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Kingdom of Saudi Arabia

وزارة الصحة
Ministry of Health

برنامج تحسين خدمات حديثي الولادة
Neonatal Services Improvement Program

Neonatal Dosage and Practical Guidelines Handbook 2nd Edition

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Authors

Saleh Al-Alaiyan, MD, FRCPC
Associate Professor, College of Medicine, AlFaisal University
Consultant Neonatologist
Senior Clinical Scientist
King Faisal Specialist Hospital, & Research Centre
Editor-in-Chief, Journal of Clinical Neonatology
PO Box 3354 Riyadh 11211
Saudi Arabia

Najwa Al-Ghamdi, BSc.Pharm, Pharm.D., MHA, BCNSP, BCPS, FCCP, TTS
Chair, Clinical Pharmacy Department
Director Pediatric Specialty Residency
Adjunct Clinical Assistant Professor, College of Pharmacy, King Saud University
Consultant Clinical Pharmacist, Pediatrics and Nutrition Support
Pharmacy Services Administration
King Fahad Medical City
P.O. Box 59046
Riyadh 11525

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بسم الله الرحمن الرحيم

Medications in this Edition:

10. Acetaminophen
11. Acetazolamide
12. Acetylcysteine
13. Acetylsalicylic Acid (ASA)
14. Acyclovir
15. Adenosine
16. Albumin
17. Allopurinol
18. Alprostadil (PGE_1)
19. Alteplase (TPA)
20. Amikacin
21. Aminophylline
22. Amiodarone
23. Amoxicillin
24. Amphotericin B
25. Amphotericin B Liposomal
26. Ampicillin
27. Amrinone (Inamrinone)
28. Atracurium
29. Atropine
30. Aztreonam
31. Beractant
32. Bumetanide
33. Caffeine Citrate
34. Calcium Glubionate
35. Calcium Gluconate
36. Captopril
37. Carbamazepine
38. Cefazolin
39. Cefepime
40. Cefotaxime
41. Ceftazidime
42. Ceftriaxone
43. Cefuroxime
44. Cephalexin
45. Chloral Hydrate
46. Chloramphenicol
47. Chlorothiazide
48. Chlorpromazine
49. Cholecalciferol (Vitamin D)
50. Cholestyramine
51. Clindamycin
52. Clonazepam
53. Cosyntropin (Tetracosactide)
54. Desmopressin Acetate
55. Dexamethasone
56. Diazepam
57. Diazoxide
58. Digoxin
59. Dobutamine
60. Domperidone
61. Dopamine
62. Enalapril/ Enalaprilat
63. Enoxaparin
64. Epinephrine
65. Erythromycin
66. Erythropoietin (Epoetin Alfa)
67. Famotidine
68. Fentanyl
69. Ferrous Sulfate
70. Fluconazole
71. Flucytosine (5-FC)
72. Folic Acid
73. Furosemide
74. Filgrastim (G-CSF)
75. Gentamicin
76. Glucagon
77. Heparin
78. Hyaluronidase
79. Hydralazine
80. Human Milk Fortifier
81. Hydrochlorothiazide
82. Hydrocortisone
83. Ibuprofen Lysine
84. Imipenem/Cilastatin
85. Indomethacin
86. Insulin (Regular)
87. Immune Globulin (IVIG)
88. Ipratropium
89. Isoproterenol
90. Ketamine
91. Levetiracetam
92. Levothyroxine (T_4)
93. Lidocaine
94. Lorazepam
95. Magnesium Sulfate
96. MCT Oil
97. Meropenem
98. Metoclopramide
99. Metolazone
100. Metronidazole
101. Midazolam
102. Milrinone
103. Morphine sulfate
104. Nafcillin
105. Naloxone
106. Nitroprusside
107. Norepinephrine
108. Nystatin
109. Octreotide
110. Omeprazole
111. Oxacillin
112. Palivizumab
113. Pancuronium
114. Penicillin G
115. Phenobarbital
116. Phentolamine
117. Phenytoin
118. Piperacillin
119. Piperacillin/ Tazobactam
120. Polycose
121. Prednisolone
122. Propranolol
123. Protamine Sulfate
124. Pyridoxine
125. Ranitidine
126. Rifampicin
127. Salbutamol (Albuterol)
128. Sildenafil
129. Sodium Bicarbonate
130. Spironolactone
131. Tromethamine (THAM)
132. Urokinase
133. Ursodeoxycholic acid
134. Vancomycin
135. Vecuronium Bromide
136. Vitamin K_1 (Phytonadione)
137. Zidovudine

Medications removed from this edition of the Neonatal Dosage and Practical Guidelines Handbook

1. Carbenicillin
2. Cefamandole
3. Cephalothin
4. Cimetidine
5. Cromolyn Sodium
6. Doxapram
7. Ethacrynic Acid
8. Mannitol
9. Meperidine
10. Methicillin
11. Sodium Polystyrene Sulfonate
12. Tocopherol (Vitamin E)

Medications added in this edition of the Neonatal Dosage and Practical Guidelines Handbook

1. Acetyl cysteine
2. Alteplase (TPA)
3. Amoxicillin
4. Carbamazepine
5. Cholecalciferol (Vitamin D)
6. Domperidone
7. Enoxaparin
8. Famotidine
9. Fluconazole
10. Ibuprofen Lysine
11. Levetiracetam
12. Milrinone
13. Octreotide
14. Omeprazole
15. Prednisolone
16. Rifampicin
17. Ursodeoxycholic acid
18. Zidovudine

Appendix Content: Practical Guidelines

1. Medications for Neonatal Resuscitation
2. Management of Hypotension in Preterm Infants
3. Non-Emergency Intubation Protocol Medication
4. Sucrose Analgesia for Simple Neonatal Procedures
5. Non-Oliguric Hyperkalemia (NOHK) in Extremely Low Birth Weight Infants
6. Protocol for Caffeine Citrate Use
7. Neonatal Parenteral Nutrition (PN) Worksheet
8. Basic Neonatal Parenteral Nutrition (PN) Calculations
9. Maple Syrup Urine Disease (MSUD) Acute Decompensation Guideline
10. Neonatal Resuscitation Medications
11. Standard Concentrations that Maybe Options for Common Drips Used in NICU
12. Calculating Body Surface Area (BSA)
13. Comparison of Currently Marketed Surfactant Products

Introduction

We are pleased to introduce the second edition of the Neonatal Dosage and Practical Guidelines Handbook. In this edition, we have added common practice guidelines that we believe will be of use in your day-to-day practice. We have also removed some medication monographs that have no longer been observed useful either due to availability of safer and more useful medication alternatives or due to their withdrawal from the market. Due to the lack of many ready manufactured suitable dosage form medication preparations, we have also added to the monographs compounding information to support pharmacy and nursing practices.

Every effort has been made to ensure that the drug dosage schedules herein are accurate and in accord with the standards accepted at the time of publication. However, as new research and experience broaden our knowledge, changes in treatment and drug therapy occur. Therefore, the reader is advised to check the product information sheet included in the package of each drug he/she plans to administer to be certain that changes have not been made in the recommended dose or in the contraindications. The authors cannot be held responsible for any typographic or other errors found in this book.

January 2016

Generic Name	Acetaminophen
Brand Name	Tylenol, Tempra
Indications	Fever, mild pain.
Dose	**Neonate:** PO, PR: 10-15 mg/kg/dose q 6-8 hrs prn. *International Evidence – Based Group for Neonatal Pain recommendation:* **Preterm (28-32 weeks):** PO: 10-12 mg/kg/dose q 6-8 hr; max. 40 mg/kg/day. PR: 20 mg/kg/dose q 12 hrs; max. 40 mg/kg/day. **Preterm (32-36 weeks) and term <10 days:** PO: 10-15 mg/kg/dose q 6 hrs; max. 60 mg/kg/day. PR: 15 mg/kg/dose q 8 hrs; max. 60 mg/kg/day. **Term ≥10 days:** PO: 10-15 mg/kg/dose q 4-6 hrs; max. 90 mg/kg/day. PR: 20 mg/kg/dose q 6-8 hrs; max. 90 mg/kg/day.
Route	PO, PR
Levels and Metabolism	Half-life in preterm: 5-11 hrs; Half-life in neonates: 2-3 hrs. Metabolized mainly in the liver.
Precautions	Hepatotoxicity may occur with serum levels >200 mcg/mL at 4 hrs or 50 mcg/mL at 12 hrs after overdose. Avoid in G6PD deficiency. Liquid preparations may contain sodium benzoate which can lead to gasping syndrome in neonates.

Generic Name	Acetazolamide
Brand Name	Diamox
Indications	Slows progression of hydrocephalus in patients who are not good surgical candidates (may be used in conjunction with furosemide), renal tubular acidosis to alkalinize the urine (carbonic anhydrase inhibitor), adjunct in the treatment of refractory seizures.
Dose	**Hydrocephalus or Adjunct Anticonvulsant:** 2.5-5 mg/kg/dose given q 12-8 hrs slow IV push or PO; increase as tolerated to 7 mg/kg/dose given q 8 hrs. **Renal Tubular Acidosis:** 5 mg/kg/dose q 8-12 hrs.
Route	IV, PO
Levels and Metabolism	Eliminated primarily by renal excretion with a serum half-life of 2-6 hrs. Tolerance to anticonvulsant effect may develop with long-term use.
Precautions	IM administration is painful and not recommended. May cause hyperchloremic metabolic acidosis (which may be severe even at very low doses in a small sick premature infant), hypokalemia, drowsiness, and rash (sulfa-like drug). Generally not recommended for prolonged use.
Extemporaneous Preparation	A 25 mg/mL oral suspension may be made with tablets and either a 1:1 mixture of Ora-Sweet and Ora-Plus or a 1:1 mixture of Ora-Sweet SF and Ora-Plus. Crush twelve 250 mg tablets in a mortar and reduce to a fine powder. Add small portions of chosen vehicle and mix to a uniform paste; mix while adding the vehicle in incremental proportions to **almost** 120 mL; transfer to a calibrated bottle, rinse mortar with vehicle, and add quantity of vehicle sufficient to make 120 mL. Label "shake well" and "refrigerate". Stable for 60 days. When diluted in 120 mL solution of cherry syrup concentrate diluted 1:4 with simple syrup, NF, it is stable 60 days refrigerated (preferred) or at room temperature.

References:

1. Allen LV Jr and Erickson MA 3rd. Stability of Acetazolamide, Allopurinol, Azathioprine, Clonazepam, and Flucytosine in Extemporaneously Compounded Oral Liquids. *AJHP*, 1996, 53(16):1944-9.

2. Nahata MC, Pai VB, and Hipple TF. *Pediatric Drug Formulations*, 5th ed, Cincinnati, OH: Harvey Whitney Books Co, 2004.

Generic Name	Acetylcysteine
Brand Name	Mucomyst
Indications	Mucolytic agent, adjunctive therapy for abnormal or viscid mucus secretions in BPD.
Dose	Nebulization: 1-2 mL of 20% solution or 2-4 mL of 10% solution, given 3-4 times daily.
Route	Inhalation
Levels and Metabolism	Onset of action: Mucus liquefaction occurs within 10-15 min; Duration > 1 hr.
Precautions	Patients should receive an aerosolized bronchodilator 10-15 min prior to acetylcysteine.

Generic Name	Acetylsalicylic Acid (ASA)
Brand Name	Aspirin
Indications	Analgesic, antipyretic, antiplatelet (post cardiac surgery).
Dose	**Analgesic and antipyretic (children):** PO, PR: 10-15 mg/kg/dose q 4-6 hrs. **Anti-inflammatory:** PO: 60-90 mg/kg/day in divided doses. **Antiplatelet:** PO: 1-5 mg/kg/day to 5-10 mg/kg/day given as a single daily dose (doses are rounded to convenient amount e.g., ½ of 80 mg tablet).
Route	PO, PR
Levels and Metabolism	Analgesic and antipyretic therapeutic levels 30-50 mcg/mL; anti-inflammatory therapeutic levels 150-300 mcg/mL. Metabolized in the liver; Elimination: renal as salicylate and conjugated metabolites.
Precautions	May cause GI upset, allergic reactions, hepatotoxicity, bleeding. Use with extreme caution in children < 2 years old. Because of possible risk of Reyes Syndrome do not use during viral illnesses especially flu or varicella.

Generic Name	Acyclovir
Brand Name	Zovirax
Indications	Herpes simplex infection (HSV), varicella zoster infection with CNS and pulmonary involvement, herpes simplex encephalitis.
Dose	**HSV Infection (Disseminated):** Premature neonates: 10 mg/kg/dose q 12 hrs for 14-21 days. Neonates:10 mg/kg/dose q 8 hrs; infuse IV over 1 hr. Usual course of treatment 10-14 days, but 21 days recommended in disseminated disease. **Varicella Zoster:** IV: 10-20 mg/kg q 8 hrs for at least 7-10 days. PO: 10 mg/kg 4 times daily for 7-10 days after exposure.
Route	IV, PO
Levels and Metabolism	30-90% of administered dose is excreted unchanged in the urine, primarily by glomerular filtration. Protein binding and metabolism are minimal. Half-life is 2-3 hrs in children over 1 year of age and adults, but longer (4 hours) in newborns. Penetrates the heart, lung, liver, saliva, and vaginal secretions with concentrations similar to those in plasma; CSF levels are approximately 50% of those in plasma.
Precautions	May cause phlebitis, crystalluria and crystal nephropathy after bolus injection, transient renal dysfunction, rash, and neurotoxicity especially with long-term use at high doses. Patients should be hydrated and acyclovir given over one hour to prevent the transient renal dysfunction. Adjustment of dose and/or intervals required in patients with impaired renal function.

Generic Name	Adenosine
Brand Name	Adinocard
Indications	Treatment of sustained paroxysmal supraventricular tachycardia (PSVT).
Dose	0.05 mg/kg by rapid IV bolus. Increase dose by increments of 0.05 mg/kg q 2 minutes until return to sinus rhythm. Maximum dose of 0.25 mg/kg IV, do not exceed 12 mg per dose. Flush IV with saline after each dose.
Route	IV
Levels and Metabolism	Metabolized very rapidly and has a half-life of approximately 1-10 seconds in the plasma.
Precautions	Adenosine is contraindicated in adenosine-deaminase deficiency which is a rare form of immune deficiency. The incidence of side effects with adenosine is quite high, although these effects are of short duration and do not require intervention. Transient side effects include sinus arrest, sinus bradycardia, atrioventricular block, cutaneous flushing, and dyspnea due to bronchoconstriction.

Generic Name	Albumin
Indications	Hypovolemia, pre-exchange transfusion for hyperbilirubinemia, infants with cardiorespiratory compromise, symptomatic hypoalbuminemia.
Dose	**Hypovolemia:** 5-10 mL/kg of 5% albumin given IV push or by infusion pump over 30 min-1 hr, repeat as clinically indicated. **Hypoalbuminemia:** 0.25-1 g/kg/dose of 20% albumin given by slow infusion. May follow by furosemide (Lasix).
Route	IV
Levels and Metabolism	Duration of volume expansion: ~24 hrs; Half-life: 21 days.
Precautions	When given rapidly may cause pulmonary edema and/or circulatory overload. In older patients, hypersensitivity reactions may include chills, fever, nausea, and urticaria. Use 25% albumin with caution in preterm infants at risk for IVH. Use with caution in severe anemia, congestive heart failure, and hypervolemia. Use within 4 hours of opening vial.

Generic Name	Allopurinol
Brand Name	Zyloprim
Indications	Hyperuricemia (secondary to inborn errors of purine metabolism, large tissue breakdown, or renal failure).
Dose	PO: 10 mg/kg/day, divided in 1-4 doses/day. IV: 200 mg/m^2/day, divided in 2-4 doses/day.
Route	PO, IV
Levels and Metabolism	Decrease in serum uric acid occurs in 1-2 days. Oral absorption: ~80% from GI tract. Metabolism: ~75% to active metabolites, mainly oxypurinol. Half-life: parent: 1-3 hrs and oxypurinol: 18-30 hrs.
Precautions	May cause GI irritation, renal impairment, leukopenia, and rash. Dosing adjustment recommended with renal impairment.
Extemporaneous Preparation	A 20 mg/mL oral suspension may be made with tablets and either a 1:1 mixture of Ora-Sweet and Ora-Plus or a 1:1 mixture of Ora-Sweet SF and Ora-Plus or a 1:4 mixture of cherry syrup concentrate and simple syrup, NF. Crush eight 300 mg tablets in a mortar and reduce to a fine powder. Add small portions of chosen vehicle and mix to a uniform paste; mix while adding the vehicle in incremental proportions to **almost** 120 mL; transfer to a calibrated bottle, rinse mortar with vehicle, and add quantity of vehicle sufficient to make 120 mL. Label "shake well". Stable for 60 days refrigerated or at room temperature.

References:

1. Allen LV Jr and Erickson MA 3rd. Stability of Acetazolamide, Allopurinol, Azathioprine, Clonazepam, and Flucytosine in Extemporaneously Compounded Oral Liquids. *AJHP*, 1996, 53(16):1944-9.
2. Nahata MC, Pai VB, and Hipple TF. *Pediatric Drug Formulations*, 5th ed, Cincinnati, OH: Harvey Whitney Books Co, 2004.

Generic Name	Alprostadil (Prostaglandin E_1; PGE_1)
Brand Name	Prostin
Indications	Temporary maintenance of patency of ductus arteriosus in the presence of PDA-dependent congenital heart disease until corrective or palliative surgery can be performed.
Dose	Initial dose: 0.05-0.1 mcg/kg/min by continuous IV infusion. Titrate to response. Maintenance: may be as low as 0.01 mcg/kg/min (max: 0.4 mcg/kg/min).
Route	IV
Levels and Metabolism	70-80% metabolized in the lungs to active metabolite that is excreted in urine. Half-life: 5-10 min. PDA will begin to close within 1-2 hrs after drug is stopped.
Precautions	Apnea occurs in 10-12% of neonates and usually appears within first hour of drug infusion. Patient may require intubation and resuscitation. May cause systemic hypotension, seizure-like activity, hypoglycemia, and fever.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Alteplase (TPA)
Brand Name	Activase
Indications	Thrombolytic agent. Used for treatment of occluded central venous catheters and thrombosis.
Dose	**Occluded CVC Clearance:** Instill into occluded catheter 1 mg/ml. Use 110% of the internal lumen volume of the catheter, not to exceed 2 mg/2 mL; retain in catheter for 0.5-2 hours; aspirate lysate and flush with 0.9% sodium chloride. May instill a second dose if catheter remains occluded. **Intravascular Thrombosis:** 0.1-0.5 mg/kg/hr for 3-6 hrs; use ultrasound assessment to monitor effect before considering a second course of treatment.
Route	Intracatheter, IV
Levels and Metabolism	Cleared rapidly from the plasma; Metabolized in the liver.
Precautions	Use with caution if there is a risk of bleeding including that from venipuncture or invasive procedures. Intracranial hemorrhage may occur. Monitor coagulation studies. Discontinue heparin several hours prior to initiation of therapy for intravascular thrombosis.

Generic Name	Amikacin
Brand Name	Amikin
Indications	Infections with gram-negative organisms (resistant to tobramycin and gentamicin) and documented infections with mycobacterial organisms.

Dose

Age	Total Daily Dose	Divided
0-7 days, <1200 g	7.5 mg/kg	q 24 hrs
0-7 days, 1200-2000 g	15 mg/kg	q 12 hrs
0-7 days, >2000 g	15-20 mg/kg	q 12 hrs
>7 days, <1200 g	7.5-10 mg/kg	q 24 hrs
>7 days, 1200-2000 g	22.5-30 mg/kg	q 8 hrs
>7 days, >2000 g	30 mg/kg	q 8 hrs

Infuse IV over 15-30 min. Recommended concentration of infusion is ≤10 mg/mL.

Route

IV, IM

Levels and Metabolism

Therapeutic Drug Monitoring:

Trough: 5-10 mcg/mL; Peak: 20-30 mcg/mL.

Draw peak levels 30 min after IV infusion or 1 hr after IM administration. Specimens should be spun and frozen or refrigerated as soon as possible.

Not absorbed from GI tract in normal host; crosses blood-brain barrier poorly; excreted through the kidneys.

Precautions

Peak levels of >35 mcg/mL and trough levels >10 mcg/mL are considered toxic. Nephrotoxicity and ototoxicity are associated with aminoglycosides in general. Dose adjustment required with impaired renal function. Literature indicates that hearing impairment in neonates is rare if the usual doses of aminoglycosides are used. May cause neuromuscular blockade especially with concomitant use of neuromuscular blocking agents and in patients with hypermagnesemia.

Generic Name	Aminophylline
Brand Name	Somophyllin
Indications	Apnea of prematurity, bronchodilation, bronchopulmonary dysplasia, prevention of post-extubation atelectasis.
Dose	**Apnea:** Loading dose: 4-6 mg/kg PO or infused IV over 30 min; Maintenance dose (8-12 hrs after loading dose): 2 mg/kg/dose IV or PO given q 6-8 hrs. **Bronchodilation:** Loading dose: 6 mg/kg IV or PO, then give maintenance dose: 0.2-0.5 mg/kg/hr.
Route	IV, PO
Levels and Metabolism	**Therapeutic Drug Monitoring:** Apnea: 6-13 mcg/mL. Bronchodilation: 10-20 mcg/mL. Trough level should be obtained 48-72 hrs after loading dose, then at least once per week. Half-life can be as long as 20-30 hrs in small premature infants.
Precautions	May cause tachycardia, jitteriness, vomiting, abdominal distention, hyperglycemia, and seizures. Bradycardia has been observed during concurrent therapy with digitalis, suggesting potentiation of vagal stimulation by these vagotonic drugs. Hold dose if heart rate >180 beats/min. Aminophylline salt is 80% theophylline. When changing from IV to PO aminophylline increase dose by 20%. When changing to PO theophylline no adjustment needed.

Generic Name	Amiodarone
Brand Name	Cordarone, Pacerone
Indications	An antiarrhythmic agent used to control life-threatening ventricular tachyarrhythmias.
Dose	**Loading dose:** 5 mg/kg IV infused over 30-60 min followed by maintenance infusion. ***(I.V. should be administered only by a pediatric cardiologist)*** **Maintenance dose:** 5 microgram/kg/minute (up to 15 microgram/kg/minute). Taper the IV infusion and switch to oral therapy as soon as possible. **Oral:** Initially 5–10 mg/kg twice daily for 7–10 days, then reduced to maintenance dose of 5–10 mg/kg once daily.
Route	IV, PO
Levels and Metabolism	The elimination half-life of amiodarone is not accurately estimated in neonates; however, it varies, depending on how the half-life has been measured and the route of amiodarone administration. After long-term oral therapy, amiodarone has a true elimination half-life between 60 and 142 days. Amiodarone is extensively metabolized in the liver by cytochrome P450 3A4. Excretion is primarily hepatic and biliary with almost no elimination via the renal route.
Precautions	Monitor for hypotension, thrombocytopenia, hepatotoxicity, a new arrhythmia, thyroid function and gasping syndrome due to the preservative benzyl alcohol.

