



وزارة الصحة  
Ministry of Health

1<sup>st</sup> Edition

# PEDIATRIC INTENSIVE CARE

Handbook

Pharmacology & Practical Guidelines





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# Introduction

The booklet in your hand is a humble effort from a group of health care professional working in the field of pediatric critical care medicine. It is not meant to be an alternative to textbooks.

Our aim is to produce a concise and practical handbook that include the most practical guidelines for common drugs used in PICU practice with its dosages and special precautions.

It includes also guidelines for management of most common diagnoses in PICU such as septic shock, traumatic brain injury, status asthmaticus and others.

The handbook also includes guidance on nutritional therapy since it is essential for recovery and survival of the critically ill children. We also included guidelines on the infection related patient safety indicators that we track each month (i.e. infection control, CLABSI, VAP and CAUTI).

We have selected some other simplified guidelines that would provide basic and pertinent information that are essential to PICU bedside physician such as the modes of pediatric mechanical ventilations; antibiotic lock and empirical antimicrobial therapy; electrolytes; blood products transfusion and cardiac arrest management.

The authors of this edition have looked carefully for the best evidence and the usual practices in PICU in accordance with the most current national and international recommendations at the time of publication. Care has been taken to ensure accuracy of the information presented but application of the guidelines information should always be used with caution using good clinical judgment that remains the professional responsibility of the health care practitioners.

The concept of having this handbook is to carefully design it to match patient's needs and to improve patient care outcome by using standardized approach using evidence-based literature whenever available.

We hope that you'll find this handbook helpful to you in day to day management of your child in PICU.

Regards,

# Acknowledgment

First and foremost, we gave thanks and praise to our Almighty God, the author of knowledge and wisdom who gives us guidance and grace to make this project a reality.

Secondly, we have taken a lot of efforts in this project but it would not have been possible to the contributors who have provided ideas, invaluable guidance, constructive criticism and inspiring the team to work hard throughout this 1st edition of PICU handbook: pharmacology and practical guidelines project. No valuable words to express our heartfelt thanks for their support that has been an instrumental in making this project a success.

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Last but not the least, our appreciations to Ministry of Health team lead by Dr. Tareef Al Aama, Deputy Minister of Curative Affairs and Dr. Ibrahim Alharfi, Head of PICU Development Committee in MOH for their unconditional support to this distinguish project.

Yours sincerely,

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# Standard Concentrations of High Alert Pediatric Drugs

Drug Name	Standard Concentration		Infusion Dose Range	Diluents ** (Stability = 12 hrs if prepared by nurse)	Maximum Concentration (Patients with fluid restriction)
	≤10 kg	>10 kg			
Alprostadil (PGE1)	5 mcg/ml		0.01 – 0.4 mcg/kg/min	D5W, NS	20 mcg/ml §§
Amiodarone	2000 mcg/ml		LD: 5 mg/kg over 20 – 120 min; followed by: 5 – 15 mcg/kg/min. (Max. 1200 mg/24 hr)	D5W	5000 mcg/ml §§
Cisatracurium	1000 mcg/ml		1 – 4 mcg/kg/min	D5W, NS	2000 mcg/ml
Dobutamine	1000 mcg/ml (RTU)*		2 – 20 mcg/kg/min (Max. 40 mcg/kg/min)	D5W, NS	5000 mcg/ml §§
Dopamine	1600 mcg/ml (RTU)* §§	3200 mcg/ml (RTU)* §§	2 – 20 mcg/kg/min (Max. 40 mcg/kg/min)	D5W, NS	6000 mcg/ml §§
Epinephrine	32 mcg/ml		0.1 – 1.5 mcg/kg/min	D5W, NS	64 mcg/ml §§
Esmolol	10,000 mcg/ml		LD: 0.1 – 0.5 mg/kg over 1 – 2 min; followed by: 50 – 200 mcg/kg/min (Max. 300 mcg/kg/min)	D5W, NS	20,000 mcg/ml §§
Fentanyl	10 mcg/ml		0.5 – 6 mcg/kg/hr	D5W, NS	50 mcg/ml
Furosemide	2000 mcg/ml		0.05 – 2 mg/kg/hr	D5W, NS	10,000 mcg/ml
Heparin	50 units/ml		LD: 75 units/kg (round to nearest 100) over 10 min; followed by: 20 units/kg/hr for children >1 yr and 28 units/kg/hr for infants (refer to hospital heparin infusion guide)**	D5W, NS	100 units/ml
Insulin	1 unit/ml		0.01 – 0.2 unit/kg/hr	NS	1 unit/ml

