Use immediately)	24 hours at room temperature. Do not refrigerate.	Cotrim-ratiopharm Ampullen SF
	Does not required reconstitution	5hours at room temperature with D5%. Do not refrigerate as precipitation may occur. Protect from light	Bactrim
IV Vancomycin	96 hours refrigerated (2-8°C) or room temperature	Refrigerated for 14 days (2-8°C)	Vivocin
	48 hours at room temperature	48 hours refrigerated (2-8°C)	Celovan
	24 hours refrigerated (2-8°C)	Information not available	Vamocin

LIST OF INOTROPES MEDICATION COMPATIBILITY

MEDICATIONS	COMPATIBILITY	INCOMPATIBILITY
IV ADRENALINE 1MG/ML (1:1000)	Fluids: D5%, D10%, Hartmann's, NS. Stability data only available for D5% for very high concentration Y-site: **Amino acid solutions., Dobutamine, Dopamine, Fentanyl, Milrinone, Morphine, Noradrenaline, Vasopressin.** Other Medications: Amiodarone, Heparin sodium, Potassium chloride, Alprostadil, Hydrocortisone, Frusemide, Magnesium sulphate, Naloxone	Fluids: **Sodium Bicarbonate**, Sodium Chloride 0.45% Y-site: Acyclovir, Ampicillin, Atropine**,** **C**alcium Gluconate, Phenobarbitone Sodium, Sodium Bicarbonate, Vancomycin. Unknown: TPN
IV NORADRENALINE ACID TARTRATE 8 MG/4 ML (Equivalent to Noradrenaline base 4mg/4ml) **(1:1000)**	Fluids: D5%, NSD5% lactated Ringer's solution. Y-site: **Dobutamine, Dopamine, Midazolam, Milrinone, Morphine sulfate, Adrenaline, Vasopressin, Fentanyl** Other Medications: Amiodarone, Heparin sodium, Hydrocortisone, Labetalol, Potassium chloride, Magnesium sulphate. Others: TPN	Fluids: No information. D10% not tested. Y-site: Aminophylline, Benzylpenicillin, Folic Acid, Insulin (Short-Acting), Phenobarbitone,Sodium Bicarbonate, Frusemide. Incompatible With Alkalis and Oxidising Agents. Unknown: Alprostadil
IV DOBUTAMINE 250MG/20ML	Compatible with D**opamine** - may be "mixed" with dopamine and given through one line. Fluids: D5%, D10%, NSD5%, NSD10%, Hartmann's, NS, HS Y site: **Adrenaline, Milrinone, Noradrenaline, Fentanyl, Morphine, Vasopressin, Dopamine** Other Medications: Amiodarone, Fluconazole, Magnesium sulphate, Potassium chloride, Alprostadil, TPN, Intralipid Others: TPN	Fluids: **Sodium bicarbonate**, alkaline solutions, diluents that contain sodium bisulfite andethanol. Y site: Aciclovir, Aminophylline, Ampicillin, Benzylpenicillin, Calcium gluconate, Cefotaxime, Ceftazidime, Dexamethasone, Heparin Sodium, Hydrocortisone, Phenobarbitone, Piperacillin-Tazobactam (EDTA-Free), Sodium Bicarbonate **Midazolam** (physical incompatible, particulate develop in 8 hours in D5%)
IV DOPAMINE 200MG/5ML	Compatible with Dobutamine - may be "mixed" with Dobutamine and given through one line. Fluids: D5%, D10%, NSD5%, HSD5%, glucose 5% in Hartmann's, Hartmann's, mannitol 20%, NS Y-Site**: Dobutamine, Midazolam, Milrinone, Morphine Sulfate, Noradrenaline, Fentanyl, Noradrenaline, Vasopressin, Adrenaline** Other medication: Amiodarone**,** Fluconazole, Heparin, Hydrocortisone Sodium Succinate, Metronidazole, Pethidine, Piperacillin-	Fluids: Sodium Bicarbonate and Other Alkaline Solutions. Y-site: Aciclovir, Ampicillin, Insulin (short-acting)

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	Tazobactam (EDTA-Free), Potassium Chloride, Magnesium Sulphate, Naloxone, Alprostadil Others: TPN	
IV MORPHINE 10MG/ML	Fluids: D5%, D10%, Hartmann's, HS, and NS. Y Site: **Adrenaline, Midazolam, Milrinone, Noradrenaline, Dopamine, Dobutamine, Dopamine** Other Medication: Alprostadil, Amikacin, Amiodarone, Ampicillin, Cefotaxime, Ceftazidime, Ceftriaxone, Cephazolin, Dexamethasone, Fluconazole, Gentamicin, Hydrocortisone Sodium Succinate, Insulin (Short-Acting), Magnesium Sulfate, Methylprednisolone, Metronidazole, Piperacillin- Tazobactam (EDTA-Free), Potassium Chloride, Bactrim, Vancomycin Others: TPN	Fluids: Morphine may precipitate out of solution when the final pH is greater than 6.4. Y-Site: Aminophylline, Azithromycin, Folic Acid, Pethidine, Phenytoin, Intralipid
IV FENTANYL CITRATE 100MCG /2 ML	Fluids: NS, D5%, D10% (not tested) Y-site: **Adrenaline**, **Midazolam, Milrinone**, **Dopamine, Dobutamine, Noradrenaline, Vasopressin** Other Medication: Dexamethasone, Heparin Sodium, Hydrocortisone, Potassium Chloride, Sodium Bicarbonate, Magnesium Sulphate, Alprostadil Others: TPN	Fluids: No information. Y-site: Azithromycin, intralipid
IV MIDAZOLAM 15MG/3ML	Fluids: D5%, D10%, NS Y-site: **Adrenaline, Dopamine, Morphine sulfate, Noradrenaline, Milrinone** Other Medication: Amikacin, Amiodarone, Calcium Gluconate, Cefotaxime, Cephazolin, Ciprofloxacin, Clindamycin, Fentanyl, Fluconazole, Gentamicin, Methylprednisolone, Metronidazole, Potassium Chloride, Vancomycin, Vecuronium	Fluids: No information. Y-site: **Dobutamine,** Fat Emulsion. Acyclovir, Albumin, Amoxicillin, Ampicillin, Azithromycin, Cefepime, Ceftazidime, Dexamethasone, Frusemide, Ganciclovir, Hydrocortisone, Imipenem - Cilastatin, Omeprazole, Phenobarbitone, Piperacillin-Tazobactam (EDTA-Free), Sodium Bicarbonate, Trimethoprim-Sulfamethoxazole, TPN.
IV MILRINONE 10MG/10ML (1MG/ML = 1000MCG/ML)	Fluids: D5%, NS, Y-site: **Adrenaline, Dobutamine, Dopamine, Fentanyl, Midazolam, Noradrenaline, Morphine** Other Medication: Amiodarone, Calcium Gluconate, Digoxin, Heparin Sodium, Insulin (Short acting), Magnesium Sulfate, Potassium Chloride, Alprostadil Others: TPN	Fluids: Sodium bicarbonate. Y-site: Frusemide, Imipenem + Cilastatin, Unknown: Vasopressin, Alprostadil

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IV VASOPRESSIN 20IU/ML	Fluid: D5%, NS Y-site: **Adrenaline, Dobutamine, Dopamine, Fentanyl, Midazolam, Noradrenaline, Morphine** Other Medications: Amiodarone, Magnesium Sulfate, Naloxone	Unknown: Milrinone, Alprostadil, TPN

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Some of the above references can be found in GarisPanduan> Clinical >Paeds> NICU