Generic Name	Amoxicillin
Brand Name	Amoxil
Indications	To treat infections involving the upper respiratory tract and urinary tract due to susceptible organisms.
Dose	20-30 mg/kg/day; in dividid doses q 12-8 hrs. UTI prophylaxis: 10-20 mg/kg once daily
Route	PO
Levels and Metabolism	Metabolized partially in the liver; eliminated by renal excretion (80% unchanged).
Precautions	With prolonged therapy, monitor renal, hepatic, and hematologic function periodically.
Preparation	Powder for oral suspension: 125 mg/5 mL, 250 mg/5 mL

Generic Name	Amphotericin B
Brand Name	Fungizone
Indications	Disseminated fungal infections caused by susceptible fungi such as: Blastomyces dermatitidis, Histoplasma capsulatum, Cryptococcus neoformans, Candida sp., Sporothrix schenkii, Coccidioides immitis, Aspergillus sp.
Dose	Test dose: 0.1/kg IV infused over 30 min or 0.25 mg/kg IV on first day over 6 hrs. Subsequently increase gradually to 0.5-1 mg/kg/day IV as single infusion over 4-6 hrs.
Route	IV
Levels and Metabolism	Poor penetration into CSF, bile, aqueous humor, and pleural fluid. Undergoes renal elimination. Initial half-life ~15-48 hrs; Terminal half-life ~15 days.
Precautions	May cause infusion related reactions, fever, vomiting, hypokalemia, mild renal tubular acidosis, and hypomagnesemia. Serious renal toxicity occurs frequently. Renal damage results from vasoconstriction, impaired acid excretion, and direct tubular damage with nephrocalcinosis. Thrombocytopenia, leukopenia, jaundice and hepatoxicity are rarely seen. Monitor K, Mg, BUN, creatinine, bilirubin, alkaline phosphatase, SGOT daily until dose stable, then q week with CBC.

Generic Name	Amphotericin B Liposomal
Brand Name	Ambisome
Indications	Treatment of systemic fungal infections resistant to conventional amphotericin B or in patients with renal or hepatic dysfunction.
Dose	5-7 mg/kg daily infused over 2 hrs.
Route	IV
Levels and Metabolism	Penetrates the liver and spleen but poor penetration into CSF. Undergoes renal elimination. Mean half-life 24-40 hrs.
Precautions	Less nephrotoxic than conventional amphotericin B.

Generic Name	Ampicillin
Brand Name	Omnipen, Polycillin
Indications	Initial empiric treatment (with an aminoglycoside) for neonates with suspected bacterial sepsis or meningitis. Drug of choice for Listeria monocytogenes and Enterococci.

Dose

Age	Total Daily Dose	Divided
0-7 days, ≤ 2000 g	100 mg/kg	q 12 hrs
0-7 days, > 2000 g	150 mg/kg	q 8 hrs
>7 days, ≤ 2000 g	150 mg/kg	q 8 hrs
>7 days, > 2000 g	200 mg/kg	q 6 hrs

Above are meningitic doses (Group B streptococcal meningitis requires even higher doses). For suspected bacterial sepsis, may use half of above doses if meningitis has been ruled out.

Route	IV, IM
Levels and Metabolism	90% excreted unchanged in urine. Half-life is 4 hrs in infants 0-7 days old, and decreases to ~ 2 hrs in older infants. Penetration into the CSF occurs with inflamed meninges only.
Precautions	May cause rash, diarrhea, interstitial nephritis. Reconstituted solution must be used within 1 hour due to loss of potency.

Generic Name	Amrinone (Inamrinone)
Brand Name	Inocor
Indications	Short term treatment of low cardiac output states (not responding to other treatments). e.g., due to sepsis, CHF.
Dose	0.75 mg/kg IV bolus over 2-3 min followed by maintenance infusion 3-5 mcg/kg/min; IV bolus may need to be repeated in 30 min; titrate to clinical response. Dose should not exceed 10 mg/kg/24hrs.
Route	IV
Levels and Metabolism	Onset of action: 2-5 min; Peak effect: within 10 min; Duration is dose dependent (30 min to 2 hrs); Half-life ~22 hrs in neonates and ~7 hrs in infants. Metabolized in the liver to several metabolites; Excreted in the urine as metabolites and unchanged drug (10-40%).
Precautions	Monitor for hypotension, thrombocytopenia, hepatotoxicity, and GI side effects. Dose adjustment required in renal impairment.

***Calculating infusion rate (mL/hr) =**

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Atracurium
Brand Name	Tracium
Indications	Muscle relaxant during endotracheal intubation, mechanical ventilation or surgery, as adjunct to general anesthesia.
Dose	**Neonate:** IV intermittent: 0.3-0.4 mg /kg as needed. IV infusion: 10-20 mcg/kg/min.
Route	IV
Levels and Metabolism	Onset of action: 1-4 min; Maximum effect within 3-5 min; Duration of effect: 20-35 min. Metabolized by rapid nonenzymatic degradation (Hofmann elimination) in the bloodstream. Half-life: 20 min.
Precautions	Potentiated by: Acidosis, aminoglycosides, hypermagnesemia, and hypokalemia. Antagonized by: Alkalosis, hypercalcemia, and caffeine.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Atropine
Brand Name	Atropen
Indications	Severe bradycardia, particularly when parasympathetic influences on the heart (digoxin, beta-blocker drugs, hyperactive carotid sinus reflex) predominate, high degree A-V block with bradycardia, reduction of muscarinic effects of cholinergic drugs like neostigmine when reversing neuromuscular blockade.
Dose	0.01-0.03 mg/kg/dose (minimum dose 0.1 mg) IV, IM, SubQ, or ET (for ET dilute in 2 ml of normal saline). Dose may be repeated q 2-5 min to achieve desired effect, with a maximum total dose of 0.04 mg/kg.
Route	IV, IM, SubQ, ET
Levels and Metabolism	Peak tachycardia in 12-16 min after dose given; Half-life ~ 6 hrs. Up to 50% excreted unchanged by the kidneys.
Precautions	Monitor for cardiac arrhythmias, fever especially in brain damaged infants, abdominal distention, esophageal reflux, mydriasis and cycloplegia. Avoid in thyrotoxicosis, tachycardia secondary to cardiac insufficiency, and obstructive gastrointestinal disease.

Generic Name	Aztreonam
Brand Name	Azactam
Indications	Treatment of multidrug resistant life-threatening infections with gram-negative aerobic organisms, especially Pseudomonas aeruginosa. Little activity against gram-positive or anaerobic bacteria. Treatment of susceptible organisms in patients with penicillin or cephalosporin allergy.
Dose	**PNA ≤7 days:** ≤2000 g: 60 mg/kg/day, divided q 12 hrs. >2000 g: 90 mg/kg/day, divided q 8 hrs. **PNA >7 days:** <1200 g: 60 mg/kg/day, divided q 12 hrs. 1200 -2000 g: 90 mg/kg/day, divided q 8 hrs. >2000 g:120 mg/kg/day, divided q 6 hrs.
Route	IV, IM
Levels and Metabolism	Up to 70% undergoes renal excretion; Half-life 3-9 hrs.
Precautions	Monitor for thrombophlebitis, rash, and diarrhea.

Generic Name	Beractant
Brand Name	Survanta
Indications	Surfactant for prevention and treatment of respiratory distress syndrome.
Dose	4 mL/kg intratracheally through ET, divided into 4 aliquots; may give up to 4 doses during the first 48 hrs of life, no more frequently than q 6 hrs apart.
Route	Intratracheal
Levels and Metabolism	Penetrates the liver and spleen but poor penetration into CSF. Undergoes renal elimination. Mean half-life 24-40 hrs.
Precautions	May cause transient bradycardia and oxygen desaturation. For intratracheal administration only. Suction infant prior to administration. Do not shake just gentle swirling if settling occurs during storage. Keep refrigerated and protected from light. Warm at room temperature before administration.

Generic Name	Bumetanide
Brand Name	Bumex
Indications	Edema refractory to furosemide.
Dose	0.01-0.05 mg/kg/dose, q 24-48 hrs.
Route	IV, PO, IM
Levels and Metabolism	Onset within a few minutes for IV and within 1 hour for PO and IM; Duration ~ 3-6 hrs; Half-life 6-15 hrs.
Precautions	Monitor for severe electrolytes disturbances and hypotension. May cause ototoxicity. 1 mg of bumetamide ~ equivalent in potency to 40 mg furosemide.

Generic Name	Caffeine Citrate
Brand Name	Cafcit, Primicaf
Indications	Neonatal apnea.
Dose	Loading dose (as caffeine citrate salt): 10-20 mg/kg. Maintenance dose: 5 mg/kg/dose given q 24 hrs. Begin maintenance 24 hrs after the loading dose. Note: doses for anhydrous caffeine are lower: use 1/2 the caffeine citrate dose. If theophylline has been administered within the previous 3 days, a full or modified loading dose (50-70%) may be given. Maintenance dose is adjusted based on patient's response and serum caffeine concentrations.
Route	IV, PO
Levels and Metabolism	**Therapeutic Drug Monitoring:** Draw trough level on day 5 or 6 after loading dose. Therapeutic levels: 7-20 mcg/mL; Toxic levels: > 40-50 mcg/mL. Interconversion between caffeine and theophylline occurs in preterm neonates. Serum half-life widely variable in newborns, mean half-life is 103 hrs. In neonates ≤ 1 month, excreted primarily unchanged in urine.
Precautions	Do not interchange caffeine citrate salt formulations with caffeine sodium benzoate. Monitor for cardiac arrhythmias, muscle tremors or twitches, and increased urine output. Consider holding dose if heart rate >180 beats/min.

Please see the appendix for protocol on use.

Generic Name	Calcium Glubionate
Brand Name	Neocalglucon, Calcionate
Indications	Treatment and replacement of calcium deficiency.
Dose	Neonates: 1200 mg/kg/day in 4-6 divided doses as calcium glubionate salt. Low-birth-weight infant: 2-4 mL/kg/day in 2-3 divided doses. Can be increased gradually as indicated by serum calcium level and clinical condition.
Route	PO
Precautions	Absorption inhibited by high phosphate intake. High osmotic load of syrup may cause diarrhea. Each 1 mL of calcium glubionate 6.5% syrup = 23 mg elemental calcium = 1.2 m Eq calcium = 360 mg of salt.

Generic Name	Calcium Gluconate (10%)
Indications	Symptomatic hypocalcemia, cardiac arrest in the presence of hyperkalemia or hypocalcemia, magnesium toxicity or calcium antagonist toxicity.
Dose	**Symptomatic Hypocalcemia:** 100-200 mg/kg/dose (1-2 mL/kg/dose) slow IV over 5-10 min, may repeat dose or follow with a continuous infusion. Maintenance dose: 200-800 mg/kg/day (2-8 mL/kg/day divided q 6 hrs or as a continuous infusion. **Cardiac Arrest:** 60-100 mg/kg/dose (0.6-1 mL/kg/dose) IV.
Route	IV
Precautions	Monitor for hypercalcemia and bradycardia. Use in digitalized patients may precipitate cardiac arrhythmias. May cause severe tissue necrosis with IV infiltration. Correct hypomagnesemia if present. Dilute salt to 50 mg/mL; recommended rate of infusion 120-240 mg/kg/hr. 1 mL of 10% calcium gluconate contains 9.4 mg elemental calcium = 4.5 mEq calcium.

Generic Name	Captopril
Brand Name	Capoten
Indications	Hypertension and afterload reduction in heart failure.
Dose	Neonates: 0.01-0.1 mg/kg/dose PO, q 8-24 hrs. Titrate up to 0.5 mg/kg/dose q 6-24 hrs Infants: 0.15-0.3 mg/kg/dose; titrate dose upwards to max. of 6 mg/kg/day in 2-4 divided doses. Dosage titrated according to patient's response.
Route	PO
Levels and Metabolism	50% metabolized and primarily eliminated by renal excretion.
Precautions	May cause hypotension, hyperkalemia, elevated BUN and serum creatinine, neutropenia, and rash. Use with caution and modify dose in renal impairment and volume depletion.
Extemporaneous Preparation	A 1 mg/mL oral solution may be made by allowing two 50 mg tablets to dissolve in 50 mL of distilled water. Add the contents of one 500 mg sodium ascorbate injection ampule or one 500 mg ascorbic acid tablet and allow to dissolve. Add quantity of distilled water sufficient to make 100 mL. Label "shake well" and "refrigerate". Stable for 56 days refrigerated.

References:

Nahata MC, Pai VB, and Hipple TF. *Pediatric Drug Formulations*, 5th ed, Cincinnati, OH: Harvey Whitney Books Co, 2004.

Generic Name	Carbamazepine
Brand Name	Tegretol
Indications	An anticonvulsant to treat a range of neonatal seizures.
Dose	2.5 mg/kg twice daily, increased as necessary by 2.5–5 mg/kg every 3–7 days; usual maintenance dose 5 mg/kg 2–3 times daily. Increase dose slowly to allow for enzyme induction on initiation of therapy. Dosage must be adjusted according to patient›s response and serum concentrations.
Route	PO
Levels and Metabolism	Sampling time: Just before next dose Therapeutic range: 4-12 mcg/mL Time to reach steady rate: 1-2 weeks
Precautions	Interacts with many drugs such as phenytoin (both drugs may be altered) and erythromycin (increases level of carbamazepine). CBC, renal and LFTs should be obtained prior to instituting therapy and periodically throughout the course of therapy. May cause Bone marrow depression mainly neutropenia, cardiovascular, renal, and hepatic disturbances, and drowsiness.
Preparation	An oral preparation in sucrose is available commercially.

References:

1. Tulloch JK1, Carr RR, Ensom MH. A systematic review of the pharmacokinetics of antiepileptic drugs in neonates with refractory seizures. J Pediatr Pharmacol Ther. 2012 Jan;17(1):31-44. doi: 10.5863/1551-6776-17.1.31.

Generic Name	Cefazolin
Brand Name	Ancef, Kefzol
Indications	First generation cephalosporin useful for treatment of infections caused by susceptible gram-positive cocci (except enterococcus).

Dose

Age	Total Daily Dose	Divided
0-7 days, ≤ 2000 g	40 mg/kg	q 12 hrs
>7 days, ≤ 2000 g	40 mg/kg	q 12 hrs
>7 days, > 2000 g	60 mg/kg	q 8 hrs

Preferred route is IV over 15-30 min.

Route	IV, IM
Levels and Metabolism	Half-life: 3-5 hrs. Eliminated unchanged in the urine. Does not penetrate well into the CSF.
Precautions	May cause rash, phlebitis, leukopenia, thrombocytopenia, and false-positive urinary reducing substances and coomb's test.

Generic Name	Cefepime
Brand Name	Maxipime
Indications	Fourth generation cephalosporin used for treatment of infections caused by susceptible gram negative bacteria, including Pseudomonas aeruginosa. Lower respiratory tract infections, cellulitis, and urinary tract infections.
Dose	**Neonates <14 days:** 30 mg/kg/dose q 12 hrs
Route	IV, IM
Levels and metabolism	Half-life: 1.7-2 hrs. Distributes into inflammatory fluid at concentrations ~80% of serum levels and into bronchial mucosa at levels ~60% of plasma levels; 85% excreted as unchanged drug in urine.
Precautions	May cause phlebitis, diarrhea, rash, seizures, neutropenia with prolonged use, thrombocytopenia, transient elevation of LFTs and elevated BUN and creatinine.

Generic Name	Cefotaxime
Brand Name	Claforan
Indications	Third generation cephalosporin used for treatment of infections caused by susceptible non-pseudomonal gram negative rods. Meningitis and neonatal sepsis in patient at risk of aminoglycoside toxicity.

Dose

Age	Total Daily Dose	Divided
0-7 days, ≤ 2000 g	100 mg/kg	q 12 hrs
0-7 days, > 2000 g	100-150 mg/kg	q 8-12 hrs
>7 days, ≤ 2000 g	150 mg/kg	q 8 hrs
>7 days, > 2000 g	150-200 mg/kg	q 6-8 hrs

IV infusion over 15-30 min preferred.

Route	IV, IM
Levels and Metabolism	Distributes widely in bile, bronchial secretions, lung tissue, ascitic fluid, middle ear, and bone; penetrates into CSF when meninges are inflamed. Half-life: 5-6 hrs in premature neonates and 2-3.4 hrs in term infants. Partially metabolized in the liver to active metabolite. Renally eliminated as unchanged drug and metabolite.
Precautions	May cause phlebitis, rash, transient neutropenia, eosinophilia, false positive urine-reducing substance and coomb's test.

Generic Name	Ceftazidime
Brand Name	Fortaz, Tazicef
Indications	Third generation cephalosporin used for treatment of infections caused by susceptible gram negative bacteria, particularly Pseudomonas aeruginosa. Meningitis and neonatal sepsis in neonates at risk of aminoglycoside toxicity.
Dose	**Postnatal Age (PNA) ≤ 7 days:** ≤ 2000 g: 100 mg/kg/day, divided q 12 hrs. > 2000 g: 100-150 mg/kg/day, divided q 8-12 hrs. **PNA > 7 days, ≤ 1,200 g:**100 mg/kg/day, divided q 12 hrs. **PNA > 7 days, ≥ 1200 g:** 150 mg/kg/day, divided q 8 hrs.
Route	IV, IM
Levels and metabolism	Half-life: 3-12 hrs. Distributes widely into bone, bile, CSF (diffuses at higher concentrations when the meninges are inflamed), pleural and lymphatic fluids. Excreted as unchanged drug in urine.
Precautions	May cause phlebitis, diarrhea, rash, neutropenia, thrombocytopenia, false positive urine-reducing substances and coomb's test.

Generic Name	Ceftriaxone
Brand Name	Rocephin
Indications	Third generation cephalosporin used in treatment of neonatal sepsis and meningitis caused by susceptible gram-negative organisms (e.g. E. coli, Pseudomonas, Klebsiella, H. influenza). Treatment of gonococcal infections.
Dose	**Sepsis and Meningitis:** PNA ≤ 7 days: 50 mg/kg q 24 hrs. PNA > 7 days: ≤ 2000 g: 50 mg/kg q 24 hrs; > 2000 gm: 50-75mg/kg q 24 hrs. **Uncomplicated Gonococcal Ophthalmia or Prophylaxis:** 25-50 mg/kg x 1 dose (max. dose 125 mg). **Disseminated Gonococcal Infection:** 25-50 mg/kg/dose (max. dose 125 mg) once daily IV or IM for 7 days, up to 10-14 days if meningitis is documented. Note: Use cefotaxime in place of ceftriaxone in hyperbilirubinemic neonates.
Route	IV, IM
Levels and Metabolism	Distributes widely in CSF, bile, bronchial secretions, lung tissue, ascitic fluid, and middle ear; highly protein bound. Eliminated by both biliary (40%) and renal mechanisms. Serum half-life in neonates 9-16 hrs.
Precautions	Use with caution in neonates with hyperbilirubinemia. May cause diarrhea, rash, eosinophilia, thrombocytosis, leukopenia, and bleeding tendencies. Dosage adjustment necessary in patients with combined renal and hepatic dysfunction.

Generic Name	Cefuroxime
Brand Name	Zinnat
Indications	Second generation cephalosporin used for treatment of infections caused by susceptible gram positive and gram negative organisms; not active against Enterococci or Pseudomonas.
Dose	**Neonates:** **< 7 days:** 50 mg/kg; divided q 12 hrs IV or IM. **7-21 days:** 75 mg/kg; divided q 8 hrs IV. **> 21 days:** 100 mg/kg; divided q 6 hrs IV. In severe infections may double the dose for all of the above age groups and administer IV only. **PO:** 10-20 mg/kg; divided q 12 hrs.
Route	IM, IV, PO
Levels and Metabolism	Distributes into bronchial secretions, bone, bile, and CSF with inflamed meninges. Half-life: 1.5-5 hrs. Elimination is primarily unchanged in the urine.
Precautions	May cause diarrhea, urticaria, neutropenia, rash, elevated liver enzymes, false-positive test for urinary reducing substances and coomb's test.

Generic Name	Cephalexin
Brand Name	Keflex
Indications	First generation cephalosporin used for treatment of infections caused by susceptible gram positive and gram negative organisms; not active against enterococci.
Dose	**Neonates:** **< 7 days:** 50 mg/kg (max.125 mg); divided q 12 hrs. **7-21 days:** 75 mg/kg (max.125 mg); divided q 8 hrs. **21-28 days:** 100 mg/kg (max.125 mg); divided q 6 hrs. **UTI prophylaxis:** 12.5 mg/kg (max.125 mg) once daily.
Route	PO
Levels and Metabolism	Absorption delayed up to 50% in neonates. Half-life: 5 hrs. Undergoes renal excretion as unchanged drug.
Precautions	May cause diarrhea, urticaria, neutropenia, rash, elevated liver enzymes, false-positive test for urinary reducing substances and coomb's test.

Generic Name	Chloral Hydrate
Brand Name	Noctec, Somnos
Indications	Sedatives and hypnotic for short term use and prior to non-painful therapeutic and diagnostic procedures.
Dose	25 mg/kg/dose given PO or PR. May repeat with caution in ½ hr if inadequate effect.
Route	PO, PR
Levels and Metabolism	Well absorbed after PO or PR administration. Onset of action 10-20 minutes; Maximum effect in 1 hr. Rapidly metabolized in the liver to an active metabolite, trichlorethanol (active metabolite), which is excreted by the kidney after conjugation to the glucuronide salt. Plasma half-life of active metabolite is 8-64 hrs in neonates (mean 37 hrs). Protein binding of active metabolite ~40%.
Precautions	Repeat doses should be used with great caution due to possible accumulation of drug and metabolite. May potentiate the effects of CNS depressants. Prolonged use is associated with direct hyperbilirubinemia. Avoid use in patients with moderate to severe renal impairment, gastric irritation, paradoxical excitation (especially in patients in pain). Note: Does not interfere with EEG results.

Generic Name	Chloramphenicol
Brand Name	Chloromycetin
Indications	Treatment of serious infections due to organisms resistant to other less toxic antibiotics. Useful for infections with Bacteroides, H. influenzae, N. meningitidis, salmonella, and Rickettsia.
Dose	Loading dose: 20 mg/kg. Maintenance dose should be given 12 hrs later, as follows:

Age and Weight	Total Daily Dose	Divided
0-7 days, ≤ 2000 g	25 mg/kg	q 24 hrs
0-7 days, > 2000 g	25 mg/kg	q 24 hrs
>7 days, ≤ 2000 g	25 mg/kg	q 24 hrs
>7 days, > 2000 g	50 mg/kg	q 12 hrs

Give IV over 15-30 min.
PO (≥1 month): 50 mg/kg; divided q 6 hrs.