Drug Name	Standard Concentration		Infusion Dose Range	Diluents ** (Stability = 12 hrs if prepared by nurse)	Maximum Concentration (Patients with fluid restriction)
	≤10 kg	>10 kg			
Isoproterenol	20 mcg/ml		0.05 – 2 mcg/kg/min	D5W, NS	64 mcg/ml §§
Labetalol	2000 mcg/ml		0.25 – 3 mg/kg/hr	D5W, NS	5000 mcg/ml
Lidocaine	4000 mcg/ml (RTU)*		LD: 0.5 – 1 mg/kg over 1 – 2 min; followed by: 10 – 50 mcg/kg/min	D5W, NS	8000 mcg/ml §§
Midazolam	1000 mcg/ml		0.5 – 6 mcg/kg/min	D5W, NS	5000 mcg/ml §§
Milrinone	200 mcg/ml		LD: 50 – 75 mcg/kg over 15 – 60 min; followed by: 0.25 – 1 mcg/kg/min.	D5W, NS	400 mcg/ml §§
Morphine	1000 mcg/ml		10 – 40 mcg/kg/hr	D5W, NS	2000 mcg/ml
Nitroglycerin	400 mcg/ml (RTU)*		0.25 – 5 mcg/kg/min (Max. 10 mcg/kg/min)	D5W – Glass, NS – Glass	400 mcg/ml
Nitroprusside – PFL*	200 mcg/ml	400 mcg/ml	0.3 – 3 mcg/kg/min (Max. 8 mcg/kg/min)	D5W	800 mcg/ml §§
Norepinephrine	32 mcg/ml §§		0.01 – 0.1 mcg/kg/min (Max. 1 – 2 mcg/kg/min)	D5W, NS	80 mcg/ml §§
Octreotide	5 mcg/ml		1 – 4 mcg/kg/hr	D5W, NS	10 mcg/ml
Phenylephrine	40 mcg/ml §§		0.1 – 0.5 mcg/kg/min	D5W, NS	80 mcg/ml §§
Salbutamol (Albuterol)	100 mcg/ml		0.5 – 5 mcg/kg/min	D5W, NS	250 mcg/ml
Terbutaline	20 mcg/ml		LD: 2 – 4 mcg/kg over 5 – 10 min; followed by: 1 – 12 mcg/kg/hr	D5W, NS	100 mcg/ml
Vasopressin	0.2 unit/ml §§		0.01 – 0.12 unit/kg/hr (vasodilatory shock with hypotension resistant to other treatments)	D5W, NS	1 unit/ml §§



# Infusion rate Calculation

## Infusion rate Calculation:

$$\text{Rate} = \frac{\text{Ordered amount of drug} \times \text{pts weight (kg)} \times \text{Time} \times \text{Total Volume}}{\text{Stock dose} \times 1000 \text{ if needed}}$$

1. Ordered amount of drug: Physician Order.
2. Patient Weight: Patient weight per Kilograms.
3. Time: If the order per minute will multiply by 60 and if the order per hour will multiply by one.
4. Total volume: The final volume after adding Dilution to the original stock based on the Standard or Maximum concentration.
5. Stock Dose: Pure Medication strength according to the company production
  - A. If the stock in mg and the order in microgram: Multiply by 1000
  - B. If the stock in mg and the order in mg: no need to multiply.
  - C. If the stock in microgram and the order in microgram: no need to multiply.