Route	IV, PO
Levels and Metabolism	**Therapeutic Drug Monitoring:** Meningitis: Peak: 15-25 mcg/mL; Trough: 5-15 mcg/mL. Other infections: Peak: 10-20 mcg/mL; Trough: 5-10 mcg/mL. Draw peak 90 minutes after 30 minute infusion and trough just prior to next dose. Distributes to most tissue and body fluid; good CSF penetration; metabolized in the liver and renally eliminated.
Precautions	May cause skin rash, diarrhea, stomatitis, and vomiting. Serious and fatal blood dyscrasias may occur; should not be used if alternate less toxic agents are effective. May cause left ventricular dysfunction, peripheral neuropathy, optic neuritis, bone marrow suppression, irreversible aplastic anemia, hemolysis in G6PD deficiency and grey baby syndrome. Dose Adjustment in renal/or hepatic impairment should be based on serum concentration.

Generic Name	Chlorothiazide
Brand Name	Diuril
Indications	Mild to moderate edema and/or hypertension. Effects potentiated when used in combination with furosemide or spironolactone. May improve pulmonary function in patients with bronchopulmonary dysplasia (BPD).
Dose	PO: 20-40 mg/kg/day; divided in two doses. IV: 2-8 mg/kg/day, divided in two doses.
Route	IV, PO
Levels and Metabolism	Poor PO absorption (10-20%); Onset of diuresis within 2 hrs. Half-life: ~5 hrs. Excreted unchanged in urine.
Precautions	Use with caution in liver and severe renal disease. May cause hyperbilirubinemia, hypokalemia, alkalosis, hyperglycemia, hyperuricemia, and hypomagnesemia.
Extemporaneous Preparation	A 50 mg/mL oral suspension may be made with tablets. Crush ten 500 mg chlorothiazide tablets in a mortar and reduce to a fine powder; mix with a small amount of glycerin to form a uniform paste. Add 2 g carboxymethylcellulose gel (mix 2 g carboxymethylcellulose with 5-10 mL water to form a paste; add 40 mL water and heat to 60°C with moderate stirring until dissolution occurs; cool and allow to stand for 1-2 hours to form a clear gel). Dissolve 500 mg citric acid in 5 mL water and add to chlorothiazide carboxymethylcellulose mixture with 0.1% parabens. Add a quantity of purified water sufficient to make 100 mL. Label «shake well» and «refrigerate». Stable for 30 days.

References:

Nahata MC, Pai VB, and Hipple TF. *Pediatric Drug Formulations*, 5th ed, Cincinnati, OH: Harvey Whitney Books Co, 2004.

Generic Name	Chlorpromazine
Brand Name	Thorazine
Indications	Neonatal abstinence syndrome.
Dose	Initially: 0.5-0.7 mg/kg/dose given q 6 hrs, decrease dose gradually over 2-3 weeks. Note: chlorpromazine is rarely used for neonatal abstinence syndrome due to adverse effects such as hypothermia and eosinophilia. Other agents are preferred such as phenobarbital.
Route	IV, IM, PO
Levels and Metabolism	Oral absorption rapid and complete; large first-pass effect (30% bioavailable); widely distributed in body tissue. Metabolized in the liver.
Precautions	Use with caution in patients with cardiovascular, renal or hepatic disease, and seizures. May cause altered central temperature regulation, leucopenia, and hyperpigmentation.

Generic Name	Cholecalciferol (Vitamin D)
Brand Name	OsteVit-D, Pentavite
Indications	Nutritional or physiological deficiency: • Rickets • Intestinal malabsorption • Chronic liver disease • Hypoparathyroidism • All infants born <35 weeks who are tolerating full enteral feeds • All breastfed babies of vitamin D deficient mothers
Dose	400-500 Units once daily For breastfed babies of Vitamin D deficient mothers: • Mild maternal vitamin D deficiency (25-50 nmol/L): 400 Units once daily until 12 months of age. • Moderate to severe maternal vitamin D deficiency (<25 nmol/L): 1000 Units once daily for 3 months to be followed by maintenance therapy for 12 months.
Route	PO
Levels and Metabolism	Vitamin D metabolism in the liver: 25-hydroxylation of vitamin D occurs leading to 25(OH) vitamin D. In the kidney, a second hydroxylation takes place by 1 α-hydroxylase leading to the formation of 1,25-dihydroxivitamin D, the biologically active form.
Precautions	Watch for symptoms of Cholecalciferol over dosage that include: anorexia, lassitude, nausea, vomiting, diarrhea, weight loss, polyuria, sweating, headache, thirst, vertigo, raised concentrations of calcium and phosphate in plasma and urine.
Preparation	OsteVit-D (0.1 ml daily -- equivalent to 500 units cholecalciferol/dose) or Pentavite (0.45 ml daily - equivalent to 400 units cholecalciferol/dose)

References:

Aly H, Abdel-Hady H. Vitamin D and the neonate: An update. J Clin Neonatol. 2015, 4:1-7.

Generic Name	Cholestyramine
Brand Name	Questran
Indications	Diarrhea secondary to ileal resection.
Dose	Children: (dose expressed in terms of anhydrous resin) 240 mg/kg/day, in 3 divided doses, mixed into feedings. Titrate dose according to response and tolerance. Can be mixed into paste and applied to skin of buttocks to reduce irritation from bile salts in babies with diarrhea or malabsorption.
Route	PO
Levels and Metabolism	Not absorbed from the GIT; forms an insoluble complex with bile acids which is excreted in feces.
Precautions	Avoid in patients with biliary obstruction or biliary atresia. Use with caution in patients with constipation. May decrease absorption of other drugs. Long term use may result in steatorrhea and deficiency of fat soluble vitamins.

Generic Name	Clindamycin
Brand Name	Cleocin
Indications	Treatment of infections caused by anaerobic bacteria and susceptible gram positive organisms, second line drug for Bacteroides fragilis infections in infants. Not appropriate for meningitis.
Dose	**PNA ≤7 days:** ≤ 2000 g: 10 mg/kg/day, divided q 12 hrs. > 2000 g: 15 mg/kg/day, divided q 8 hrs. **PNA >7 days:** < 1200 g: 10 mg/kg/day, divided q 12 hrs. 1200-2000 g: 15 mg/kg/day, divided q 8 hrs. > 2000 g: 20-30 mg/kg/day, divided q 6-8 hrs. **Infants:** PO: 10-30 mg/kg/day, divided q 6-8 hrs. IV, IM: 25-40 mg/kg/day, divided q 6-8 hrs.
Route	IV, IM, PO
Levels and Metabolism	Rapidly absorbed after PO with ~90% bioavailability. Half-life: 8.7 hrs in premature infants and 3.6 hrs in full-term infants. Distributes into bile, saliva, ascitic fluid and bone. Poor CSF distribution, even with inflamed meninges. Eliminated by hepatic inactivation and renal excretion of metabolites.
Precaution	May cause diarrhea, pseudomembranous colitis, rash, Stevens-Johnson Syndrome, elevated liver enzymes, and sterile abscess with IM injection. Rapid IV administration may cause hypotension, arrhythmias, and cardiac arrest.

Generic Name	Clonazepam
Brand Name	Clonopin, Rivotril
Indication	Seizures: Effective for typical absence (petit mal), myoclonic seizures, may be effective for infantile spasms, atypical petit mal, and akinetic seizures.
Dose	Infants and children: 0.01-0.03 mg/kg/day, divided in 2-3 doses; increase gradually in increments of 0.25-0.5 mg/day, at intervals of 3 days. Maintenance dose: 0.1-0.2 mg/kg/day, divided 3 times/day.
Route	PO
Levels and Metabolism	Therapeutic levels: 20-80 ng/mL. (Relationship between serum concentration and seizure control is not well established).Well absorbed. Extensively metabolized in the liver. Half-life 22-33 hrs in children.
Precautions	Use with caution in patients with chronic respiratory disease, hepatic disease, or impaired renal function; abrupt discontinuation may precipitate withdrawal symptoms, status epilepticus, or seizures (withdraw gradually). May cause drowsiness, hypotonia, and bronchial hypersecretion.
Extemporaneous Preparation	A 0.1 mg/mL oral suspension may be made with tablets and one of three different vehicles (cherry syrup; a 1:1 mixture of Ora-Sweet and Ora-Plus; or a 1:1 mixture of Ora-Sweet SF and Ora-Plus). Crush six 2 mg tablets in a mortar and reduce to a fine powder. Add 10 mL of the chosen vehicle and mix to a uniform paste; mix while adding the vehicle in incremental proportions to **almost** 120 mL; transfer to a calibrated bottle, rinse mortar with vehicle, and add quantity of vehicle sufficient to make 120 mL. Label “shake well” and “protect from light”. Stable for 60 days when stored in amber prescription bottles in the dark at room temperature or refrigerated.

References:

Allen LV Jr and Erickson MA 3rd. Stability of Acetazolamide, Allopurinol, Azathioprine, Clonazepam, and Flucytosine in Extemporaneously Compounded Oral Liquids. *AJHP*, 1996, 53(16):1944-9.

Generic Name	Cosyntropin (Tetracosactide)
Brand Name	Cortrosyn, Synacthen
Indications	Diagnostic test to differentiate primary adrenal from secondary adrenocortical insufficiency and for congenital adrenal hyperplasia.
Dose	**Adrenocortical Insufficiency:** 0.015 mg/kg/dose. **Congenital Adrenal Hyperplasia:** 1 mg/m^2/dose up to a max. of 1 mg.
Route	IV, IM
Levels and Metabolism	Onset of action: Plasma cortisol levels rise in healthy individuals in 5 min; Max. effect: At 45-60 min after the dose. Plasma cortisol should be measured immediately before and 30 min after the dose; dose should be given in the early morning. Metabolism unknown.
Precautions	Patient should not receive corticosteroids or spironolactone the day prior to and the day of the test. May cause bradycardia, tachycardia, hypertension, edema, and rash.

Generic Name	Desmopressin Acetate
Brand Name	DDAVP, Minirin
Indications	Treatment of diabetes insipidus.
Dose	**Neonates :** **PO:** Initially 1-4 mcg 2-3 times daily, adjusted according to response. **Intranasally:** Initially 0.1-0.5 mcg daily in 1-2 doses, adjusted according to response. **IM:** Initially 0.1mcg once daily, adjusted according to response.
Route	PO, Intranasally, IM
Levels and Metabolism	PO onset of antidiuretic hormone (ADH) action: 1 hr; Maximum effect: 2-7 hrs; Duration: 6-8 hrs. Intranasally onset of ADH action: within 1 hr; Maximum effect within 1.5 hrs; Duration: 5-21 hrs. PO absorption 5-15% and nasal solution 10-20%. Metabolism is unknown and excretion is primarily in urine.
Precautions	May cause edema, hyponatremia, seizures, nausea, and vomiting. Monitor fluid intake, urine volume, specific gravity, plasma ad urine osmolality, and serum electrolytes.

Generic Name	Dexamethasone
Brand Name	Decadron
Indications	Cerebral edema, airway edema prior to extubation, and BPD to facilitate ventilator weaning.
Dose	**Cerebral Edema:** PO, IV, IM: Loading dose: 1-2 mg/kg single dose, then maintenance of 1-1.5 mg/kg/day, divided q 4-6 hrs. **BPD (to facilitate ventilator weaning):** PO, IV: (Numerous dosing schedules have been proposed) range 0.5-0.6 mg/kg/day, given in divided doses q 12 hrs for 3-7 days, then taper over 1-6 weeks. **Regimen example:** -0.075 mg/kg/dose q12 hrs for 3 days, then - 0.05mg/kg/dose q 12 hrs for 3 days, then - 0.025mg/kg/dose q 12 hrs for 2 days, then - 0.01 mg/kg/dose q 12 hrs for 2 days. - Doses may be administered slow IV push or PO. - Repeat courses may be indicated in selected infants with severe BPD. **Airway Edema or Extubation:** IV: Usual 0.25 mg/kg/dose given ~4 hrs prior to scheduled extubation and then q 8 hrs for total of 3 doses; range 0.25-1 mg/kg/dose for 1-3 doses; max. dose: 1mg/kg/day. Note: A longer duration of therapy may be needed for more severe cases.
Route	IV, IM, PO
Levels and Metabolism	Terminal half-life in extremely low birth weight infants with BPD: 9.3 hrs; metabolized in the liver and eliminated in urine and bile.
Precautions	Data regarding neurodevelopmental outcome have been reported including increased risk of cerebral palsy. Suppressions of hypothalamic-pituitary-adrenal axis may occur. May suppress bone growth in children. Monitor for edema, hypertension, hyperglycemia, hypokalemia, muscle weakness, and GI bleeding.

Generic Name	Diazepam
Brand Name	Valium
Indications	Status epilepticus, severe recurrent convulsive seizures, neonatal tetanus.
Dose	**Seizures:** 0.1-0.3 mg/kg/dose slow IV push, may repeat as needed every 15-30 min for 2-3 doses to a max. of 2 mg. **Rectal:** 1.25-2.5 mg repeated once after 10 min if necessary. **Neonatal Tetanus (for muscle spasms):** 0.1-0.3 mg/kg slow IV push, may be repeat q1-4 hrs.
Route	IV, PO, PR
Levels and Metabolism	Well absorbed after PO and rectal administration. Metabolized in the liver to active metabolite. Half-life in neonates 50-95 hrs for diazepam and up to 100 hrs for the active metabolite. Metabolites excreted in the urine. Onset of action for IV 1-3 min and for rectal 2-10 min with a duration of 15-30min.
Precautions	Not recommended at first line agent for neonatal status epilepticus. Use with caution in patients with low albumin, renal or hepatic dysfunction, and in neonates due to decreased clearance of diazepam and active metabolite. Rapid IV administration may cause sudden respiratory depression, apnea, and hypotension. Abrupt discontinuation may cause withdrawal symptoms or seizures.

Generic Name	Diazoxide
Brand Name	Hyperstat
Indications	Hyperinsulinemic hypoglycemia (such as nisidioblastosis).
Dose	Initial: 10 mg/kg/day in divided doses 2-3 times per day; Usual range: 5-15 mg/kg/day, divided q 8-12 hrs. Start with higher dosage and taper according to response.
Route	IV, PO
Levels and Metabolism	Protein binding >90%. Half-life: 10-24 hrs in infants; 50% excreted unchanged in urine. Hyperglycemic effect onset of action within 1 hr with duration of 8 hrs in normal renal function.
Precautions	Positive responses are usually seen in 48-72 hrs. May cause excessive hair growth, seizures, hypotension, hyperglycemia, ketoacidosis, GI disturbances, arrhythmias, hyperuricemia, and sodium retention leading to edema and congestive heart failure. Use with caution in renal impairment.

Generic Name	Digoxin

Brand Name

Lanoxin

Indications

Congestive heart failure (not useful in decompensated PDA in premature infants), paroxysmal supraventricular tachycardia, and atrial fibrillation.

Dose

Age	Digitalizing (Loading) Dose		Total Daily Maintenance Dose	
	PO	IM or IV	PO	IM or IV
Preterm	20-30 mcg/kg	15-25 mcg/kg	5-7.5 mcg/kg	4-6 mcg/kg
Term	25-35 mcg/kg	20-30 mcg/kg	6-10 mcg/kg	5-8 mcg/kg

Digitalize by giving 50% initially then give remainder divided into 2 doses q 6-12 hrs. Maintenance dose divided q12-24 hrs.

Route

IV, IM, PO

Levels and Metabolism

Therapeutic trough level: 0.8-2 ng/mL.

Serum sampling recommended at steady state (after 5-8 days of therapy).

Note: Serum concentration must be used in conjunction with clinical symptoms and EKG. Neonates may have falsely elevated levels due to presence of digoxin like substances.

Route	Onset of action	Peak action
PO	1-2 hrs	2-8 hrs
IM	15-60 min	2-5 hrs
IV	5-30 min	1-4 hrs

Distribution phase 6-8 hrs; half-life 35-45 hrs in full term neonates and up to 170 hrs in premature neonates; 50-70% excreted unchanged in urine.

Precautions

May cause bradycardia. Toxicity may be associated with arrhythmias. Use with caution in renal failure; dosage adjustment is required based on creatinine clearance. Electrolyte disturbances may increase risk of digoxin toxicity.

Digoxin injection comes in a highly concentrated dosage form. Ensure special dilution is prepared to avoid medication errors related to overdosing.

Generic Name	Dobutamine
Brand Name	Dobutrex
Indications	Inotropic support in low cardiac output states, after cardiac surgery, shock, and hypotension.
Dose	IV continuous infusion: 2-15 mcg/kg/min, adjusted according to response. Maximum dose: 20 mcg/kg/min.
Route	IV
Levels and	Onset of action: 1-10 min; Peak effect in 10-20 min; Half -life 2 min.
Metabolism	Metabolized in the liver and tissues to inactive metabolites.
Precautions	Potent drug, must be diluted prior to use. Administer using infusion pump. Hypovolemia should be corrected prior to use. May cause hypotension if patient is hypovolemic. Tachycardia, arrhythmias, and hypertension may occur at high doses.

***Calculating infusion rate (mL/hr) =**

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

Dobutamine Titration Chart:

Concentration (mcg/ml)	Dose (mcg/kg/min)	IV Rate (ml/kg/hr)
800	2.5 5 7.5 10	0.19 0.38 0.56 0.75
1600	2.5 5 7.5 10	0.094 0.19 0.28 0.38
3200	2.5 5 7.5 10	0.047 0.094 0.14 0.19

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Domperidone
Brand Name	Motilium
Indications	To control nausea, vomiting, and gastro-esophageal reflux.
Dose	100 -300 mcg/kg/dose; given 4 to 6 times daily prior to feeds.
Route	PO
Levels and Metabolism	Eliminated by renal excretion; half-life is prolonged in severe renal impairment
Precautions	It is contraindicated in moderate or severe hepatic impairment. Dose modification in mild hepatic impairment is not needed. On repeated administration, the dosing frequency of domperidone should be reduced to once or twice daily depending on the severity of the impairment, and the dose may need to be reduced. Overdosing may cause extrapyramidal symptoms in young children. Close monitoring is needed in patients who are known to have existing prolongation of cardiac conduction intervals, particularly prolonged QT interval.
Preparation	0ral suspension contains domperidone 1 mg/mL.

References

1. Tighe M, Afzal NA, Bevan A, Hayen A, Munro A, Beattie RM. Pharmacological treatment of children with gastro-oesophageal reflux. Cochrane Database Syst Rev. 2014 Nov 24;11:CD008550. doi: 10.1002/14651858.CD008550.pub2.

2. Gounaris A1, Costalos C, Varchalama E, Kokori F, Grivea IN, Konstantinidi K, Syrogiannopoulos GA. Gastric emptying of preterm neonates receiving domperidone. Neonatology. 2010;97(1):56-60. doi: 10.1159/000231517. Epub 2009 Jul 31.

Generic Name	Dopamine
Brand Name	Intropin
Indications	Hypotension or shock not responding to adequate fluid volume replacement. In low doses increases renal perfusion and urine flow.
Dose	IV continuous infusion: 2-20 mcg/kg/min. Typical initial dose: 5-10 mcg/kg/min if given for blood pressure support; 2-3 mcg/kg/min if given to improve renal perfusion. Note: Hemodynamic effects are dose dependent: **Low dose:** 1-5 mcg/kg/min for increased urine output and renal blood flow. **Intermediate dose:** 5-15 mcg/kg/min for increased renal blood flow, heart rate, cardiac contractility, cardiac output, and blood pressure. **High dose:** >15 mcg/kg/min: alpha adrenergic effects predominate, vasoconstriction, increased blood pressure.
Route	IV
Levels and Metabolism	Metabolized rapidly in plasma, kidneys, and liver; 25% to norepinephrine. Half-life: 2 min.
Precautions	Must be diluted prior to use. Hemodynamic effects should be monitored. Dopamine must not be used as sole therapy in hypovolemic patients. Extravasation may cause tissue necrosis. Do not administer into an umbilical arterial catheter. May cause tachycardia and arrhythmias and increase pulmonary artery pressure.

***Calculating infusion rate (mL/hr) =**

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

Dopamine Titration Chart:

Concentration (mcg/ml)	Dose (mcg/kg/min)	IV Rate (ml/kg/hr)
800	2.5	0.19
	5	0.38
	7.5	0.56
	10	0.75
1600	2.5	0.094
	5	0.19
	7.5	0.28
	10	0.38
3200	2.5	0.047
	5	0.094
	7.5	0.14
	10	0.19

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Enalapril/ Enalaprilat
Brand Name	Vasotec
Indications	Mild-severe hypertension and afterload reduction in CHF.
Dose	Enalapril (PO): Initial 0.01 mg/kg/day, every 24 hrs; increase dose and interval as required every few days to up to 0.1 mg/kg/day divided in 1-3 doses. Enalaprilat (IV): 5-10 mcg/kg/dose, every 8-24 hrs.
Route	PO, IV
Levels and Metabolism	Enalapril is a prodrug (inactive) and undergoes biotransformation to enalaprilat (active) in the liver. PO absorption 55-75%. Onset of action: 1-2 hrs (PO) and duration 8-24 hrs (PO, IV).Elimination: up to 80% in the urine.
Precautions	Use with caution in renal impairment. Oliguria and increased serum creatinine occur frequently. May cause hypotension (especially in volume depleted patients), hypoglycemia, hyperkalemia, and bone marrow suppression.
Extemporaneous Preparation	A 1 mg/mL oral suspension may be made with tablets and one of three different vehicles (cherry syrup, a 1:1 mixture of Ora-Sweet and Ora-Plus, or a 1:1 mixture of Ora-Sweet SF and Ora-Plus). Crush six 20 mg tablets in a mortar and reduce to a fine powder. Add 15 mL of the chosen vehicle and mix to a uniform paste; mix while adding the vehicle in incremental proportions to **almost** 120 mL; transfer to a calibrated bottle, rinse mortar with vehicle, and add quantity of vehicle sufficient to make 120 mL. Label “shake well” and “protect from light”. Stable for 60 days when stored in amber plastic prescription bottles in the dark at room temperature or refrigerated. A more dilute, 0.1 mg/mL oral suspension may be made with tablets and an isotonic buffer solution at pH 5. Grind one 20 mg tablet in a glass mortar and reduce to a fine powder; mix with isotonic citrate buffer (pH 5) and filter; add quantity of buffer solution sufficient to make 200 mL. Label “shake well”, “protect from light”, and “refrigerate”. Stable for 90 days.

References:

1. Allen LV Jr and Erickson MA 3rd. Stability of Alprazolam, Chloroquine Phosphate, Cisapride, Enalapril Maleate, and Hydralazine Hydrochloride in Extemporaneously Compounded Oral Liquids. *AJHP*, 1998, 55(18):1915-20.
2. Boulton DW, Woods DJ, Fawcett JP, et al. The Stability of an Enalapril Maleate Oral Solution Prepared From Tablets. *Aust J Hosp Pharm*, 1994, 24(2):151-6.

Generic Name	Enoxaparin
Brand Name	Lovenox
Indications	A low molecular weight heparin (LMWH) used as prophylaxis and treatment of thromboembolic disorders.
Dose	Prophylaxis: 0.75 mg/kg q 12 hrs. Treatment: 1.5 mg/kg q 12 hrs.
Route	SubQ
Levels and Metabolism	Based on antifactor Xa and anithromin activities: Max. effect after SubQ: 3-5 hrs; Duration ~12 hrs. Metabolized primarily in the liver. Excreted in urine as active and inactive products.
Precautions	Bleeding or thrombocytopenia may occur. Use with caution in patients with increased risk of bleeding, history of heparin-induced thrombocytopenia, and severe renal dysfunction. Reference range for antifactor Xa: 0.5-1 Unit/mL measured 4-6 hours after SubQ administration. Preterm infants may require a higher dose of 2 mg/kg q 12 hrs to maintain target levels.

Generic Name	Epinephrine
Brand Name	Adrenalin
Indications	Cardiac asystole or profound bradycardia and hypotension, acute cardiovascular collapse, short-term use in cardiac failure resistant to other drugs. In older infants may be used subcutaneously for relief of bronchospasm.
Dose	**Severe Bradycardia and Hypotension:** IV, ET: 0.1-0.3 ml/kg/dose (equivalent to 10-30 mcg/kg/dose) of 1:10,000 solution. Repeat q 3-5 min as needed. Continuous IV infusion: Start at 0.1 mcg/kg/min, titrate as needed; maximum dose 1 mcg/kg/min.
Route	IV, ET
Levels and Metabolism	Metabolized in the liver and other tissues.
Precautions	Cardiac arrhythmias may occur, particularly premature ventricular contractions and ventricular tachycardia. Renal vascular ischemia, severe hypertension with intracranial hemorrhage, and increased myocardial oxygen requirements. Therapeutic doses may cause hypokalemia. IV infiltration may cause tissue ischemia and necrosis.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Erythromycin
Brand Name	E.E.S., Pediamycin
Indications	Infections caused by Chlamydia, Mycoplasma, and Ureaplasma. Treatment of and prophylaxis against B. pertussis. As a prokinetic in cases of feeding intolerance. Ophthalmic ointment used to prevent gonococcal ophthalmia neonatorum.
Dose	**PO: Ethylsuccinate (EES):** PNA ≤7 days: 20 mg/kg/day, divided q 12 hrs. PNA >7 days, < 1200 g: 20 mg/kg/day, divided q 12 hrs. PNA >7 days, 1200-2000 g: 30 mg/kg/day, divided q 8 hrs. PNA >7 days, > 2000 g: 30-40 mg/kg /day, divided q 6-8 hrs. **Ophthalmic: Prophylaxis of Neonatal Gonococcal Ophthalmia:** 0.5-1 cm ribbon of ointment instilled into each conjunctival sac once. **Chlamydial Conjunctivitis and Pneumonia:** **PO (EES):** 50 mg/kg/day, divided q 6 hrs. **IV: Lactobionate:** 25-40 mg/kg/day, divided q 6 hrs. **Feeding Intolerance (Dysmotility):** 3-10 mg/kg/dose PO q 6 hrs. Start at lower dose then increase.
Route	PO, IV, Topical (Ophthalmic)
Levels and Metabolism	Absorption: variable but better with salt forms; 18-45% absorbed; EES may be better absorbed with food. Distributes into the body tissues, liver, and bile. Penetrates poorly into the CNS. Metabolized in the liver. Half-life ~2 hrs. Eliminated through the bile.
Precautions	Use with caution in patients with hepatic impairment. May cause prolongation of QT interval and ventricular arrhythmias. Monitor heart rate and blood pressure closely during IV administration; observe IV site closely for signs of irritation or infiltration. Monitor CBC for eosinophilia. May potentiate effects of drugs metabolized through cytochrome P450 isoenzyme CYP1A2 and CYP3A4 (such as digoxin, theophylline, midazolam).

Generic Name	Erythropoietin (Epoetin Alfa)
Brand Name	Epogen, Procrit
Indications	Anemia and to decrease the need for erythrocyte transfusions in high-risk preterm infants.
Dose	25-100 Units/kg/dose 3 times/week or 100 Units/kg/dose 5 times/week or 200 Units/kg/dose every other day for 10 doses.
Route	SubQ, IV
Levels and Metabolism	SubQ absorption 30%; distributes rapidly in plasma; majority of drug taken up by liver, kidneys, and bone marrow. Half-life: 12-18 hrs.
Precautions	Subcut administration results in 30-50% lower dose requirements compared to IV administration. Use with caution in patients with seizures. May cause hypertension, neutropenia, and irritation at injection site.

Generic Name	Famotidine
Brand Name	Pepcid
Indications	Prevention and treatment of stress ulcer and GI bleeding aggravated by gastric acid secretion.
Dose	PO: 0.5-1 mg/kg/dose, q 24 hrs. Slow IV: 0.25-0.5 mg/kg/dose, q 24 hrs.
Route	IV, PO
Levels and Metabolism	PO bioavailability ~50%. Metabolized by the liver (30%). Half-life ~10 hrs; 60-70% of dose eliminated unchanged in urine.
Precautions	May cause diarrhea or constipation. Dose adjustment required in renal impairment.

Generic Name	Fentanyl
Brand Name	Sublimaze
Indications	Analgesia, short term sedation, adjunct to general anesthesia.
Dose	Sedation and analgesia: Intermittent: 0.5-4 mcg/kg/dose given by slow IV push, repeat as required q 2-4 hrs. Continuous IV infusion: 0.5-5 mcg/kg/hr. Tolerance may develop with prolonged use.
Route	IV
Levels and Metabolism	Highly lipophilic, redistributes into muscle and fat. Metabolized extensively in the liver then excreted by the kidney.
Precautions	Physical and psychological dependence may occur with prolonged use; abrupt discontinuation may result in withdrawal and seizures. Rapid IV infusion may result in skeletal muscle and chest wall rigidity, respiratory distress and impaired ventilation. Inject slowly over 3-5 minutes; nondepolarizing skeletal muscle relaxant may be required. Use with caution in bradycardia, renal failure, and increased intracranial pressure. 50-100 times more potent than morphine on a weight basis.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/hr) x Weight (kg)}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Ferrous Sulfate
Brand Name	Fer-In-Sol
Indications	Treatment and prevention of iron deficiency anemia.
Dose	**Dose expressed as elemental iron (Fe):** Prophylaxis: 2-4 mg Fe/kg/day. Give in 1-2 divided doses per day. Therapeutic: 6 mg Fe/kg/day. Give in 1-2 divided doses per day. Maximum dose 15 mg/day.
Route	PO
Levels and Metabolism	Absorbed in the duodenum and upper jejunum; 20-30% absorbed in conditions of inadequate iron stores and 10% in normal iron stores. Food and achlorhydria decrease absorption.
Precautions	May increase red cell hemolysis in vitamin E deficient infants. Nausea, constipation, black stools, lethargy, hypotension, erosion of gastric mucosa may occur.

Generic Name	Fluconazole
Brand Name	Diflucan
Indications	Systemic fungal infections including meningitis due to Candida species.
Dose	**≤29 weeks gestation (PO, IV):** PNA 0-14 days: 5-6 mg/kg/dose q 72 hrs. PNA >14 days: 5-6 mg/kg/dose q 48 hrs. **30-36 weeks gestation (PO, IV):** PNA 0-14 days: 3-6 mg/kg/dose q 48 hrs. PNA >14 days: 3-6 mg/kg/dose q 24 hrs. **Systemic Infections Including Meningitis (PO, IV):** Loading Dose: 12 mg/kg on day 1, then 6 mg/kg/dose q 24 hrs. **Oropharyngeal Candidiasis (PO):** Loading Dose: 6 mg/kg on day 1, then 3 mg/kg/dose q 24 hrs. Duration of therapy depends on type of infection and may range from 14 to 28 days. For meningitis duration is 10-12 weeks after CSF culture becomes negative. **Prophylaxis:** 3 mg/kg/dose twice weekly.
Route	PO, IV
Levels and Metabolism	Well absorbed orally with oral bioavailability >90%; Widely distributed into body tissues and fluids including CSF. Minimal hepatic metabolism; 80% eliminated unchanged in the urine.
Precautions	Use with caution in patients with renal impairment; dosage adjustment required. May cause QT prolongation, elevated liver enzymes, nausea, vomiting, diarrhea, rash, leukopenia, and thrombocytopenia. Monitor for drug interactions with drugs that are metabolized through the Cytochrome P450 system.

Generic Name	Flucytosine (5-FC)
Brand Name	Ancobon
Indications	Systemic fungal infections in combination with Amphotericin B or fluconazole.
Dose	50 mg/kg q 12 hrs; given for 2-6 weeks.
Route	PO, IV
Levels and Metabolism	Therapeutic levels: 25-50 mcg/mL. Obtain trough immediately before the next dose. Maintain trough ≥ 25mcg/mL to prevent emergence of resistance. Absorption: 75-90%; widely distributed into body tissues and fluids. Minimal hepatic metabolism. Eliminated unchanged in the urine.
Precautions	Toxicity related to serum concentrations above 80 mcg/ml; use with caution in patients with renal impairment; dosage adjustment required. May cause enterocolitis, nausea, vomiting, diarrhea, rash, anemia, leukopenia, thrombocytopenia, elevated liver enzymes, increased BUN or creatinine, and CNS derangements.

Generic Name	Folic Acid
Brand Name	Folvite
Indications	Folic acid deficiency.
Dose	Premature infants: 50 mcg/24 hrs (~15 mcg/kg/24 hrs).
Route	IV, IM, PO, SubQ
Levels and Metabolism	Total folate Serum levels: 5-15 ng/mL.
Precautions	May cause allergic reactions. Large doses may mask the hematologic effects of vitamin B-12 deficiency but will not prevent the progression of neurologic abnormalities.

Generic Name	Furosemide
Brand Name	Lasix
Indications	Diuresis in CHF, conditions of fluid overload or pulmonary edema, oliguria not secondary to hypovolemia, and in infants with BPD.
Dose	Intermittent: 1-3 mg/kg/dose IV, IM, or PO given q 12-24 hrs. Continuous IV infusion: 0.05 mg/kg/hr, titrate dosage to clinical effect.
Route	IV, IM, PO
Levels and Metabolism	Onset of action: 30-60 min (PO), 30 min (IM), 5 min (IV). Absorption: 65% with normal renal function; duration of effect ~6 hrs. Eliminated primarily unchanged in the urine.
Precautions	May cause sodium, calcium and potassium depletion, dehydration, and hypochloremic metabolic alkalosis. Hypercalciuria and development of renal calculi with chronic therapy. Ototoxicity, including both transient and permanent hearing loss. Increased risk of deafness in presence of renal failure and with aminoglycoside use. In infants on digoxin, potassium depletion may exacerbate digoxin toxicity. Displaces bilirubin from albumin especially in doses greater than 1 mg/kg.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mg/kg/hr) x Weight (kg)}}{\text{Concentration (mg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Filgrastim (G-CSF)
Brand Name	Neupogen
Indications	Neutropenia, ANC < 500.
Dose	IV, SubQ: 5-10 mcg/kg/day. Give once daily until ANC >1000 or 5 doses have been given.
Route	IV, SubQ
Levels and Metabolism	Onset of action: immediate, transient leukopenia followed by a sustained elevation in neutrophils within 24 hrs.
Precautions	May cause low grade fever, mild anemia, and mild decreases in platelets.

Generic Name	Gentamicin

Brand Name Garamycin

Indications Infections caused by susceptible gram negative organism (such as E. colli, Pseudomonas, Proteus). Used in combination with ampicillin as empiric therapy for newborn sepsis.

Dose IV or IM dosing for suspected or proven neonatal infection:

Postnatal Age (Weeks)	Postnatal Age (Days)	Dose (mg/kg)	Interval (hrs)
≤ 29	0 to 7 8 to 28 ≥ 29	5 4 4	48 36 24
30 to 34	0 to 7 ≥ 8	4.5 4	36 24
≥ 35	All	4	24

Administer over 15-30 min.

Intraventitricular/Intrathecal: 1 mg/day (use preservative free preparation)

Route IV, IM, IT/IVT

Levels and Metabolism **Therapeutic Drug Monitoring:**

Peak: 5-10 mcg/mL; drawn 30 min after the end of a 30 min IV-infusion or 1 hr after an IM injection.

Trough: 0.5-2 mcg/mL; drawn within 30min before next dose.

Serum concentrations should be checked with third dose.

Distributes primarily within the extracellular fluid volume and in most tissue; poor penetration into the CSF. Accumulates in the renal cortex. Volume of distribution increases in neonates with fever, edema, ascites, and fluid overload. Hal-life: 3-12 hrs. Eliminated completely unchanged in urine.

Precautions May cause ototoxicity (vertigo or deafness) and nephrotoxicity at high serum levels. Causes destruction of cochlear hair cells and vestibular sensory cells. Deafness is usually irreversible. May potentiate effects of neuromuscular blocking agents and aggravate effect of hypermagnesemia.

Generic Name	Glucagon
Band Name	Glucagen
Indications	Hypoglycemia, refractory to dextrose infusion.
Dose	**Hypoglycemia associated with diabetes:** 0.02 mg/kg **Endogenous hyperinsulinemia:** 0.1-0.2 mg/kg/dose, repeated q 20 min prn. Maximum total dose: 1 mg. By continuous IV infusion 1-18 mcg/kg/hr, adjusted according to response (max. 50 mcg/kg/hrs).
Route	IV, IM, SubQ
Levels and Metabolism	Onset of action: 8-10 min (IM) and 1min (IV); Duration: 12-27 min (IM) and 9-17 (IV). Extensively degraded in liver and kidneys. Half-life: 6-8 min.
Precautions	May deplete glycogen stores. At high doses cardiac stimulatory effects. May cause nausea, vomiting, and respiratory distress. 1 unit of glucagon = 1 mg of glucagon

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/hr) x Weight (kg)}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Heparin
Brand Name	Multiparin
Indications	Anticoagulation to maintain patency of peripheral and central catheters, treatment of thrombosis.
Dose	**Patency of Catheters:** 0.5-1 Units/ml of IV fluid. **Line Flushing:** 10 Units/mL commonly used; volume of heparin flush is usually similar to volume of catheter. **Systemic Heparinization:** Initial loading dose: 75 Units/kg given over 10 min (use 50 Units/kg if patient <35 weeks) followed by continuous IV infusion: 28 Units/kg/hr.
Route	IV
Levels and Metabolism	Adjust dosing to maintain APTT of 60-85 seconds (1.5-2.5 times control value). Obtain blood for APTT 4 hrs after heparin loading dose and 4 hrs after every infusion rate change. Metabolized by liver. Excretion by kidneys should occur within 6 hrs, but may be delayed. Half-life is dose-dependent, but averages 1-3 hrs.
Precautions	May cause hemorrhage, allergy, thrombocytopenia, elevated liver enzymes. Antidote: Avoid in infants with evidence of intracranial or gastrointestinal bleeding, or thrombocytopenia (less than 50,000/ mm^3).

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (Units/kg/hr) x Weight (kg)}}{\text{Concentration (Units/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Hyaluronidase
Brand Name	Wydase
Indications	Hyaluronidase is a protein enzyme that enhances the permeability of tissue, facilitating Absorption of extravasated IV fluid. Severe tissue infiltration/ extravasation of IV solutions, especially hypertonic solutions or drugs that are irritating such as calcium, vancomycin, naficillin, and aminophylline.
Dose	Give SubQ or intradermally 1 mL (150 Units) as 5 separate 0.2-ml injections around the periphery of extravasation site. Use 25 or 26-gauge needle and change needle after each injection. Approach lesion from periphery and beneath - do not inject directly into the affected area. Use within 1 hr of extravasation for best results.
Route	SubQ
Levels and Metabolism	Onset of action immediate. Duration: 24-48 hrs.
Precautions	Not recommended for IV use. Do not infiltrate into infected areas or use for infiltrations/extravasations of vasoconstrictive drugs such as dopamine, epinephrine, and norepinephrine.

Generic Name	Hydralazine
Brand Name	Apresoline
Indications	Hypertension, afterload reduction in patients with congestive heart failure.
Dose	Intermittent: 0.1-0.5 mg/kg/dose given slow IV push, IM, or PO q 4-6 hrs as needed for blood pressure control. Dose may be gradually increased to max. of 6 mg/kg/day PO in 2-4 divided doses or 3 mg/kg/day IV in 4-6 divided doses. Continuous IV infusion: 12.5-50 mcg/kg/hr.
Route	IV, IM, PO
Levels and Metabolism	Onset of action: 20-30 min (PO) and 5-20 min (IV). Duration: 2-4 hrs (PO) and 2-6 hrs (IV). Bioavailability: 30-50% (large first pass effect); Metabolized by the liver; 14% eliminated unchanged in urine.
Precautions	Lupus-like syndrome, blood dyscrasias (anemia, agranulocytosis), tachycardia, nasal congestion, diarrhea, and emesis.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/hr) x Weight (kg)}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Human Milk Fortifier

Brand Name Human Milk Fortifier (HMF)

Indications Nutritional supplementation of breast milk for premature infants.

Dose

1. Shake container of human milk to be fortified.
2. Pour desired amount of human milk into a container according to the following schedule:

Additional Calories Desired	Human Milk	Enfamil Human Milk Fortifier
2 Calories/fluid ounce	50 mL	1 packet
4 Calories/fluid ounce	25 mL	1 packet

3. Add the HMF powder to the measured human milk, cap container, **shake well**, and feed.
4. Use within 4 hours of preparation, or within normal hospital policy and procedures. **Shake well** before using.

Route PO

Precautions May cause hypercalcemia. Improper dilution may be harmful. Nutritionally incomplete.

References Enfamil Human Milk Fortifier product insert.

Generic Name	Hydrochlorothiazide
Brand Name	Esidrix, Hydrodiuril
Indications	Diuresis in mild to moderate edema and mild to moderate hypertension. Effects potentiated when used with furosemide or spironolactone. May improve pulmonary function in patients with BPD.
Dose	1-2 mg/kg/dose q 12 hrs PO.
Route	PO
Levels and Metabolism	Rapidly absorbed from GI tract. Onset of action within 2 hrs. Half-life dependent on GFR. Eliminated unchanged in urine.
Precautions	May cause hypokalemia, hyperglycemia, and hyperuricemia. Do not use in patients with significant renal or hepatic impairment.
Extemporaneous Preparation	A 10 mg/mL oral syrup can be made with tablets. Crush forty 25 mg Hydrochlorothiazide tablets into a powder using a mortar and pestle. Mix with simple syrup vehicle and q.s. to 100 mL. Stable for 60 days in refrigerator.

References:

Hydrochlorothiazide 10 mg per mL Oral Syrup. *International Journal of Pharmaceutical Compounding*, Nov/Dec 2005, 9(6).

Generic Name	Hydrocortisone
Brand Name	Cortef, SoluCortef
Indications	Septic shock, adrenal insufficiency, congenital adrenal hyperplasia, allergic reaction, neonatal hypoglycemia refractory to other treatments.
Dose	**Physiologic Replacement:** 6-12 mg/m^2/day IV or IM; 12-24 mg/m^2/day PO in 2-3 divided doses. **Congenital Adrenal Hyperplasia:** 12.5 mg/m^2/day IV or IM; 25 mg/m^2/day PO. **Shock:** 20-30 mg/m^2/day IV in 2-3 divided doses or ~1 mg/kg/dose q 8 hrs. **Stress Doses:** 25-50 mg/m^2/day IV or IM divided q 6 hrs; 75 mg/m^2/day PO divided q 6-8 hrs. **Acute Adrenal Crisis:** 50 mg/m^2 IV bolus followed by 50 mg/m^2 divided q 6-8 hrs. **Neonatal Hypoglycemia:** IV/PO: 5 mg/kg/day, divided q 8-12 hrs or 1-2 mg/kg/dose q 6 hrs.
Route	IV, IM, PO
Levels and Metabolism	Absorption is rapid; Half-life 8-12 hrs; Metabolized in the liver and eliminated in the urine.
Precautions	In acute use may mask signs of infection or exacerbate systemic fungal infections. Chronic use may cause growth failure, peptic ulcer, hypertension, sodium and water retention, increased excretion of potassium, and bone demineralization. ***For body surface area (BSA) calculation see appendix.***
Extemporaneous Preparation	A 2 mg/mL oral suspension can be made with tablets. Crush ten 20 mg Hydrocortisone tablets in a mortar to a fine powder. Wet powder with a minimal amount of 1:1 Ora-Plus/Ora-Sweet as a vehicle to form a viscous but smooth and uniform mixture. Continue adding the vehicle in incremental proportions to **almost** 100 mL; transfer to a calibrated bottle, rinse mortar with vehicle, and add quantity sufficient to make 100 mL. Stable for 60 days refrigerated (preferred) or at room temperature. Shake well before use.

References:

1. Chong G, et al, "Stability of Hydrocortisone in Extemporaneously Compounded Suspensions," *J Inform Pharmacother*, 2003;13:100-110.
2. Nationwide Children's Hospital and Toronto Children's Hospital for Sick Children Experience since 2004.
3. Fawcett JP, Boulton DW, Jiang R, Woods DJ. Stability of Hydrocortisone Oral Suspensions Prepared from Tablets and Powder. *Ann of Pharma*, 1995;29:987-90.

Generic Name	Ibuprofen Lysine
Brand Name	Neoprofen
Indications	Closure of the ductus arteriosus (PDA) for premature infants at age 2 days or greater
Dose	Initial dose: 10 mg/kg/dose followed by 2 doses of 5 mg/kg/dose given 24 hours and 48 hours after the initial dose. Administer over 15 minutes. Use birth weight to calculate all doses. Hold second and third doses if urine output is <0.6 mL/kg/hr; may give when renal function improves.
Route	IV
Levels and Metabolism	Ibuprofen is 95% protein bound and has a volume of distribution of 320 mL/kg. The metabolism and excretion of ibuprofen have not been well studied in preterm infants.
Precautions	Ibuprofen is contraindicated in premature neonates with at least one of the following: 1. Proven or suspected infection that is untreated 2. Congenital heart disease in which patency of the ductus arteriosus is necessary for satisfactory pulmonary or systemic blood flow 3. Active bleeding, especially intracranial hemorrhage or gastrointestinal bleeding 4. Thrombocytopenia 5. Coagulation defects 6. Suspected NEC 7. Significant impairment of renal function

Generic Name	Imipenem and Cilastatin
Brand Name	Primaxin
Indications	Effective against most gram-negative and gram-positive bacteria, both aerobes and anaerobes, including Pseudomonas aeruginosa and Bacteroides fragilis. Marked activity against species producing Beta-lactamases. Should be reserved for use against organisms that are resistant to the usual antibiotics.
Dose	**Neonates:** 0-4 weeks, < 1200 g: 20 mg/kg/dose q 18-24 hrs. PNA ≤7 days, 1200-1500 g: 40 mg/kg/day, divided q 12 hrs. PNA >7 days, 1500 g: 75 mg/kg/day, divided q 8 hrs.
Route	IV
Levels and Metabolism	Low CSF penetration; Half-life 1.5-3 hrs. Renal metabolism and excretion; 70-80% as unchanged in the urine.
Precautions	Use with caution in patients with seizures. Dose adjustment required in renal impairment. May cause nausea, vomiting, diarrhea, skin rash, phlebitis, eosinophilia, and transient elevation of liver function tests.