**Example 1:** Your 8 kg patient has Epinephrine Infusion ordered at 0.1 mcg/kg/min. Medication ampoule came as 1 mg in 1mL, What is the Infusion rate?

$$\text{Rate} = \frac{0.1 \times 8 \times 60 \times 32}{1 \times 1000} = 1.5 \text{ ml / hr.}$$

0.1 : Is the Physician Order.

8 : Is the patient weight Per Kg.

60 : The order per Minute .

32 : Total Dilution ( 1ml Stock volume + 31 ML D5W as per ( \*Standard Concentration of High Alert Pediatric Drugs)

1: is the original Medication Stock .

x1000 : the order per Microgram and the stock per Mg.

**Example 2:** Your patient has Fentanyl ordered at 2 mcg/kg/hr. the patient weight is 6 kg. Then Drug comes as 100 mcg in 2 ml , What is the infusion rate?

$$\text{Rate} = \frac{2 \times 6 \times 1 \times 10}{100} = 1.2 \text{ ml / hr.}$$

2 : is the physician order

6: Patient weight per Kg.

1: one hour ( the Order per hour)

10: total dilution (2ml Stock volume + 8 ML D5W as per) \*Standard Concentration of High Alert Pediatric Drugs)

100: Original Medication Strength

**Example 3:** Your patient has Furosemide ordered at 0.5mg/kg/hr. the patient weight is 10 kg. Then Drug comes as 20 mg in 2 ml , What is the infusion rate?

$$\text{Rate} = \frac{0.5 \times 10 \times 1 \times 10}{20} = 2.5 \text{ ml / hr.}$$

0.5 : is the physician order

10: Patient weight per Kg.

1: one hour ( the Order per hour)

10: total dilution ( 2ml Stock volume + 8 ML D5W as per ( \*Standard Concentration of High Alert Pediatric Drugs)

20: Original Medication Strength

**Example 4 :** Your patient has Insulin ordered at 0.05 Unit /kg/hr. the patient weight is 8 kg. Then Drug comes as 100 International Unit in 1 ml , What is the infusion rate?

$$\text{Rate} = \frac{0.05 \times 8 \times 1 \times 50}{50} = 0.4 \text{ ml / hr.}$$

0.05 : is the physician order

8 : Patient weight per Kg.



1: one hour ( the Order per hour)


50 : total dilution ( 0.5 ml Stock volume + 49.5 ML NS as per ( \*Standard Concentration of High Alert Pediatric Drugs)


50: Original Medication Strength .


\*:Refer to the table Standard Concentrations of High Alert Pediatric Drug.




## Drug Dosing Guidelines




Acetaminophen • Analgesic, • Non-narcotic • Antipyretic  	PO	Neonate, infant & children	10 –15 mg/kg/dose every 4 – 6 hours > 45 kg do not exceed 3 g/day Max: 75 mg/kg/day	Comments: - Infusion over 15 minutes - High dose may cause hemolytic anemia in patient with G6PD deficiency
	IV	Neonate, infant & Children	< 10 kg: 7.5 mg/kg/dose every 6 hours >10 kg: 15 mg/kg/dose every 6 hours Max: 75 mg/kg/day (3,750 mg/day) – (Max 60 mg/kg/day for up to 2 years old)	
		Children & adolescents >50 kg	1 g every 6 hours or 650 mg every 4 hours Max: single dose 1 g, daily dose 4 g	
Acetazolamide • Diuretic • Carbonic Anhydrase Inhibitor  	PO & IV	Infant & children	Edema: 5 mg/kg/dose every 8 – 12 hours	
			Metabolic alkalosis: 3-5 mg/kg/dose every 6 – 8 hours Max Adult dose: 500 mg as single dose	
Acetylcysteine • Antidote • Mucolytic Agent	Acetaminophen poisoning:			
	PO	Loading Dose (LD): 140 mg/kg. (Max. 15 g/dose)		
		Maintenance: 70 mg/kg every 4 hours for 17 doses. (Max. 7.5g/dose)		
	IV	LD: 150 mg/kg (Max: 15 g) infused over 60 minutes		
		2nd dose: 50 mg/kg (Max: 5 g) infused over 4 hours		
3rd dose: 100 mg/kg (Max: 10 g) infused over 16 hours				
Nebulizer	Infant: 1 – 2 ml of 20% solution every 6 – 8 hours			
	Children: 3 – 5 ml of 20% solution every 6 – 8 hours			