Generic Name	Indomethacin
Brand Name	Indocin
Indications	Closure of patent ductus arteriosus, prevention of intraventricular hemorrhage.
Dose	**Treatment of PDA:** Usually 3 doses per course:

Age at 1st dose	1st dose	2nd dose	3rd dose
< 48 hrs	0.2 mg/kg	0.1 mg/kg	0.1 mg/kg
2-7 days	0.2 mg/kg	0.2 mg/kg	0.2 mg/kg
> 7 days	0.2 mg/kg	0.25 mg/kg	0.25 mg/kg

Give doses 12-24 hrs apart.

Longer treatment courses maybe used: 0.2 mg/kg/day for up to 5-7 days.

Prevention of IVH for infants with a birth weight ≤ 1 kg or gestational age

≤ 28 weeks: 0.1 mg/kg q 24 hrs for 3 doses beginning at 6-12 hrs of age.

Route	IV
Levels and Metabolism	Metabolized in the liver and eliminated in the feces and urine. Half-life ranges between 11-20 hrs.
Precautions	May cause transient decrease in urine output. If anuria or severe oliguria occurs, doses should be delayed. May cause hyponatremia, hypokalemia and hypoglycemia. Causes platelet dysfunction and decreased GI blood flow. Contraindicated in active bleeding, significant thrombocytopenia, NEC, and significant renal impairment.

Generic Name	Insulin (Regular)
Brand Name	Humlin, Novolin
Indications	Hyperglycemia in very-low-birth weight infants with persistent glucose intolerance, adjuvant therapy for hyperkalemia.
Dose	Intermittent: 0.1-0.2 Units/kg q 6-12 hrs SubQ or IV. Continuous infusion: 0.01-0.1 Units/kg/hr. Titrate to blood glucose levels. **Hyperkalemia:** 0.05 Units/kg regular insulin + 0.5-1 g/kg using D10W (infuse dextrose over 15 min followed by insulin). *Please see appendix for protocol.*
Route	IV, SubQ
Levels and Metabolism	Plasma half-life is ~9 min (adults). Degraded in the liver and kidney.
Precautions	Neonates are very sensitive to hypoglycemia; start at lower end of dose and monitor serum glucose closely. Check blood glucose levels every 15-30 minutes after initiation of insulin infusion and after changes in infusion rate.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (Units/kg/hr) x Weight (kg)}}{\text{Concentration (Units/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Intravenous Immune Globulin (IVIG)
Brand Name	Octagam
Indications	Hypogammaglobulinemia, alloimmune thrombocytopenia.
Dose	**Hypogammaglobulemia:** Usual dose 0.5 g/kg as single dose every 4 weeks. **Alloimmune thrombocytopenia:** 0.4-1 g/kg as single dose infused over 6 hrs. **Severe hemolysis (Rh or ABO iso)**: When the total serum bilirubin levels approach or surpass the exchange transfusions limits: 0.5-1 g/kg in the first few hours of life, to be infused over 2-4 hours and the dose can be repeated 2-3 times.
Route	IV
Levels and	Maintain trough IgG ≥ 500 mg/dL.
Metabolism	Half-life: 21-29 days.
Precautions	May cause volume overload, infuse over 2-6 hours, monitor for infusion related side effects (hypersensitivity reaction.). May cause acute renal failure. Start infusion at 0.01 mL/kg/min; double rate q 15-30 min, up to a max of 0.08 mL/kg/min (refer to individual IVIG product for administration guidelines).

Generic Name	Ipratropium
Brand Name	Atrovent
Indications	Anticholinergic bronchodilator. Used for bronchospasm in infants with bronchopulmonary dysplasia (BPD).
Dose	25 mcg/kg/dose 3 times a day.
Route	Nebulization
Levels and Metabolism	Not readily absorbed into the systemic circulation from the lung or GIT. Following inhalation 15% of dose reaches the lower airways. Onset of action: 1-3 min; peak effect: ~2 hrs; duration: ~4-6 hrs.
Precautions	May cause palpitation and tachycardia.

Generic Name	Isoproterenol
Brand Name	Isuprel
Indications	Cardiovascular shock, impaired cardiac output with bradycardia, and as pulmonary vasodilator (older infants).
Dose	Continuous IV infusion: 0.05-0.5 mcg/kg/min; increase or decrease dose to achieve desired clinical effect. Max. dose: 2 mcg/kg/min.
Route	IV
Levels and Metabolism	Metabolized in the liver and lungs; Half-life 2-5 min.
Precautions	May cause hypoglycemia, arrhythmias, tachycardia severe enough to cause CHF, systemic vasodilatation, decreases venous return to the heart, hypoxemia by increasing intrapulmonary shunting and tissue sloughing from infiltrations.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Ketamine
Brand Name	Ketalar
Indications	Anesthesia, analgesia for short surgical procedures before intubation.
Dose	IM: 4 mg/kg; IV: 0.5-2 mg/kg.
Route	IV, IM
Levels and metabolism	Onset of action: 3-4 min (IM) and 30 seconds (IV); Duration: 12-25 min (IM) and 5-10 min (IV). Metabolized in the liver; Half-life: 10-15 min.
Precautions	May cause hypertension, hypotension, seizures, increases ICP, laryngospasm, and stimulation of salivary secretions.

Generic Name	Levetiracetam
Brand Name	Keppra
Indications	Neonatal seizures.
Dose	**Neonates:** IV, PO: Initial 10 mg/kg once daily, increased gradually by max. 10 mg/kg twice daily every 2 weeks; max. 30 mg/kg twice daily.
Route	IV, PO
Levels and metabolism	Oral absorption rapid and complete; Bioavailability ~100%. Metabolism is not extensive; ~70% excreted unchanged in urine and the remainder as inactive metabolites.
Precautions	Dose adjustment needed in renal impairment. May cause vomiting, diarrhea, and somnolence.

Generic Name	Levothyroxine (T_4)
Brand Name	Synthroid
Indications	Congenital or acquired hypothyroidism.
Dose	PO: 10-15 mcg/kg/dose daily. IV, IM: 50-75% of PO dose.
Route	PO, IV, IM
Levels and Metabolism	PO absorption erratic (40-80%). Metabolism: liver and peripheral sites to triiodothyronine (active). Half-life: 6-7 days. Eliminated in the urine and feces.
Precautions	Monitor TSH and T_4 after 2 weeks of therapy. Assess for signs of hypothyroidism and thyrotoxicosis. Give oral doses one hour before or 2 hrs after feeds, preferably in the morning.
Extemporaneous Preparation	A 25 mcg/mL oral suspension may be made with tablets and 40 mL glycerol. Crush twenty-five 0.1 mg levothyroxine tablets in a mortar and reduce to a fine powder. Add small portions of glycerol and mix to a uniform suspension. Transfer to a calibrated 100 mL amber bottle; rinse the mortar with about 10 mL of glycerol and pour into the bottle; repeat until all 40 mL of glycerol is used. Add quantity of water sufficient to make 100 mL. Label «shake well» and «refrigerate». Stable for 8 days refrigerated.

References:

Boulton DW, Fawcett JP, and Woods DJ. Stability of an Extemporaneously Compounded Levothyroxine Sodium Oral Liquid. *AJHP*, 1996; 53(10):1157-61.

Generic Name	Lidocaine
Brand Name	Xylocaine
Indications	Ventricular arrhythmias: premature ventricular contractions, ventricular tachycardia, ventricular fibrillation.
Dose	Stat dose: 0.5-1 mg/kg IV push over 5 minutes. May repeat every 5-10 min prn. Maximum total dose 5 mg/kg. Continuous IV infusion:10-50 mcg/kg/min.
Route	IV
Levels and Metabolism	Onset of action: 45-90 seconds; Duration: 10-20 min; Protein binding: 60-80%; Metabolized in the liver to active metabolite; Half-life up to 3 hrs. <10% eliminated unchanged in the urine.
Precautions:	May cause CNS toxicity, seizures and cardiac toxicity. Use with caution in hepatic or renal disease due to potential accumulation of toxic levels.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Lorazepam
Brand Name	Ativan
Indications	Seizures, sedation
Dose	0.05-0.1 mg/kg over 2-5 min, may be repeated in 10-15 min.
Route	IV, IM, PO
Levels and Metabolism	Onset of action: 5 min. Mean half-life: 40 hrs; Metabolized in the liver.
Precautions	May cause respiratory depression. Neurotoxicity and myoclonus have been reported. Antidote: Flumazenil 0.01 mg/kg/dose IV push. May repeat every minute for up to 4 more doses.

Generic Name	Magnesium Sulfate
Indications	Hypomagnesemia, hypocalcemia, torsade de pointes (polymorphic ventricular tachycardia), and severe persistent pulmonary hypertension of the newborn unresponsive to other vasodilation management, if nitric oxide is not available.
Dose	Hypomagnesemia: 25-100 mg/kg/dose (0.2-0.8 mEq/kg/dose) IV q 8-12 hrs for 2-3 doses. Maintenance: 0.25-0.5 mEq/kg/day IV. Hypocalcemia: 100 mg/kg IV q12 hrs for 2-3 doses.
Route	IV, IM
Precautions	May cause heart block, CNS and respiratory depression, hypotension, intestinal ileus, urinary retention, hypotonia and hypermagnesemia. Monitor magnesium level.

Generic Name	MCT Oil
Indications	Caloric supplementation for patients who cannot digest long chain fats.
Dose	Initial: 0.5 ml every other feeding, then advance to every feeding. Increase in increments of 0.25-0.5 ml per feeding at intervals of 2-3 days as tolerated. 1 ml = 0.93 g = 7.6 calories.
Route	PO
Levels and Metabolism	Up to 30% absorbed unchanged as triglyceride; almost completely oxidized by liver to acetyl COA and carbon dioxide; ~20% eliminated in expired CO_2 in 50 min; <10% in feces.
Precautions	May cause sedation, ketosis, abdominal pain, and diarrhea. Does not provide essential fatty acids.

Generic Name	Meropenem
Brand Name	Merrem
Indications	Treatment of multidrug resistant gram negative and gram positive aerobic and anaerobic pathogens.
Dose	**PNA ≤ 7 days:** 20 mg/kg/dose q 12 hrs. **PNA > 7days:** 1200-2000 g: 20 mg/kg/dose q 12 hrs. > 2000 g: 20 mg/kg/dose q 8 hrs. **Miningitis:** 40 mg/kg/dose q 8 hrs.
Route	IV
Levels and Metabolism	Penetrates to most tissues and body fluids including CSF, bone, bile, and lung tissue; 20% hydrolyzed in the plasma to inactive metabolite; half-life 2-3 hrs; 70% excreted in urine unchanged.
Precautions	Use with caution in patients with history of seizures and renal impairment. May cause diarrhea and hypotension. Monitor for: - Thrombocytosis and eosinophilia with prolonged use. - Renal function - increase dose interval in renal failure. - Hepatic function – at the beginning of treatment and weekly thereafter. - Vomiting and pseudomembranous colitis – consider alternate antibiotic.

Generic Name	Metoclopramide
Brand Name	Reglan
Indications	Facilitate gastric emptying and GI motility.
Dose	0.03-0.2 mg/kg/dose given q 6-8 hrs PO or IV.
Route	IV, PO
Levels and Metabolism	Absorbed well from GI tract. Variable first-pass metabolism by liver. Lipid-soluble; large volume of distribution. Significant fraction excreted unchanged in urine.
Precautions	Intended for short-term use only (several weeks). Dystonic reactions and extrapyramidal signs may be seen with prolonged use. May cause seizures.

Generic Name	Metolazone
Brand Name	Mykrox
Indications	Thiazide-like diuretic, used for edema resistant to loop diuretics.
Dose	Children: 0.2-0.4 mg/kg/day, divided every 12-24 hrs.
Route	PO
Levels and Metabolism	Onset of action: ~1 hr; Half-life: 6-20 hrs; 70-95% excreted unchanged in urine.
Precautions	Safety and effectiveness in pediatric patients have not been established in controlled clinical trials. May cause electrolyte disturbances, hypotension, tachycardia, and bone marrow suppression.
Extemporaneous Preparation	A 1 mg/mL oral suspension may be made by with tablets and one of three different vehicles (cherry syrup diluted 1:4 with simple syrup; a 1:1 mixture of Ora-Sweet and Ora-Plus; or a 1:1 mixture of Ora-Sweet SF and Ora-Plus). Crush twelve 10 mg tablets in a mortar and reduce to a fine powder. Add small portions of the chosen vehicle and mix to a uniform paste; mix while adding the vehicle in incremental proportions to **almost** 120 mL; transfer to a calibrated bottle, rinse mortar with vehicle, and add quantity of vehicle sufficient to make 120 mL. Label "shake well" and "refrigerate". Stable for 60 days.

References

Nahata, MC, Pai VB, and Hipple TF, *Pediatric Drug Formulations*, 5th ed, Cincinnati, OH: Harvey Whitney Books Co, 2004.

Generic Name	Metronidazole
Brand Name	Flagyl
Indications	Anaerobic bacterial and protozoal infections such as, amebiasis, giardia lamblia, trichamonas. Treatment of antibiotic associated colitis caused by C. difficile.

Dose

Weight	Age	Amount per Dose	Dose Interval
< 1200 g	0-28 days	7.5 mg/kg	q 48 hrs
1200-2000 g	0-7 days	7.5 mg/kg	q 24 hrs
1200-2000 g	>7 days	7.5 mg/kg	q 12 hrs
>2000 g	0-7 days	7.5 mg/kg	q 12 hrs
> 2000 g	>7 days	15 mg/kg	q 12 hrs

May give IV or PO.

Route	IV, PO
Levels and Metabolism	Good oral absorption; widely distributed in body tissues and fluids including bile, bone, CSF. Metabolized in the liver. Half-life 25-75 hrs; 20% eliminated unchanged in urine and up to 15% in feces.
Precautions	Use with caution in liver impairment. May cause nausea, vomiting, neutropenia, and rarely seizures.

Generic Name	Midazolam
Brand Name	Versed
Indications	Sedation and anesthesia and refractory seizures.
Dose	**Moderate (Conscious) Sedation for Mechanical Ventilation:** Continuous IV infusion: 0.2-1 mcg/kg/min. **Sedation for Procedures or Pre-op:** IV, IM: 0.05-0.1 mg/kg/dose, may repeat q 2-4 hrs as needed. PO: 0.25 mg/kg/dose. **Anticonvulsant:** Loading dose: 0.15 mg/kg (150 mcg/kg) IV given over at least 5 minutes. Maintenance infusion: 0.06-0.4 mg/kg/hr (or 1-7 mcg/kg/min).
Route	IV, IM, PO
Levels and Metabolism	PO absorption rapid; Onset of action: 10-20 min (PO), 1-5 min (IV, IM); Half-life 4-17 hrs. Metabolized by hydroxylation and conjugation prior to excretion in urine. Metabolites have little sedative effect.
Precautions	Use with caution in patients with renal and hepatic dysfunction. May cause respiratory depression. May cause myoclonus in premature infants. Rapid IV injection may cause hypotension and seizures.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mg/kg/hr) x Weight (kg)}}{\text{Concentration (mg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Milrinone
Brand Name	Primacor
Indications	Short term treatment of low cardiac output states (not responding to other treatments). e.g., due to sepsis, CHF.
Dose	**Loading dose:** 50 mcg/kg IV infused over 30-60 min followed by maintenance infusion. **Maintenance dose:** 0.25-0.75 mcg/kg/min. Dose should be titrated based on hemodynamic and clinical response.
Route	IV
Levels and Metabolism	Onset of action: 5-15 min; Half-life 1-5 in infants. Excreted in the urine as unchanged drug (~85%) and liver metabolite (~15%).
Precautions	Monitor for hypotension, electrolyte changes, thrombocytopenia, hepatotoxicity, and renal function. Dose adjustment required in renal impairment.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Morphine sulfate
Indications	Analgesia, sedation and treatment of iatrogenic withdrawal.
Dose	Intermittent: IM, IV, SubQ: 0.05 mg/kg q 4-8 hrs; max dose: 0.1 mg/kg/dose. Continuous IV infusion: 0.01-0.04 mg/kg/hr. **Treatment of iatrogenic withdrawal:** – Due to morphine infusion: equivalent DAILY dose divided q 4 hrs: ***Example:*** *1.5 kg baby receiving 0.05 mg/kg/hr morphine* *DAILY morphine dose = 1.8 mg (i.e. 0.05 mg/kg/hr x 1.5 kg x 24 hrs)* *Morphine dose = 1.8 mg divided every 4 hours = 0.3mg IV q 4 hrs* – Due to fentanyl infusion: 50 times HOURLY fentanyl dose given q 4 hrs: ***Example:*** *1.5 kg baby receiving 3 mcg/kg/hr fentanyl.* *HOURLY fentanyl dose = 4.5 mcg (i.e. 3 mcg/kg/hr x 1.5 kg)* *Morphine dose = 50 X 4.5 mcg = 225 mcg = 0.225 mg = 0.23 mg IV q 4 hrs* Reduce dose by 10-20% of original dose every 24-72 hrs. Adjust weaning schedule based on signs and symptoms of withdrawal. – Give IV push over 5 minutes. – Oral dose is approximately 3 to 5 times IV dose (Example: 0.2 mg IV = 0.6–1 mg PO)
Route	IV, IM, SubQ
Levels and Metabolism	Poorly absorbed when given PO. Metabolized by the liver (conjugated to glucuronide) and excreted by the kidney. Half-life reported to be 10-20 hrs in preterm infants.
Precautions	May cause dependence, CNS and respiratory depression, seizures, nausea, vomiting, ileus, constipation, hypotension, bradycardia, peripheral vasodilatation, and urinary retention. **Neonatal Abstinence Syndrome** - Start when infant has a Finnegan score of > 8 three times or >10 twice, seizures, or significant weight loss. - Initial PO dose: (based on Finnegan Neonatal Abstinence Scoring): Scores 8-10: 0.24 mg/kg/day, divided q 3-4 hrs Scores 11-13: 0.28 mg/kg/day, divided q 3-4 hrs Scores 14-16: 0.32 mg/kg/day, divided q 3-4 hrs Scores ≥17: 0.36 mg/kg/day, divided q 3-4 hrs ***Calculating infusion rate (mL/hr)** = $\frac{\text{Dose (mg/kg/min) x Weight (kg)}}{\text{Concentration (mg/mL)}}$ ** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Nafcillin
Brand Name	Unipen, Nafcil
Indications	Treatment of infections caused by penicillinase-producing staphylococcus.

Dose

Age, Weight	Total Daily Dose	Divided
0-7 days, < 2000 g	50 mg/kg	q 12 hrs
0-7 days, > 2000 g	75 mg/kg	q 8 hrs
>7 days, < 2000 g	75 mg/kg	q 8 hrs
>7 days, > 2000 g	100 mg/kg	q 6 hrs

Route	IV
Levels and Metabolism	Distributed into bile, bone, synovial, and pericardial fluids; CSF penetration poor unless meninges are inflamed; Half-life: 2-5 hrs; eliminated primarily in bile; 10-30% eliminated unchanged in urine.
Precautions	Use with caution in infants with hepatic dysfunction. Irritating to veins; observe for phlebitis. May cause hypokalemia, neutropenia, anemia, eosinophilia, and rarely interstitial nephritis.

Generic Name	Naloxone
Brand Name	Narcan
Indications	Neonatal respiratory depression secondary to narcotics.
Dose	Give 0.1 mg/kg/dose IV, IM, ET, or SubQ; doses as low as 0.01mg/kg may be given, repeat q 2-3 min if needed.
Route	IV, IM, SubQ, ET
Levels and Metabolism	Onset of action: 2-5 min; Half-life: 1.2-3 hrs. Metabolized by the liver and excreted in the urine.
Precautions	May precipitate withdrawal symptoms in neonates with physical dependence to narcotics.

Generic Name	Nitroprusside
Brand Name	Nipride, Nitropress
Indications	Hypertension, reduction of afterload.
Dose	Initial dose: 0.25-0.5 mcg/kg/min IV continuous infusion, titrate to achieve desired effect to max. of 4 mcg/kg/min. Maintenance dose: < 2 mcg/kg/min.
Route	IV
Levels and Metabolism	**Therapeutic Drug Monitoring:** Thyocyanate: toxic level: 35-100 mcg/mL. Cyanide: toxic level: >2 mcg/mL. Hypotensive effect: onset of action: within 2 min; duration: 1-10 min. Metabolized by erythrocytes and tissue sulfhydryl group to cyanide; cyanide is then metabolized in the liver by rhodanase to thiocyanate which is then eliminated in the urine. Half-life: <10 min (thiocyanate: 3-7 days).
Precautions	May cause excessive hypotension and tachycardia. Requires careful monitoring of BP and prompt adjustment of infusion rate. Use with caution in renal and hepatic impairment. Protect from light.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Norepinephrine
Brand Name	Levophed
Indications	Treatment of shock, severe hypotension.
Dose	0.02-0.1 mcg/kg/min, max. dose: 1 mcg/kg/min.
Route	IV
Levels and Metabolism	Onset of action rapid with limited duration. Metabolized by catchol-o methyl tranoferase and monoamine-oxidase enzymes then eliminated in the urine.
Precautions	Hypovolemia should be corrected before norepinephrine use. May cause arrhythmias, hypertension, and organ ischemia. Administer through a central line (UVC, Longline, or Surgical CVL). Dose listed above is a guide only and must be considered in light of clinical response. Begin at low dose and titrate to effect. Dosages should be increased or decreased in small increments only.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mcg/kg/min) x Weight (kg) x 60 min/hr}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Nystatin
Brand Name	Mycostatin
Indications	Treatment of cutaneous and mucocutaneous Candidal infections.
Dose	Thrush: 100,000 units (1 mL) q 6-8 hrs. Prophylaxis: 100,000 units (1 mL) q 8 hrs. Diaper rash: Topical cream, ointment, or powder applied 2-4 times per day.
Route	PO, topical
Levels and Metabolism	Poorly absorbed; eliminated in feces unchanged.
Precautions	May cause diarrhea, GI symptoms, contact dermatitis.

Generic Name	Octreotide
Brand Name	Sandostatin
Indications	Treatment of hyperinsulinemic hypoglycemia (nesidioblastosis) and as an adjunct treatment for chylothorax.
Dose	**Hyperinsulinemic Hypoglycemia:** 1 mcg/kg/dose q 6 hrs SubQ or IV. Titrate to response. Max. dose: 10 mcg/kg/dose q 6 hrs. **Chylothorax:** Start at 1 mcg/kg/hr SubQ or IV continuous infusion. Titrate upwards as needed up to a max. of 7 mcg/kg/hr. Monitor chyle production.
Route	IV, SubQ
Levels and Metabolism	Extensively metabolized by the liver; 30% excreted unchanged in the urine.
Precautions	May cause cholelithiasis, biliary sludge, elevated liver enzymes, increased CPK, hypoglycemia, nausea, vomiting, and fat malabsorption.

***Calculating infusion rate (mL/hr) =**

$$\frac{\text{Dose (mcg/kg/hr) x Weight (kg)}}{\text{Concentration (mcg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Omeprazole
Brand Name	Aciloc, Losec
Indications	Gastro-esophageal reflux disease, esophagitis, or peptic ulceration.
Dose	Neonates:PO, IV: 0.5 mg/kg once daily; may be increased to 2 mg/kg once daily.
Route	PO, IV
Levels and Metabolism	Absorption is rapid; metabolized in the liver and eliminated through the kidney; both vary with age. There is insufficient data on metabolism in children less than 2 years. At birth, there is a low level of activity of the enzymes CYP2C19 and CYP3A4 and adult levels of activity are reached in early childhood.
Precautions	• Observe for symptomatic improvement within 3 days • Intraesophageal pH monitoring might be required to assess efficacy • Periodic complete blood count and liver function tests with long term therapy
Preparation	Compatible with are glucose 5%, sodium chloride 0.9%, sodium chloride/glucose combinations. The intravenous is prepared in two steps: **1.** Add 10 mL of sodium chloride 0.9% to the 40 mg omeprazole vial and shake gently to dissolve (total of 10 mL). The resulting solution contains 4 mg/mL omeprazole. **2.** Further dilute 1 mL of the 4 mg/mL omeprazole solution with 9 mL of compatible fluid (total of 10 mL). The resulting solution contains 0.4 mg/mL omeprazole.

Dose	0.5 mg	1 mg	1.5 mg	2 mg	2.5 mg	3 mg
Volume	1.25 mL	2.5 mL	3.7 mL	5 mL	6.25 mL	7.5 mL

Infuse over 20 to 30 minutes

Extemporaneous Preparation: Omeprazole 2 mg/mL Oral Suspension

Materials:

- 5 capsules Omeprazole (20 mg)
- Sodium Bicarbonate solution 8.4% (50 mL)

Preparation: Empty the contents of the capsules into a mortar and triturate gently with about 10 mL of the Sodium Bicarbonate solution. A smooth paste will be formed when the enteric coating has dissolved and the drug is dispersed. Make to volume.

Stability: 14 days at 24°c or 30 days at 5°c. Store in amber containers. Shake before use.

Dose	1 mg	2 mg	3 mg	4 mg	5 mg	6 mg
Volume	0.5 mL	1 mL	1.5 mL	2 mL	2.5 mL	3 mL

References

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2. paediatric patients. Eur J Clin Pharmacol (2010) 66:323–330DOI 10.1007/s00228-009-0774-9
3. Davidson G1, Wenzl TG, Thomson M, Omari T, Barker P, Lundborg P, Illueca M. Efficacy and safety of once-daily esomeprazole for the treatment of gastroesophageal reflux disease in neonatal patients. J Pediatr. 2013 Sep;163(3):692-8.e1-2. doi: 10.1016/j.jpeds.2013.05.007. Epub 2013 Jun 22.
4. Quercia RA, Chengde F, Xinchun L, et al, "Stability of Omeprazole in an Extemporaneoulsy Prepared Oral Liquid," Am J Health-Systs Pharm, 1997; 54:1833-6.

Generic Name	Oxacillin
Brand Name	Bactocill, Prostaphlin
Indications	Treatment of infections due to susceptible penicillinase-producing staphylococcus.

Dose

Age	Total Daily Dose	Divided
0-7 days, < 2000 g	50 mg/kg	q 12 hrs
0-7 days, > 2000 g	75-150 mg/kg	q 8 hrs
>7 days, < 2000 g	75-150 mg/kg	q 8 hrs
>7 days, > 2000 g	100-150 mg/kg	q 6 hrs

Infuse over 30 min.

Route	IV, IM
Levels and Metabolism	Distributes well into bile, pleural and synovial fluids, lungs and bone. Penetrates CSF only when meninges are inflamed. Metabolized in the liver. Half-life: 1.6 hrs.
Precautions	May cause fever, mild leukopenia, and rarely acute interstitial nephritis.

Generic Name	Palivizumab
Brand Name	Synagis
Indications	RSV prophylaxis in high risk infants. **Main indications:** 1. Up to 24 months of age, hemodynamically significant a cyanotic and cyanotic congenital. 2. Heart disease. 3. Less than 24 months of age receiving medical therapy for chronic lung disease within the last 6 months before the start of the RSV season. 4. Up to 12 months of age, born at 28 weeks gestation or earlier. 5. Up to 6 months of age, born at 29 - 32 weeks gestation 6. Less than 6 months of age, born between 32 -35 weeks gestation with at least 2 of the following risk factors: i. School-age siblings ii. Child care attendance iii. Severe neuromuscular disease iv. Congenital abnormalities of the airways
Dose	15 mg/kg once monthly during RSV season.
Route	IM
Levels and Metabolism	Half-life: 20 days.
Precautions	Observe injection site for swelling. Does not interfere with other vaccines.

Generic Name	Pancuronium Bromide
Brand Name	Pavulon
Indications	Skeletal muscle relaxant, paralysis for ventilator therapy or surgery.
Dose	Intermittent: 0.1 mg/kg/dose IV as needed q 30-60 min. Continuous IV infusion: 0.02-0.04 mg/kg/hr.
Route	IV
Levels and Metabolism	Onset of action: 1-2 min. Duration: 40-60 min (dose dependent). Partially metabolized by the liver; 60% excreted unchanged in the urine and 40% unchanged in bile.
Precautions	May cause tachycardia, hypertension, and increased salivation. Potentiated by: acidosis, hepatic disease, renal failure, aminoglycosides, hypermagnesemia, and hypokalemia. Antagonized by: alkalosis, hypercalcemia, and caffeine.

***Calculating infusion rate (mL/hr)** =

$$\frac{\text{Dose (mg/kg/hr) x Weight (kg)}}{\text{Concentration (mg/mL)}}$$

** For recommended standard concentrations and more details on calculations please see the appendix.*

Generic Name	Penicillin G
Indications	Treatment of infections caused by susceptible organisms (such as Streptococci, Neisseria). For congenital syphilis and meningitis.
Dose	**PNA ≤ 7 days:** ≤ 2000 g: 50,000 Units/kg/day, divided q 12 hrs (Meningitis: 100,000 Units/kg/day, divided q 12 hrs). > 2000 g: 75,000 Units/kg/day, divided q 8 hrs (Meningitis: 150,000 Units/kg/day, divided q 8 hrs). Congenital syphilis: 100,000 Units/kg/day, divided q 12 hrs. Group B strep. meningitis: 250,000-450,000 units/kg/day, divided q 8 hrs. **PNA >7 days:** <1200 g: 50,000 Units/kg/day, divided q 12 hrs (Meningitis: 100,000 Units/kg/day, divided q 12 hrs). 1200-2000 g: 75,000 Units/kg/day, divided q 8 hrs (Meningitis: 150,000 Units/kg/day, divided q 8 hrs). > 2000 g: 100,000 Units/kg/day, divided q 6 hrs (Meningitis: 200,000 Units/kg/day, divided q 6 hrs) Congenital syphilis: 150,000 Units/kg/day, divided q 8 hrs. Group B strep. meningitis: 450,000 Units/kg/day, divided q 6 hrs.
Route	IV, IM
Levels and Metabolism	Poor penetration into uninflamed meninges; 10-30% metabolized in the liver; half-life ranges from 1-3 hrs. Excreted unchanged and as metabolite in the urine.
Precautions	May cause anaphylaxis, diarrhea, hemolytic anemia, hematuria, and interstitial nephritis. Seizures may occur with IV bolus injection, particularly with the higher doses used in meningitis.

Generic Name	Phenobarbital
Brand Name	Luminal
Indications	Anticonvulsant (first-line drug for seizures in neonates), narcotic withdrawal, may be used for neonatal hyperbilirubinemia and chronic cholestasis.
Dose	**Anticonvulsant:** Loading dose: 15-20 mg/kg IV as single or divided doses. May give additional boluses: 5-10 mg/kg/dose; max. up to 40 mg/kg total. Maintenance: 3-4 mg/kg/day, IV or PO given once daily; up to 5 mg/kg/day, once daily. **Hyperbilirubinemia:** 3-8 mg/kg/day, IV or PO in 2-3 divided doses.
Route	IV, IM, PO
Levels and Metabolism	Therapeutic serum level: 15-40 mcg/mL. PO absorption: up to 90%; metabolized by liver, then excreted in urine; 20-50% excreted unchanged; excretion enhanced by alkaline urine, half-life ranges between 45-200 hrs.
Precautions	Abrupt withdrawal may cause status epilepticus. Use with caution in hepatic and renal impairment. May cause Respiratory depression, drowsiness, and hyperactivity. Drug interactions: Induces liver enzymes.

Generic Name	Phentolamine
Brand Name	Regitine
Indications	Prevention of dermal necrosis and sloughing due to IV infiltration of drugs with alpha-adrenergic effects such as dopamine or norepinephrine.
Dose	Make solution of 0.25-0.5 mg/mL with normal saline. Inject 1 mL (in 5 divided doses of 0.2 mL) SubQ around site of extravasation; max total dose: 0.1 mg/kg or 2.5 mg total.
Route	SubQ
Levels and Metabolism	Metabolized by the liver; 10-13% excreted unchanged in the urine.
Precautions	May cause hypotension.

Generic Name	Phenytoin
Brand Name	Dilantin
Indications	Seizures refractory to treatment with phenobarbital alone.
Dose	Loading dose: 15-20 mg/kg IV, given over 30 minutes in single or divided doses. Maintenance: 4-8 mg/kg IV or PO, once daily or q 12 hrs.
Route	IV, PO
Levels and Metabolism	Therapeutic serum levels: 6-15 mcg/mL. Obtain initial trough level 48 hrs after IV loading dose. PO absorption slow and variable. Metabolized by the liver. Half-life: 18-60 hrs (depends on serum concentration). Highly variable clearance, dependent upon intrinsic hepatic function and dose given. 85-90% protein-bound.
Precautions	Difficult to use safely and effectively in neonates. Do not exceed infusion rate of 0.5 mg/kg/min; avoid IM. Administration requires 0.22 micron in-line filter. May cause hyperglycemia, osteomalacia, and arrhythmias. Hypersensitivity reactions include: rashes, abnormal LFTs, eosinophilia, and blood dyscrasias. Drug interaction: Induces liver enzymes.

Generic Name	Piperacillin
Indications	Treatment of infections caused by susceptible Pseudomonas aeruginosa, Klebsiella, Serratia, E. coli, Enterobacter, Citrobacter, and Proteus. Also effective against Group B streptococcus.
Dose	**PNA ≤7 days:** ≤36 weeks gestation: 150 mg/kg/day, divided q 12 hrs. >36 weeks gestation: 225 mg/kg/day, divided q 8 hrs. **PNA >7 days:** ≤ 36 weeks gestation: 225 mg/kg/day, divided q 8 hrs. > 36 weeks gestation: 300 mg/kg/day, divided q 6 hrs.
Route	IV, IM
Levels and Metabolism	Penetrates poorly uninflamed meninges; good biliary concentration; Half-life: 2-4 hrs depending on age.
Precaution	May cause seizures, hypokalemia, eosinophilia, elevated LFTs, and interstitial nephritis.

Generic Name	Piperacillin and Tazobactam
Brand Name	Tazocin
Indications	Treatment of sepsis, intra-abdominal infections caused by susceptible beta-lactamase producing bacteria.
Dose	150-300 mg as piperacillin/kg/day, divided q 6-8 hrs. *(Please refer to piperacillin for details on dosing)*
Route	IV
Levels and Metabolism	Widely distributed into tissues and body fluid; poor penetration into uninflamed meninges. Eliminated primarily unchanged in urine. Half-life: 1.5 hrs.
Precautions	May cause seizures, hypokalemia, hypertension, edema, interstitial nephritis, and bone marrow suppression. Piperacillin to Tazobactam ratio: 8:1.

Generic Name	Polycose
Indications	Caloric supplementation.
Dose	Liquid form: 1 mL = 2 calories. Powder form: 1 teaspoon = 8 calories, 1 tablespoon = 23 calories.
Route	PO
Precautions	May cause diarrhea.

Generic Name	Prednisolone
Brand Name	Orapred
Indications	Corticosteroid with anti-inflammatory and glucocorticoid actions.
Dose	PO: 0.5-2 mg/kg/day divided every 12-24 hrs.
Route	PO
Levels and Metabolism	The liver is the principal site of its metabolism which typically inactivates the drug
Precaution	May cause immunosuppression, infection, hypertension, CHF, hypokalemia, edema, hyperglycemia, growth suppression, adrenal suppression, hypothalamic pituitary adrenal (HPA) suppression and peptic ulcer disease, nausea, vomiting. Monitor serum blood glucose, CBC and electrolytes

Generic Name	Propranolol
Brand Name	Inderal
Indications	Tachyarrhythmias, hypertension, palliation of Tetralogy of Fallot, adjunctive treatment in neonatal thyrotoxicosis.
Dose	Starting dose PO: 0.25 mg/kg/dose q 6-8 hrs. Increase as needed to max. of 5 mg/kg/day. Starting dose IV: 0.01 mg/kg q 6-8 hrs over 10 min. Increase as needed to max. of 0.15 mg/kg/dose q 6-8 hrs.
Route	IV, PO
Levels and Metabolism	Extensive first pass effect; 30-40% bioavailable; metabolized in the liver to active and inactive metabolites. Metabolites eliminated in urine.
Precaution	Clearance decreased in hepatic dysfunction. May cause hypotension, bradycardia, hypoglycemia, and GI disturbance.

Generic Name	Protamine Sulfate
Brand Name	Denpru
Indications	Reversal of heparin effect.
Dose	1 mg protamine neutralizes 100 Units of heparin delivered within 4 hrs, given by slow IV push or IM; maximum dose 50 mg.
Route	IV, IM
Levels and Metabolism	Onset of action: within 5 min; Elimination unknown.
Precautions	Warning: Protamine sulfate has its own anticoagulant effect and if given in doses in excess of the amount needed to neutralize heparin could result in uncontrollable bleeding. May cause hypotension and bradycardia.

Generic Name	Pyridoxine
Indications	Diagnosis and treatment of pyridoxine-dependent seizures and prevention and/or treatment of vitamin B6 deficiency.
Dose	Initial diagnostic dose in presence of seizures: 50-100 mg IV push or IM. Maintenance dose: 50-100 mg/day PO. Vitamin B6 deficiency: 2-5 mg per day PO.
Route	PO, IV, IM
Levels and Metabolism	Rapidly absorbed form the GI; converted in the liver to active form. Half-life: 15-20 days. Eliminated by liver.
Precautions	Profound sedation may occur; be prepared to support with ventilator. Adverse neurologic effects may occur with chronic administration.

Generic Name	Ranitidine
Brand Name	Zantac
Indications	Prevention and treatment of stress ulcer and GI bleeding aggravated by gastric acid secretion.
Dose	PO: 2 mg/kg/dose, q 12-8 hrs. IV: 0.5-1 mg/kg/dose, q 12-8 hrs. Continuous infusion: 0.04-0.08 mg/kg/hrs.
Route	IV, PO
Levels and Metabolism	Metabolized by the liver. PO bioavailability ~50%. Half-life 3-7 hrs. 30% of PO dose and 70% of IV dose eliminated unchanged in urine and feces.
Precautions	May cause nausea, diarrhea, constipation, vomiting, and thrombocytopenia.

Generic Name	Rifampicin
Brand Name	Rifampin
Indications	Broad spectrum antibiotic. Inhibits DNA dependent RNA polymerase activity Effective against Mycobacteria, Neisseria, gram-positive cocci. Effective in the treatment of persistent coagulase negative staphylococci infections in neonates in combination with vancomycin or aminoglycosides. Used as prophylaxis for meningitis contacts.
Dose	PO, IV: 5-10 mg/kg/dose once q 24 hrs Severe infections: 20 mg/kg/dose once q 24 hrs
Route	IV: Infuse over 30-60 minutes via syringe pump. PO: Give on empty stomach.
Levels and Metabolism	Metabolism: hepatic; undergoes enterohepatic recirculation. Excretion in adults: Feces (60% to 65%) and urine (~30%) as unchanged drug.
Precautions	CBC, renal and hepatic function tests should be obtained prior to instituting therapy and periodically throughout the course of therapy. Neonates with impaired liver function should only be given rifampin in case of necessity and then with caution and under strict medical supervision. Causes orange/red discoloration of body secretions. It passes into the breast milk and therefore should not be used during lactation.
Preparation	Use solution prepared in Pharmacy if available. Reconstitute each vial using 9.5 mL of the diluent supplied. Shake the vial for 30 seconds (600 mg in 10 mL [60 mg/mL]). Take 1mL of this solution and further dilute to 10 mL with sodium chloride 0.9%, glucose 5% or glucose/saline combinations (6 mg/mL). If prepared in D5W it is stable for only 4 hours. Extemporaneous Preparation: A rifampin 1% w/v suspension (10 mg/mL) may be made with capsules and one of four syrups (Syrup NF, simple syrup, Syrpalta® syrup, or raspberry syrup). Empty the contents of four 300 mg capsules or eight 150 mg capsules onto a piece of weighing paper. If necessary, crush contents to produce a fine powder. Transfer powder to a 4-ounce amber glass or plastic prescription bottle. Rinse paper and spatula with 20 mL of chosen syrup and add the rinse to bottle; shake vigorously. Add 100 mL syrup to the bottle and shake vigorously. Label “shake well”. Stable for 4 weeks at room temperature or refrigerated.

References

1. N Margreth van der Lugt, Sylke J Steggerda and Frans J Walther. Use of rifampin in persistent coagulase negative staphylococcal bacteremia in neonates. BMC Pediatrics 2010, 10:84 doi:10.1186/1471-2431-10-84.
2. Russell CD, Lawson McLean A, Saunders C, Laurenson IF. Adjunctive rifampicin may improve outcomes in Staphylococcus aureus bacteraemia: a systematic review.
3. Nahata MC, Pai VB, and Hipple TF, Pediatric Drug Formulations, 5th ed, Cincinnati, OH: Harvey Whitney Books Co, 2004.

Generic Name	Salbutamol (Albuterol)
Brand Name	Proventil, Ventolin
Indications	Bronchodilation, treatment of hyperkalemia.
Dose	Nebulization: 0.1-0.5 mg/kg/dose given q 2-6 hrs. Inhalation: 100 mcg (1 MDI actuation)/dose q 2-6 hrs. IV: 4 mcg/kg/dose; repeat if necessary. Continuous infusion: 1-2 mcg/kg/min, adjusted according to response and heart rate up to 5 mcg/kg/min.
Route	Inhalation, IV
Levels and Metabolism	Metabolized in the liver; half-life: ~3.5 hrs. Elimination: 30% unchanged in urine.
Precautions	May cause tachycardia, arrhythmias, tremor, and irritable behavior. Do not administer if heart rate > 180 beats/min. Excessive or prolonged use may cause tolerance.

Generic Name	Sildenafil
Brand Name	Viagra, Revatio
Indications	Persistent pulmonary hypertension refractory to inhaled nitric oxide, for those unable to be weaned off of nitric oxide, or in situations where nitric oxide is unavailable.
Dose	0.3-1 mg/kg/dose q 6-12 hrs.
Route	PO
Levels and Metabolism	Rapid PO absorption; 40% bioavailability. Distributes well into tissue. Protein binding: 96%. Metabolized in the liver; metabolite has 50% of sildenafil's activity. Half-life: 4 hrs (active metabolite: 4 hrs). Excreted as metabolites in feces
Precautions	Monitor blood pressure and oxygenation. Rare cases of sudden vision loss due to nonarteritic ischemic optic neuropathy have been reported.
Extemporaneous Preparation	A 2.5 mg/mL sildenafil citrate oral suspension may be made with tablets and either a 1:1 mixture of methylcellulose 1% and simple syrup NF or a 1:1 mixture of Ora-Sweet and Ora-Plus. Crush thirty sildenafil 25 mg tablets (Viagra) in a mortar and reduce to a fine powder. Add small portions of chosen vehicle and mix to a uniform paste; mix while adding vehicle in incremental proportions to **almost** 300 mL; transfer to a graduated cylinder, rinse mortar with vehicle, and add quantity of vehicle sufficient to make 300 mL. Store in amber plastic bottles and label "shake well". Stable for 90 days at room temperature or refrigerated.

References:

Nahata MC, Morosco RS, and Brady MT. Extemporaneous Sildenafil Citrate Oral Suspensions for the Treatment of Pulmonary Hypertension in Children. *AJHP*, 2006, 63(3):254-7.

Generic Name	Sodium Bicarbonate
Indications	Metabolic acidosis during prolonged resuscitation in the presence of adequate ventilation, treatment of bicarbonate deficit due to renal or GI losses.
Dose	**Resuscitation:** 0.5-1 mEq/kg slow IV push; may repeat in 10 min. **Metabolic Acidosis:** Based on the following formula: HCO_3 (mEq) = base deficit (mEq/L) x weight (kg) x 0.3 Or HCO_3 (mEq) = 0.5 x weight (kg) x [24 - serum HCO_3^- (mEq/L)] Administer half of the calculated dose, and then assess need for remainder. **Distal Renal Tubular Acidosis:** 2-3 mEq/kg/day. **Proximal Renal Tubular Acidosis:** 5-10 mEq/kg/day.
Route	IV, PO
Levels and Metabolism	Onset of IV rapid; duration 8-10 min; elimination: reabsorbed by the kidney and < 1% excreted in urine.
Precautions	The osmolarity of sodium bicarbonate (8.4%) is 2000 mOsm/L. Sodium bicarbonate 4.2% is the recommended preparation for neonates to reduce adverse events. May cause cerebral hemorrhage, local tissue necrosis, hypocalcemia, hypernatremia, and hypokalemia. **Basic science and observational studies do not support the use of sodium bicarbonate during resuscitation.**

Generic Name	Spironolactone
Brand Name	Aldactone
Indications	Diuresis in combination with other diuretics in the treatment of congestive heart failure and BPD (conditions of increased aldosterone secretion).
Dose	1-3 mg/kg/dose PO, given q 12-24 hrs.
Route	PO
Levels and Metabolism	Metabolized in the liver to canrenone, an active metabolite with a half-life of 13-24 hrs. Highly protein bound. Eliminated in urine and bile.
Precautions	May cause hyponatremia, hyperkalemia, rashes, vomiting, diarrhea, headaches, nausea, and drowsiness. Use with caution in patients with impaired renal function.
Extemporaneous Preparation	A 1 mg/mL oral suspension may be made with tablets. Crush ten 25 mg tablets in a mortar and reduce to a fine powder. Add a small amount of purified water and soak for 5 minutes; add 50 mL 1.5% carboxymethylcellulose, 100 mL syrup NF, and mix to a uniform paste; mix while adding purified water in incremental proportions to **almost** 250 mL; transfer to a calibrated bottle, rinse mortar with purified water, and add quantity of purified water sufficient to make 250 mL. Label "shake well". Stable for 3 months at room temperature or refrigerated.

References:

Nahata MC, Morosco RS, and Hipple TF. Stability of Spironolactone in an Extemporaneously Prepared Suspension at Two Temperatures. *Ann Pharmacother*, 1993, 27(10):1198-9.