<p>Acyclovir</p> <ul style="list-style-type: none"> <li>• Antiviral Agent</li> </ul> 	<p><b>HSV infection:</b></p>		<p>Comments:</p> <ul style="list-style-type: none"> <li>- Obese patient should be dosed using ideal body weight (IBW)</li> <li>- Monitor IV site for phlebitis</li> <li>- IV acyclovir &gt; 15 mg/kg/dose may be associated with an increased risk of nephrotoxicity</li> </ul>	
	Disseminated, CNS, skin, eye or mouth disease:	<p>IV: 15 -20 mg/kg/dose every 8 hours</p> <p>Treatment duration:</p> <p>Cutaneous and mucous membrane infection: 14 days</p> <p>CNS or disseminated infection: 21 days</p>		
	<p><b>HSV encephalitis:</b></p>			
	Neonate, infant & children:	<p>IV: 10-20 mg/kg/dose every 8 hours for 14 to 21 days</p>		
	Children >12 yrs:	<p>IV: 10 mg/kg/dose every 8 hours for 14 to 21 days</p>		
	<p><b>Herpes Simplex Mucocutaneous, Immunocompromised:</b></p>			
		<p>IV</p>		<p>10 mg/kg/dose every 8 hours for 7 to 14 days</p>
		<p>PO: children <math>\geq</math> 2 yrs</p>		<p>1000 mg/day divided in 3 to 5 doses for 7 to 14 days</p> <p>(Max: 80mg/kg/day)</p>
	<p><b>HSV gingivostomatitis:</b></p>			
		<p>PO:</p>		<p>20 mg/kg/dose 4 times daily for 7 days</p> <p>(Max: 200 mg/dose)</p>
	<p><b>Varicella zoster: (shingles, herpes zoster, and chickenpox)</b></p>			
		<p>IV:</p>		<p>10 mg/kg/dose every 8 hours for 7 to 14 days or until no new lesions for 48 hours</p>
		<p>PO: children <math>\geq</math> 2 years:</p>		<p>20 mg/kg/dose 4 times daily for 5 days</p> <p>(Max daily dose: 3200 mg/ day)</p>

Adenosine • Antiarrhythmic Agent	Paroxysmal supraventricular tachycardia:		Comments: - Administer by rapid IV/IO push over 1 – 2 seconds followed by Saline flush
	Neonate:		
		initial dose: RAPID IV push 0.1 mg/kg ; if not effective increase dose by 0.05 -0.1 mg/kg every 1 – 2 minutes (Max single dose: 0.3 mg/kg)	
	Infant & children:		
	rapid IV initial: 0.1 mg/kg (Max: 6 mg) If not effective give 0.2 mg/kg (Max: 12mg)		
Alprostadil • Prostaglandin	Patent Ductus Arteriosus		Comments: - May cause apnea, flushing, bradycardia and hypotension.
	Neonate, infant & children:	Continuous IV infusion: 0.05 – 0.1 mcg/kg/minute (Max: 0.4 mcg/kg/minute)  Decrease the rate to the lowest effective dose (no adverse effect) down to 0.005 mcg/kg/minute	
Alteplase: (tPA) Thrombolytic Agent	Occluded central venous catheter:		
	≤ 10 kg	0.5 mg diluted in 1 ml NS	
	> 10 to <30 kg	1 mg/ml (Max: 2mg/2ml)	
	≥ 30kg	2mg in 2 ml	
	Instill in lumen over 1 to 2 minutes; leave in lumen for 1 to 2 hours then aspirate out of catheter (Do not infuse into patient)		
	Parapneumonic effusion:		
	Infant > 3 months, children and adolescents:		
Intrapleural: 4 mg in 40 ml NS 1st dose with one-hour dwell time repeated every 24 hours for 3 days			
Amikacin • Antibiotic (Aminoglycoside)	Neonate: (sepsis & meningitis) by post neonatal age (PNA)		Comments: Draw trough level within 30minutes prior to 3rd dose  Trough level: severe infection: < 8 mcg/L, Moderate infection:
	PNA ≤ 7 days & ≥ 2kg: 15 – 20 mg/kg/day divided every 12 hours		
	PNA > 7 days & ≥ 2 kg: 30 mg/kg/day divided every 8 hours.		
	Infants, children & adolescents:		