Generic Name	Tromethamine (THAM)
Indications	Correction of metabolic acidosis, usually given in lieu of sodium bicarbonate when infant is hypernatremic.
Dose	ml = Weight (kg) x Base deficit (mEq/L). Max. 500 mg/kg/dose (13.9 ml/kg/dose).
Route	IV
Levels and Metabolism	THAM is a 0.3 molar solution of tris(hydroxymethyl)-aminomethane. Each 1 mM = 120 mg = 3.3 ml= 1 mEq of THAM. Rapidly eliminated by the kidneys.
Precautions	May cause hypoglycemia, hyperkalemia, alkalosis, venospasm, and tissue necrosis from infiltration. Do not use in renal failure. Infusion via umbilical venous catheter should be avoided.

Generic Name	Urokinase
Brand Name	Abbokinase
Indications	Occluded CVC and intravascular thrombosis.
Dose	**Occluded IV catheter:** Use a concentration of 5,000 Units/mL; administer into catheter a volume equal to the internal volume of catheter over 1-2 min; leave in place for 1-4 hrs, then aspirate out of catheter, flush catheter with NS; may repeat with 10,000 Units/ml in each lumen if no response. Do not infuse into patient. **Thrombolysis:** Loading dose: 4,400 Units/kg, then maintenance of 4,400 Units/kg/hr for 6-12 hrs; as high as 10,000 Units/kg/hr if necessary.
Route	IV
Levels and Metabolism	Onset of action rapid. Half-life: 10-20 min. Eliminated by the liver.
Precautions	Bleeding, especially at sites of trauma or surgery. Dislodgement of emboli from thrombus. Do not start urokinase if heparin has been given recently; discontinue heparin and then start urokinase when APTT is less than twice the normal value.

Generic Name	Ursodeoxycholic acid
Brand Name	Ursodil
Indications	Naturally occurring bile acid present in small quantities in human bile. For chronic liver diseases associated with cholestasis.
Dose	10 to 15 mg/kg/dose; given 1-2 times daily.
Route	PO; may be given at any time in regard to feeds
Levels and Metabolism	Suppresses synthesis and secretion of cholesterol by the liver and inhibits intestinal absorption of cholesterol. So it can cause transient increase in liver function test values and transient hypercholesterolemia
Precautions	Monitor bilirubin levels and LFTs, prior to instituting therapy and periodically throughout the course of therapy.
Extemporaneous Preparation	Ursodeoxycholic Acid 50 mg/mL Oral Suspension Materials: • 20 tablets ursodeoxycholic acid (300 mg) • Ora-Blend q.s. to 120 mL Preparation: • Crush the tablet in a mortar to fine powder. • Add Ora-Blend to form a smooth paste. Note: If Ora-Blend unavailable: Pre-mix the Ora-Plus and Ora-Sweet, to form the diluent. • Gradually add diluent and transfer to final measuring flask, rinsing mortar well. Mix well. • Transfer finished product to pre-rinsed amber plastic medicine bottle. • Label appropriately. Stability: Thirty (30) days Auxiliary Labels: Store at room temperature. Shake well before use.

References:

1. Chen CY, Tsao P, Chen H, et al. Ursodeoxycholic acid (UDCA) therapy in very-low-birth-weight infants with parenteral nutrition-associated cholestasis. J Pediatr 2004;145:317-21.
2. Arslanoglu S, Moro GE, Tauschel H, et al. Ursodeoxycholic acid treatment in preterm infants: a pilot study for the prevention of cholestasis associated with total parenteral nutrition. J Pediatr Gastroenterol Nutr 2008;46:228-31.
3. Am J Health-Syst Pharm. 1997; 54: 1401-4

Generic Name	Vancomycin

Brand Name

Vancocin

Indications

Infections due to methicillin-resistant Staphylococcus, beta-lactam resistant coagulase negative staphylococcus, penicillin-resistant streptococcus. Orally for C. difficile colitis.

Dose

Corrected GA	Postnatal Age	Dose	Frequency
< 30 weeks	0-7 days	10-15 mg/kg/dose	q 24 hrs
	>7 days	10-15 mg/kg/dose	q 12 hrs
30-37 weeks	0-7 days	15 mg/kg/dose	q 12 hrs
	>7 days	15 mg/kg/dose	q 8 hrs
37-44 weeks	All ages	10-20 mg/kg/dose	q 12 hrs

Higher doses may be requested at the discretion of the microbiologist.
Dosage adjustment may be required in cases of renal impairment.

Route

IV

Levels and Metabolism

Desired trough level: 5-15 mcg/mL.
Desired peak level: 25-40 mcg/mL.
Check trough level before 3rd dose and peak level 1 hr after the end of a 1 hr infusion.
Oral absorption poor; distributes widely into body tissue and fluid.
Low CSF penetration even if meninges inflamed. Half-life: 6-10 hrs.
Eliminated unchanged in urine.

Precautions

Use with caution in patients with renal impairment or those receiving other nephrotoxic drugs. Dosage modification required in renal impairment. Rapid infusion (< 60 min) may be associated with hypotension and an erythema multiform-like reaction with intense pruritis that occurs on the upper body, face, and arms.

Generic Name	Vecuronium Bromide
Brand Name	Norcuron
Indications	Skeletal muscle relaxation and paralysis for ventilator therapy or surgery.
Dose	0.03-0.15 mg/kg/dose prn (usually given as 0.1 mg/kg/dose q 1-2 hrs).
Route	IV
Levels and Metabolism	Onset of action: 1-2 min. Duration: 30-40 min (varies with dose and age). Cleared rapidly in the bile and urine.
Precautions	Hypoxemia may occur due to inadequate mechanical ventilation and deterioration in pulmonary mechanics. Tachycardia and blood pressure changes occur frequently. Avoid in hepatic disease. Potentiated by: acidosis, hypothermia, neuromuscular disease, hepatic disease, renal failure, cardiovascular disease, aminoglycosides, hypermagnesemia, hypokalemia. Antagonized by: alkalosis, hyperkalemia, caffeine. Vecuronium has no sedative or analgesic properties, so analgesia and/or sedation can be given if indicated.

Generic Name	Vitamin K_1 (Phytonadione)
Brand Name	Aquamephyton
Indications	Prophylaxis and treatment of neonatal hemorrhagic disease, treatment of hypoprothrombinemia secondary to liver disease or malabsorption, vitamin K deficiency.
Dose	**Prophylaxis:** 0.5-1 mg IM at birth. Preterm <32 weeks gestation: ≥ 1000 g: 0.5 mg IM; < 1000 g: 0.25 mg IM. **Treatment:** 1-2 mg/day.
Route	IM, SubQ, IV
Levels and Metabolism	Oral absorption in the intestines in the presence of bile; rapidly metabolized in the liver then eliminated in bile and urine.
Precautions	IV administration has been associated with severe reactions resembling anaphylaxis. Monitor response with serial PT.

Generic Name	Zidovudine
Brand Name	Retrovir
Indications	Chemoprophylaxis to reduce perinatal HIV transmission.
Dose	**Neonates ≥ 35 weeks of gestation** **PO**: 2 mg/kg/dose q 6 hrs for the first 6 weeks of life. **IV**: 1.5 mg/kg/dose q 6 hrs for the first 6 weeks of life. **Neonates ≥ 30 weeks but < 35 weeks of gestation** **PO**: 2 mg/kg/dose q 12 hrs for the ***first 2 weeks*** of life then increase to q 8 hrs for the next 4 weeks (total of 6 weeks). **IV**: 1.5 mg/kg/dose q 12 hrs for the ***first 2 weeks*** of life then increase to q 8 hrs for the next 4 weeks (total of 6 weeks). **Neonates < 30 weeks gestation** **PO**: 2 mg/kg/dose q 12 hrs for the ***first 4 weeks*** of life then increase to q 8 hrs for the next 2 weeks (total of 6 weeks). **IV**: 1.5 mg/kg/dose q 12 hrs for the ***first 4 weeks*** of life then increase to q 8 hrs for the next 2 weeks (total of 6 weeks).
Route	PO, IV
Levels and Metabolism	PO well absorbed; Metabolized in the liver to inactive metabolites; Half-life in premature neonates: 6 hrs.
Precautions	May cause neutropenia, lactic acidosis, and hepatotoxicity. Should be administered as soon as possible, preferably within 8-12 hours after birth.

Practical Guidelines

These guidelines are intended as a practical resource and supportive guide for every day clinicians and users.

Medications for Neonatal Resuscitation

Drugs currently recommended include:

1. Epinephrine (1:10,000)
2. Isotonic sodium chloride solution (0.9%) as an intravascular volume expansion agent
3. Data are insufficient to support recommending routine use of bicarbonate in neonatal resuscitation; however, sodium bicarbonate (2 mEq/kg IV) may be useful in cases of prolonged arrest after adequate ventilation is established.

Studies show that 0.9% saline provides better cardiac and blood pressure support to correct both the metabolic acidosis itself and the underlying cause of the acidosis.

Use of sodium bicarbonate in the delivery room has been associated with an increased incidence of intraventricular hemorrhage in VLBW infants.

Epinephrine should be considered only when the heart rate is below 60 beats/min and ventilation has been established and provided for at least 30 seconds. The only exception to this rule may be in infants born without a detectable pulse or heart rate.

The recommended dose is **0.01-0.03 mg/kg (0.1-0.3 mL of the 1:10,000 solution),** preferably administered intravenously (IV).

If vascular access cannot be established, epinephrine may be given via the ET tube, but in such cases, the dose should be increased to **3 times** the IV dose. Ensure that the small volume is not deposited on the ET tube connector or in the lumen of the tube. Administration of epinephrine may be followed with infusion of 0.5-1 mL of saline to ensure that the drug is delivered to the lung, where it is absorbed and delivered to the heart.

Without sufficient ventilation, other therapies, including medications, will not be effective in establishing adequate heart rate and perfusion

Management of Hypotension in Preterm Infants

Hypotension occurs in up to 20% of very low birth weight infants, there are numerous controversies surrounding the management of hypotension in the very low birth weight (VLBW) infant. In extreme prematurity, the definition of hypotension varies, and the treatment remains prone to personal preference. Fluctuation of blood pressure (BP) may be as important as its absolute value and therefore should be minimized as much as possible in the first days of life. Hypotension is associated with poor outcomes including an increased mortality and morbidities. Invasive BP monitoring is the ideal, it is important to keep in consideration calibration and accurate position of the transducer. Non-invasive methods of measuring BP tend to overestimate readings in VLBW babies and therefore looking at trends is essential.

A rule of thumb is to take the gestational age or postmenstrual age to be the minimal of mean blood pressure in premature infants.

Treatment of hypotension is indicated when infant shows clinical or lab evidence of poor perfusion such as pallor, hypoxia, metabolic acidosis or poor urine output.

1-Volume expansion

- One bolus of normal saline of 10 mL/kg over 30-60 min can be used in the initial management of hypotension.
- Repeat the same volume if there is hypovolemia or warm septic shock.
- In blood loss, PRBCs should be used.
- **Albumin is not recommended.**

2. Vasopressors

Dopamine:

- It acts on *alpha, beta1,* and dopaminergic adrenergic receptors.
- It should be considered as the first line inotropes for the treatment of hypotension in VLBW infants.
- Start with 5 microgram/kg/min and increase by 5 mcg/kg/min if no response to a maximum of 20 mcg/kg/min.

Dobutamine:

- It stimulates *beta* 1 adrenergic receptors with little effect on *beta* 2 or *alpha* receptors
- To be added if no response is achieved at 10 mcg/kg/min of dopamine.
- Start at 5 mcg/kg/min and can be increased gradually till 20 mcg/kg/min.

Epinephrine:

- It stimulates alpha and beta adrenergic receptors and causes vasodilatation at very low doses.
- Several reports indicate that epinephrine can be safe and effective in neonatal shock.
- It should be used as 3rd line inotropes for the treatment of hypotension.
- Infusion should start at 0.1 mcg /kg/min and increased incrementally to a maximum dose of 1 mcg/kg/min.

No evidence to support the use of Norepinephrine, Milrinone and Vasopressin in VLBW infants with hypotension.

Hydrocortisone:

- It has been shown to increase blood pressure and reduce the duration of inotropic support in this population.
- Prior to start of corticosteroid therapy a random serum cortisol is advisable to rule out relative adrenal insufficiency.
- Start as 1 mg/kg /dose given q 8 hrs for 48-72 hrs.

Weaning of the Vasopressors:

- After 24 hrs, hydrocortisone dose should be assessed and weaned to 0.5 mg/kg q 8 hrs if BP improves.
- Epinephrine should be weaned first by 0.05 mcg/kg/min every 1hr, faster weaning may be required if MBP is too high.
- Dopamine /Dobutamine can be weaned by 2 mcg/kg/min every hour, faster weaning (5 mcg/kg/min) may be required if MBP is too high.

References

1. Saudi Neonatology Society Guidelines-2012.
2. Neofax 2011.
3. Paradisis M, Osborn D. Adrenaline for prevention of morbidity and mortality in preterm infants with cardiovascular compromise. Cochrane Review, Neonatal, 2004:89:F168-F173.
4. Ng, P.C., et al., A Double-Blind, Randomized, Controlled Study of a "Stress Dose" of Hydrocortisone for Rescue Treatment of Refractory Hypotension in Preterm Infants. Pediatrics, 2006; 117(2):367-375.

Non-Emergency Intubation Protocol Medication

A consensus statement from the International Evidence-Based Group for Neonatal Pain concluded that "tracheal intubation without the use of analgesia or sedation should be performed only for resuscitation in the delivery room or for life-threatening situations associated with the unavailability of intravenous access".

(1) Some of the reasons offered for not using premedications before intubation are concern for adverse reactions and/or toxic effects of the medications, inadequate time for administration of medications in emergency situations, and the perception that risk/benefit ratios are worsened by using premedications.

(2) To avoid any of these adverse reactions, it is recommended to have the following:

1. Appropriate equipment such as an oxygen source, appropriately sized bags, face masks, endotracheal tubes, stylet, laryngoscope, and suction.
2. Infants should have cardiorespiratory, oxygen saturation, and noninvasive blood pressure monitoring during nonemergent intubation, and an end-tidal carbon dioxide detector should be available. Intravenous access should preferably be established, and the stomach should be decompressed.
3. Individuals who perform intubations should be experienced in the use of bag-mask ventilation and be knowledgeable about the effects of the procedure of laryngoscopy and intubation, as well as risks and benefits of premedication.
4. Individuals who are experts in using laryngeal mask airway (LMA) should be around during intubation.
5. If intubation attempts are unsuccessful in these infants, then LMA should be used.

The medications used in intubation are different according to the corrected age and the clinical condition of the infant such as presence high serum potassium.

A. Infants at < 34 wks corrected age:

1. Morphine 0.1 mg/kg IV.
2. Atropine 20 mcg/kg IV.
3. If still vigorous and difficult to intubate another dose of morphine 0.1 mg/kg IV or Succinylcholine 1mg/kg IV should be used.
4. If after 2nd dose of morphine , the infant is still vigorous, then succinylcholine* 1mg/kg IV should be given.

**** Succinylcholine should be replaced with Rocuronium 1mg/kg IV if patient has acute hyperkalemia > 6 mmol/dL.***

B. Infants at ≥ 34 wks corrected age:

1. Midazolam 0.1 mg/kg IV.
2. Atropine 20 mcg/kg IV.
3. If still vigorous and difficult to intubate another dose of midazolam 0.1 mg/kg or succinylcholine 1mg/kg IV should be used.
4. If after 2nd dose of midazolam the infant is still vigorous, succinylcholine* 1mg/kg should be given.

**** Succinylcholine should be replaced with Rocuronium 1mg/kg IV if patient has acute hyperkalemia > 6 mmol/dL.***

References

1. Anand KJS, International Evidence-Based Group for Neonatal Pain. Consensus statement for the prevention and management of pain in the newborn. *Arch Pediatr Adolesc Med*. 2001;155(2):173–180.
2. Kumar P, Denson SE, Mancuso TJ. Premedication for nonemergency endotracheal intubation in the neonate. Pediatrics. 2010 Mar;125(3):608-15.

Sucrose Analgesia for Simple Neonatal Procedures

Oral Sucrose has been shown to be an effective and safe treatment for reducing the pain response of neonates. The aim is to reduce the discomfort caused by procedures performed in neonates.

Indications:

Painful procedures include but are not limited to venipuncture, peripheral venous line placement, heel prick, arterial stab, and peripheral arterial line placement. Ways to reduce pain can be through the use of pharmacological and non-pharmacological measures. Oral sucrose analgesia may be used to eliminate crying, and significantly reduce the physiological stress of pain.

Exclusions:

1. Infants on continuous or scheduled pain medications (i.e., fentanyl, morphine, etc.).
2. Infants with preexisting hyperglycemia (accucheck > 8.5 mmol/L).
3. Major procedures (i.e., chest tube insertion, etc.).

Administration:

Dose: 0.2 mL of a 66.7% Sucrose Solution (Syrup BP, 0.67 g/ml).
No more than 4 oral sucrose doses are to be administered in any 24 hr period.
There is no minimum interval time between doses of oral sucrose.

Dosage Regimen:

When to administer:

1. Administer 24% Oral Sucrose 2-4 minutes prior to procedure.
2. If procedure > 15 minutes, may repeat in 2-5 min if pain score > 7, for a total of 3 doses per procedure.
3. Maximum of 9 doses in a 24-hr period (i.e., 3 doses given for 3 procedures).

How to administer:

1.Term infants

a. Pacifier user: Dip the pacifier in 1-2 mL of 24% Oral Sucrose and allow the infant to suck.
b. Nonpacifier user: place a few drops (2-8) of 24% Oral Sucrose (using a TB syringe) to the anterior part (tip) of the tongue.

2. Preterm infants

a. Give 0.1-0.4 mL (using a TB syringe) and administer via nasogastric tube (NGT) or to the anterior part of the tongue.

Contraindications:

1. Neonates with known fructose intolerance.
2. Neonates <1500 g and <31 weeks postconceptional age.
3. Neonates who are paralyzed.
4. Use with caution in infants who are intubated.

Storage:

Oral Sucrose Solution (Syrup BP) should be stored in the refrigerator and discarded one week after the bottle has been opened.

References:

1. Stevens B, Yamada J, Ohlsson A. Sucrose analgesia in newborn infants undergoing painful procedures. Cochrane Database of Systematic Reviews, Issue 2, 2002.

2. Haouari N, Wood C, Griffiths G, Levene M.. The analgesic effect of sucrose in full term infants: a randomized controlled trial. BMJ, 1995; 310: 1498-1500.

3. Johnston CC, Filion F, Snider L,et al. Routine sucrose analgesia during the first week of life in neonates younger than 31 weeks' postconceptional age. Pediatrics, 2002;110:523-528.

4. Ietrak L, Burch K, Caravantes R, Knoerlein K, et al. Sucrose Analgesia: identifying potentially better practices. Pediatrics, 2006;118:s197-s202.

Non-Oliguric Hyperkalemia (NOHK) in Extremely Low Birth Weight Infants

Hyperkalemia is often observed transiently in ELBW infants during the first days of life. The reported incidence of NOHK varies widely but it can reach up to 60% of the ELBW infants. It does not appear to be associated with renal failure, increased potassium intake, or excessive bruising. Hyperkalemia may occur as a result of increased potassium intake, decreased potassium excretion, or a shift of potassium from the intracellular to the extracellular space. Hyperkalemia which develops in the absence of oliguria and potassium intake is known as non-oliguric hyperkalemia. If untreated, it may cause fatal cardiac arrhythmia, periventricular leukomalacia, brain hemorrhage, and even sudden death.

NOHK is defined as a plasma potassium level > 6.5 mmol/L in the absence of acute renal failure during the first 72 hrs of age with urine output ≥ 1 mL/kg/hr.

Initial Work-Up:

- Examine the infant and check the rhythm strip on monitor.
- Check electrolytes, BUN/Creatinine, Calcium, Magnesium, Phosphorus, glucose and CBC.
- Repeat serum potassium for more confirmation.
- Check the urine output.
- Obtain EKG Lead II Strip; watch for changes associated with elevated potassium level.

If hyperkalemia is Confirmed do the Following:

1. Start Insulin and dextrose infusion as the first line of therapy (the ratio of infusion glucose to regular insulin can be 10-15 g glucose to 0.5-1 Unit regular insulin, and the glucose infusion rate can be maintained at least 6 mg/kg/min). A general dosing guide is: 0.05 Unit/kg regular insulin + 0.5-1 g/kg using D10W (infuse dextrose over 15 min followed by insulin).
2. Intravenous salbutamol infusion as 4 mcg/kg every 4 hours can be used; however, no substantial data show the superiority of salbutamol over insulin/dextrose for premature infants.
3. Exchange transfusion may be used as a last resort therapy.
4. Treatment can be discontinued when serum potassium is **< 6 mmol/L.**

Oral and rectal ion exchange resins should be avoided as they are ineffective and associated with significant and potentially life threatening complications.

References:

1. Vemgal P, Ohlsson A. Interventions for non-oliguric hyperkalemia in preterm neonates. Cochrane Database Syst Rev. 2012 May 16;5:CD005257. doi: 10.1002/14651858.CD005257.pub3.

Protocol for Caffeine Citrate Use

Indications:

- Short-term treatment of apnea of prematurity in infants between 28-32 weeks GA.
- If patient is reintubated, caffeine citrate must be discontinued**.**

Established Benefits:

1. Facilitates extubation, with shorter duration of intubation and noninvasive respiratory support.
2. Reduces incidence of bronchopulmonary dysplasia/chronic lung disease.
3. Decreases need for treatment of patent ductus arteriosus.
4. Improves motor function and visual perception at 5-year follow-up.
5. Reduces severity of retinopathy of prematurity.

Pharmacokinetics:

- ***Therapeutic range***: 7-20 mg/L.
- ***Vd***: 0.8-0.9 L/kg.
- ***Half-life***: 72-96 hours (range 40-230 hrs).
- ***Time to reach peak serum concentration***: Within 30 minutes to 2 hrs (oral)**.**

Dosing Regimen:

- ***Loading dose***: 20 mg/kg/dose as **caffeine citrate** infuse over 30 minutes.
- ***Maintenance dose***: 5-8 mg/kg/day as **caffeine citrate** once daily to start 24 hours after the loading dose, given as IV over 10 minutes or as PO.
    - If theophylline has been administered to the patient within the previous 3 days (even if from another hospital), a full or modified loading dose (50-75% of a loading dose) may be given

Discharge Criteria:

- ***Patient discharged home on caffeine citrate***
    - Patient must be apnea-free for at least 48 hrs.
- ***Discontinuation of caffeine citrate***
    - Once the patient is off caffeine citrate, he/she must be apnea-free for at least 7 days as inpatient prior to hospital discharge.

References

Nicole R. Dobson and Carl E. Hunt. Pharmacology Review: Caffeine Use in Neonates: Indications, Pharmacokinetics, Clinical Effects, Outcomes. NeoReviews, 2013;14(11): e540-e550.

Neonatal Parenteral Nutrition (PN) Worksheet

STEP ONE

Calculate Total Fluid Intake (TFI):

TFI: ___mL/kg/day x Wt ____kg = mL/day

STEP TWO

Calculate volume for PN (PN solution and Fat Emulsion):

Volume for PN:

TFI_____mL/day – Other parenteral fluid____mL/day – Feeds____mL/day =____mL/day ÷ 24 hrs =____ mL/hr

STEP THREE

Calculate fat emulsion volume and rate (mL/hr):

20% Fat Emulsion volume/rate: (20% preferred over 10%)

____ g/kg/day x Wt _____ kg ÷ 0.2 g/mL = _____ mL/day ÷ 24 hrs/day = _____ mL/hr

(Recommend 0.5-1 g/kg/day for replacement of essential fatty acids and maximum of 2.5-3 g/kg/day for caloric supplementation)

STEP FOUR

Calculate PN solution volume and rate (mL/hr):

PN volume_____mL/hr - Fat volume_____mL/hr=_____mL/hr

STEP FIVE CALCULATE DEXTROSE CONCENTRATION

Dextrose_____% (Maximum dextrose concentration through peripheral line should be 10% when possible)

To calculate % dextrose from mg/Kg/minute (GIR):

_____ mg/kg/min x 6 x Wt _____kg ÷ PN solution rate _____mL/hr = _____ %

To calculate mg/kg/minute (GIR) from % dextrose:

_____ % dextrose x PN solution rate _____mL/hour ÷ (6 x Wt _____kg) = _____ mg/kg/min

STEP SIX

Calculate protein in grams/Kg/day:

Range 0.5-2.5 g/kg/day (cysteine 40 mg/g protein is automatically added)

_____ g/kg/day x Wt _____ kg ÷ _____ PN solution rate mL/hr x 24 hour x 100% = _____ % amino acids

STEP SEVEN

Calculation of electrolytes/trace elements:

Sodium: Usual maintenance 3-5 mEq/kg/day

Potassium: Usual maintenance 2-4 mEq/kg/day

Chloride: Usual maintenance 2-3 mEq/kg/day.

Watch for hyperchloremic acidosis in preemies (sometimes seen with >3 mEq/kg/day of chloride).

Phosphate:

Preterm infants: 1.3-2 mmol/kg/day of phosphate (start at 1.3 mmol/kg; may need to start lower due to calcium-phosphorous incompatibility).

Term infants: 1-1.5 mmol/kg/day of phosphate. (Start at 1 mmol/kg; May need to start lower due to calcium-phosphorous incompatibility). **SEE STEP EIGHT**

Due to problems of calcium and phosphate compatibility, it is not always possible to deliver the total calcium and phosphorus requirement in the PN solution. See sample compatibility graph under.

Calcium: Usual range of doses: Term infants - 1.5-2 mEq/kg/day Preterm = 2.5-5 mEq/kg/day

See comments above about calcium and phosphate compatibility. **SEE STEP EIGHT**

Magnesium sulfate: Start at 0.25 - 0.3 mEq/kg/day (range 0.25-0.5 mEq/kg/day) (Do not give to infants who are in renal failure or whose mother's received magnesium for greater than 1 day until document serum mg level < 2.5 mEq/L)

MVI-Pediatric: < 2.5 kg = 2 mL/kg ≥ 2.5 kg = 5 mL

Review package insert of specific multivitamin available at your center.

Heparin: Usually 0.5-1 Unit/mL

(If giving > 160-170 mL/kg/day of parenteral fluids use 0.5 Unit/mL because infant will get >> 6-7 Unit/kg/hr of heparin)

Acetate: Sodium and potassium (cations) must balance with chloride, phosphate, and acetate (anions). The acetate salt of sodium or potassium is used for whatever is not ordered as chloride or phosphate. To calculate the amount of acetate in the PN solution:

(Na mEq/kg + K mEq/kg) - (Cl mEq/kg + [Phosphate mmol/kg ÷ 0.7]) = mEq/kg Acetate

To give more acetate, decrease the amount of chloride. To give less acetate, increase the amount of chloride.

Example – PN solution with:

K^+	2 mEq/kg
Na^+	5 mEq/kg
Cl^-	2 mEq/kg
Phos	1.5 mmol/kg

(K^++Na^+- (Cl^- +Phos/0.7) = (2 + 5) - (2 + 1.5/0.7) = 2.8 mEq/kg Acetate needed in this PN to balance cations

Trace Elements: Example: as PTE-4

0.2 mL/kg contains: zinc 200 mcg/kg, copper 20 mcg/kg, manganese 5 mcg/kg, and chromium 0.2 mcg/kg

< 2.5 kg = 0.2 mL/kg/day plus extra zinc 0.2 mg/kg/day

> 2.5 kg == 0.2 mL/kg/day plus extra zinc 0.05 mg/kg/day

Selenium = 2 mcg/kg/day

If direct bilirubin > 2.5 mg/dL omit copper and manganese and give zinc and chromium.

If renal failure present omit chromium and selenium and give zinc and copper.

STEP EIGHT

Calculation of calcium phosphate compatibility

1. Calculate Calcium Concentration in mEq/L OR mmol/L(it depends on the compatibility graph of the amino acid used)
   = (mEq/kg or mmol/L of Calcium x Wt in kg) – PN volume in Liters = Calcium (mEq/L or mmol/L)
2. Calculate Phosphate Concentration in mmol/L =
   (mmol/kg of Phosphate x Wt in Kg) – PN volume in Liters = Phosphate (mmol/L)
3. Calculate Amino Acid (AA) Concentration in g/dL (or %) =
   (g/kg/day AA x Wt in kg x 100) – PN volume (in mL) = AA concentration (g/dL or %)
4. Choose the AA graph and compare your calculated calcium and phosphate concentrations.

Example:

Your patient weighs 2 kg and is receiving the AA 1.5 g/kg/day, and Is getting calcium 2.5 mEq/kg and Phosphate 1 mmol/kg; Volume Is 144 mL.

1. Calcium conc. = (2.5 mEq/kg x 2kg) ÷ (0.144 Liter) = 34.7 mEq/L
2. Phosphate conc. = (1 mmol/kg x 2 kg) ÷ (0.144 Liter) = 13.9 mmol/L
3. AA conc. = (1.5 g/kg/day x 2 kg) ÷ 144 mL x 100 mL/dL = 2 g/dL or 2 %
4. Choose specific AA graph. Anything to the left of the solid line is soluble; anything to the right will precipitate.

STEP NINE:

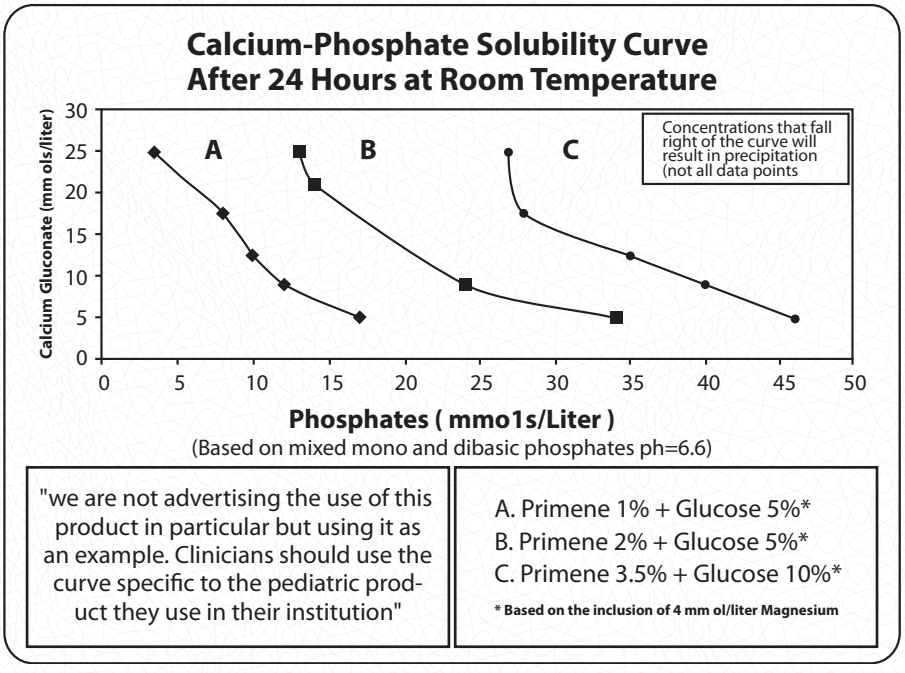
Calculation of calories

1. Calculate only non-protein calories (carbohydrate & fat).
2. **Carbohydrate (kcal/kg)** =
   ___% dextrose ÷ 100 x PN total volume ____mL =___g/day x 3.4 kcal/g =____kcal/day ÷ Wt (kg) =_____kcal/kg

3. **Fat**
   a. 10% Fat Emulsion = 1.1 calories/mL
   Fat Emulsion rate _____ mL/hr x 24 hrs x 1.1 kcal/mL = _____ Cal/day - Wt (kg) = _____
   b. 20% Fat Emulsion = 2 kcal/mL (same calculation as with 10%)
4. **Total parenteral calories** = (Carbohydrate + Fat)

Basic Neonatal Parenteral Nutrition (PN) Calculations

1. Amino Acid concentration (%) =
$$\frac{\text{grams/kg/day x weight (kg) x 100}}{\text{Total PN volume (mL)}}$$
2. Calcium concentration (mmol/L) =
$$\frac{\text{mmoL/kg/day x weight (kg)}}{\text{Total PN volume (L)}}$$
3. Phosphate concentration (mmol/L) =
same as above calculation for calcium
4. Dextrose infusion rate-GIR (mg/kg/min) =
$$\frac{\text{\%Dextrose in PN x rate (mL/hr)}}{\text{6 x weight (kg)}}$$
5. Conversion of IV Fat Emulsion dose (gram/kg/day) to rate (mL/hr) =
gram/kg/day x weight (kg) x 0.2



Maple Syrup Urine Disease (MSUD) Acute Decompensation Guideline

Treatment Includes:

1. **Hydration:**
   - Start D_{10}1/2NS at 1.5-2 x maintenance; change to D_{10}NS if Na level <140
   - Add $NaHCO_3$ if pH <7.2
   - Add KCl if renal function not compromised

1. **Correction of biochemical abnormalities:**
   - Hypoglycemia - administer 1-2 g/kg of glucose IV STAT; follow with hydration solution.
   - Metabolic acidosis - administer $NaHCO_3$ as a bolus (1 mEq/kg) if acutely acidotic with pH <7.2 or bicarbonate level <14, followed by a continuous infusion. If hypernatremia becomes a problem, reduce the rate of $NaHCO_3$ drip; may replace with K acetate.
   - Hyperammonemia - elevated ammonia reflects a secondary inhibition of the urea cycle. As treatment for the organic acidemia proceeds, ammonia level should diminish.

2. **Reversal of catabolism /promotion of anabolism:**

   - **Glucose:** Immediate hydration with fluid containing D10%; until PN can be initiated
     - Patients with peripheral access: PN as follows:
       - ⇒ D10%
       - ⇒ AA (*Aminoplasmal) 0.5 g/kg (minimum of 0.5% in final solution)
       - ⇒ IVFE 1-1.5 g/kg
     - Patients with central access: PN as follows:
       - ⇒ Dextrose @ GIR = 15 mg/kg/min up to 20 mg/kg/min
       - ⇒ AA (*Aminoplasmal) 0.5 g/kg (minimum of 0.5% in final solution)
       - ⇒ IV Fat Emulsion 1-1.5 g/kg

**Aminoplasmal AA will provide: 76 mg Leucine/g of AA, 39 mg Isoleucine/g AA, 48 mg Valine/g AA.*

- **Insulin:** Check glucose 1 hour after D10%/ PN initiation and follow the following insulin sliding scale:
  - If BG >16 — contact MD to adjust sliding scale
  - If BG 14.1-16 mmol/L — start insulin @ 0.05 Units/kg/hr
  - If BG 12.1-14 mmol/L — start insulin @ 0.04 Units/kg/hr
  - If BG 10-12 mmol/L — start insulin @ 0.03 Units/kg/hr
  - If BG <10 mmol/L — hold insulin
  - Check glucose q 1-2 hrs for the first 24 hours (to be left to the discretion of the intensivist)
- Do not hold or reduce PN without adjusting insulin infusion to reduce risk of insulin induced hypoglycemia.

4. Control of brain edema:

- Avoid infusion of hypotonic solutions
- Maintain Na level 140-145
- Furosemide 0.5-1 mg/kg prn to prevent water retention
- May consider mannitol 0.5 g/kg IV prn for life threatening increase in ICP

5. Elimination of toxic metabolites:

- Correction of acute metabolic abnormalities (acidosis, hypoglycemia) may help clear factors contributing to encephalopathy associated with acute metabolic crises.
- Empiric co-factor administration:
  - L-Carnitine (controversial): Free carnitine levels maybe low due to increased esterification with organic acid metabolites.
    Dose: 150 mg/kg/day IV/PO divided q 6-8 hrs.
- Dialysis (see #7 below)

6. Treatment of precipitating factors:

- Infection should be treated vigorously when possible. Note that neutropenia (and thrombocytopenia) frequently accompany metabolic decompensation. Bone marrow recovery is expected once the levels of toxic metabolites diminish significantly.
  Empiric therapy: Ceftriaxone: 50-100 mg/kg/day IV once daily (higher end of dose in suspected meningitis).

7. Cofactor supplementation:

- Thiamine 100 mg/day PO might be useful in cases of thiamine-responsive MSUD. Children with established diagnoses will often be known whether or not they are responders.

8. **Dialysis:** Nephrology should be alerted early on in the hospital course
   - Indicated in cases with:
     - intractable metabolic acidosis
     - unresponsive hyperammonemia (>600 µmol/L)
     - coma
     - severe electrolyte disturbances (usually iatrogenic)

9. **Monitoring:**
   - Clinical parameters
     - Mental status
     - Fluid balance
     - Evidence of bleeding (if thrombocytopenic)
     - Symptoms of infection (if neutropenic)
   - Biochemical parameters
     - Electrolytes, measured CO2, glucose, ammonia, blood gases, CBC with differential, platelets
     - Urine for ketones every void; follow specific gravity (maintain <1.010)
     - Serum (goal: 290-300 mOsm/L) and urine amorality (goal: <400 mOsm/L)
   - Urine output (maintain 2-4 mL/kg/hr)

Neonatal Resuscitation Medications

Medication	Concentration to Administer	Preparation	Dosage and Route	Rate and Precautions
Epinephrine	1:10,000 (0.1 mg/mL)	10 mL prefilled syringe	0.1-0.3 mL/kg IV or ET	Give rapidly; may repeat every 5 min, as needed.
Volume Expanders	Normal Saline, Ringer›s Lactate	Varies	10 ml/kg IV	Give over 5-10 min; may repeat as needed.
Sodium Bicarbonate	0.5 mEq/mL (4.2% solution)	10 mL prefilled syringes	1-2 mEq/kg (2-4 ml/kg) IV	Give slowly over at least 2 min; may repeat every 10 min.
Naloxone	0.4 mg/mL	1 mL syringe	0.1 mg/kg (0.25 mL/kg) IV, IM, SubQ, ET	Give rapidly; may repeat as needed.

Note: ET = Endotracheal (ET administration should be followed by 0.5 mL of normal saline flush).

Medication	Weight 1 kg	Weight 2 kg	Weight 3 kg	Weight 4 kg
Epinephrine 1:10,000	0.1-0.3 mL	0.2-0.6 mL	0.3-0.9 mL	0.4-1.2 mL
Volume Expanders	10 mL	20 mL	30 mL	40 mL
Sodium Bicarbonate 0.5 mEq/ml	4 mL (2 mEq)	8 mL (4 mEq)	12 mL (6 mEq)	16 mL (8 mEq)
Naloxone 0.4 mg/ ml	0.25 mL (0.1 mg)	0.5 mL (0.2 mg)	0.75 mL (0.3 mg)	1 mL (0.4 mg)

Standard Concentrations that Maybe Options for Common Drips Used in NICU

Medication	Appropriate Diluent	Standard Concentration Options	Maximum Concentration
Alprostadil	D5W, D10W, NS	5 mcg/mL 10 mcg/mL	20 mcg/mL
Amrinone	NS	500 mcg/mL 1000 mcg/mL	3000 mcg/mL
Atracurium	D5W, NS	500 mcg/mL 1000 mcg/mL	5000 mcg/mL
Dopamine	D5W, D10W, NS	800 mcg/mL 1600 mcg/mL 3200 mcg/mL	5000 mcg/mL
Dobutamine	D5W, D10W, NS	800 mcg/mL 1600 mcg/mL 3200 mcg/mL	5000 mcg/mL
Epinephrine	D5W, NS	8 mcg/mL 16 mcg/mL 32 mcg/mL 64 mcg/mL	125 mcg/mL
Fentanyl	D5W, D10W, NS	10 mcg/mL	50 mcg/mL
Furosemide	D5W, NS	0.5 mg/mL 1 mg/mL 2 mg/mL	5 mg/mL
Glucagon		20 mcg/mL 40 mcg/mL	80 mcg/mL
Heparin	D5W, NS	50 units/mL	100 units/mL
Hydralazine	D5W, NS	100 mcg/mL 500 mcg/mL	1000 mcg/mL
Insulin (Regular)	D5W, NS	0.1 Units/mL 0.5 Units/ml	1 Units/mL
Isoproterenol	D5W, NS	10 mcg/mL	20 mcg/mL

Cont. Standard Concentrations that Maybe Options for Common Drips Used in NICU

Medication	Appropriate Diluent	Standard Concentration Options	Maximum Concentration
Lidocaine	D5W, NS	2000 mcg/mL	4000 mcg/mL
Midazolam	D5W, NS	500 mcg/mL 1000 mcg/mL	5000 mcg/mL
Milrinone	D5W, NS	200 mcg/mL	400 mcg/mL
Morphine	D5W, NS	1 mg/mL	2 mg/mL
Nitroprusside	D5W	200 mcg/mL	400 mcg/mL
Norepinephrine	D5W, NS	8 mcg/mL 16 mcg/mL 32 mcg/mL	125 mcg/mL
Octreotide	D5W, NS	5 mcg/mL 10 mcg/mL	25 mcg/mL
Pancuronium	D5W, NS	0.01 mg/mL 0.02 mg/mL 0.05 mg/mL	0.1 mg/mL

To convert from microgram (mcg) to milligram (mg) divide by 1000.

Example for Calculating Rate:

To start Dopamine 7.5 mcg/kg/min.

Patient weight = 5 kg.

Patient not fluid restricted.

1. Calculate the dose: 7.5 mcg/kg/min x 5 kg = 37.5 mcg/min
2. Based on above standard concentrations, may choose: 800 or 1600 mcg/ml
3. To prepare the standard concentration of dopamine 800 mcg/mL:
   Pharmacy has dopamine 80 mg/2 mL (i.e., 40 mg/mL).
   To prepare 50 mL volume of 800 mcg/mL.
   50 mL x 800 mcg = 40,000 mcg in 50 mL or if ÷1000 = 40 mg in 50 mL.
   Take 1 mL of the 40 mg/mL vial and complete with 49 mL of D5W or NS to make the 800 mcg/mL standard concentration.

4. Determine rate = Dose/Standard Concentration = 37.5 mcg/800 mcg/mL = 0.047 mL/min.
5. Convert the rate to mcg per hour for pump programming: 0.047 mL/min x 60 min = 2.8 mL/hr.

Calculating Body Surface Area (BSA)

Weight (kg)	**BSA** (sq meters)
0.6	0.08
1	0.1
1.4	0.12
2	0.15
3	0.2
4	0.25
BSA (m^2) = (0.05 x kg) + 0.05	

Comparison of Currently Marketed Surfactant Products

Variable	Calfactant (Infasurt)	Beractant (Survanta)
Type and source	Natural, calf lung wash	Modified natural, bovine lung mince extract
Phospholipids	Natural DPPC with mixed phospholipids	Natural and supplemented DPPC and mixed phospholipids
Proteins	Calf proteins SP-B and SP-C	Bovines proteins SP-B and SP-C
Recommended dose	3 mL/kg (phospholipids 105 mg/kg)	4 mL/kg (phospholipids 100 mg/kg)
Indications	Prophylaxis and rescue therapy	Prophylaxis and rescue therapy
Criteria for prophylaxis	Premature infants <29 weeks' GA at high risk for RDS.	Birth weight <1,250 g or evidence of surfactant deficiency.
Recommended regimen for prophylaxis	Give 1st dose ASAP after birth, preferably within 30 min; repeat q12hr up to a total of 3 doses if infant still remains intubated or repeat as early as 6 hrs up to a total of 4 doses if infant still remains intubated and requires FiO_2 ≥30 with PaO_2 ≤80 mmHg.	Give 1st dose ASAP after birth, preferably within 15 min; repeat as early as 6 hrs up to a total of 4 doses if infant still remains intubated and requires FiO_2 ≥30 with PaO_2 ≤80 mmHg.
Criteria for rescue therapy	Infants ≤72 hr of age with confirmed RDS who require endotracheal intubation.	Infants with confirmed RDS who require endotracheal intubation.
Recommended regimen for rescue therapy	Give 1st dose ASAP after RDS diagnosis, repeat q 12 hr up to a total of 3 doses if infant still remains intubated or repeat as early as 6 hrs up to a total of 4 doses if infant still remains intubated and requires FiO_2 ≥30 with PaO_2 ≤80 mmHg.	Give 1st dose ASAP after RDS diagnosis, preferably by 8 hr PNA; repeat as early as 6 hr up to a total of 4 doses if infant still remains intubated and requires FiO_2 ≥30 with PaO_2 ≤80 mmHg.

Variable	Calfactant (Infasurt)	Beractant (Survanta)
Recommended administration technique	Administer through side-port of ETT adaptor via ventilator, divide dose into 2 aliquots with position change OR through disconnect ETT via 5-French catheter, divide dose into 4 aliquots with position change.	Administer through disconnected ETT via 5-French catheter, divide dose into 4 aliquots with position change.
Formulation	Suspension	Suspension
Storage	Refrigerate 2-8˚C; protect from light	Refrigerate 2-8˚C; protect from light
Volume/vial	6 mL	4 mL, 8 mL
Special instructions	Gentle swirling of the vial may be necessary for redispersion; warming to room temperature is not necessary; do not shake.	Warm to room temperature before use, do not shake.
Stability	If warmed to room temperature <24 hr, unopened, unused vials may be returned once to refrigerator; single use vials contains no preservative, discard unused portion.	If warmed to room temperature <8 hr, unopened, unused vials may be returned once to refrigerator; single use vials contains no preservative, discard unused portion.

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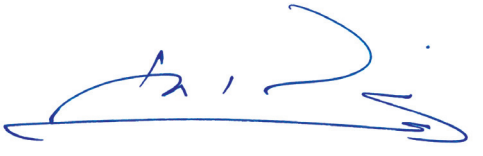
This Manual of Neonatal Dosege and Practical Guidelines was reviewed by the advisory committee

for Neonatal Services Improvement Program in the Ministry of Health

and has been approved for use in all Ministry of Health hospitals



Jahad Abdulrahman Alaql, MD

Consultant Neonatologist

Director, Neonatal Services Improvement Program

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