	<p>General dosing, severe, susceptible infections: IM, IV: 15 – 22.5 mg/kg/day divided every 8 hours or 15 – 20 mg/kg/dose once daily. (Max: 30 mg/kg/day divided every 8 hours)</p> <p>CNS infection:</p> <p>Meningitis: IV: 20 – 30 mg/kg/day divided every 8 hours.</p> <p>Ventriculitis: intra-ventricular/ intrathecal: 5 – 30 mg/day (Use preservative free preparation).</p> <p>Cystic fibrosis, pulmonary infection:</p> <p>Traditional dosing: IV, IM: 10 mg/kg/dose every 8 hours Extended interval dosing: IV: 30 mg/kg/dose every 24 hours</p> <p>Mycobacterium, avium complex infection:</p> <p>IV: 15 – 30 mg/kg/day divided every 12 – 24 hours (Max: 1500mg/day)</p> <p>Tuberculosis, drug resistant:</p> <p>Infant, children &amp; adolescents: IM, IV: 15 – 20 mg/kg/dose once daily as part of multiple drug regimen. (Max: 1000mg/day) (ATS/CDC/IDSA)</p> <p>Peritonitis:</p> <p>Continuous Intra-peritoneal: Loading dose: 25mg/L of dialysate, Maintenance dose: 12mg/L</p>	
<p>Aminophylline</p> <ul style="list-style-type: none"> <li>• Bronchodilator</li> <li>• Respiratory Stimulant</li> </ul> 	<p>Apnea of prematurity:</p> <p>IV: loading dose: 5 – 8 mg/kg/dose. Infused over 30 to 60 minutes Maintenance: 2 -6 mg/kg/day divided every 8 to 12 hours (Start maintenance dose 8 to 12 hours after the loading dose)</p> <p>Obstructive airway disease:</p> <p>Patient not currently receiving aminophylline/theophylline: LD: 6 mg/kg IV bolus</p> <p>Initial Maintenance Infusion of Aminophylline (theophylline equivalent) at infusion rates adjusted for age: 6 weeks to 6 months of age: 0.3 to 0.5 mg/kg/hour. 6 months to 1 year of age: 0.6 to 0.7 mg/kg/hour. 1 to 9 years of age: 1 mg/kg/hour. 9 to 12 years of age: 0.9 mg/kg/hour. 12 to 16 years of age: 0.6 mg/kg/hour. Cardiac decompensation, liver dysfunction, shock, sepsis with organ failure: 0.2 mg/kg/hour</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Consider withholding next dose if heart rate is greater than 180 beats per minute.</li> <li>- Use ideal body weight for obese patients</li> <li>- Draw level 12 – 24 hour after initiation of continuous infusion.</li> <li>- Avoid using aminophylline if you cannot measure the level</li> </ul>


<p>Amiodarone</p> <ul style="list-style-type: none"> <li>• Antiarrhythmic Agent, Class III</li> </ul> 	Supraventricular Tachycardia with a Pulse, Pulseless VF/VT, Perfusing tachycardia (VT):		<p>Comments:</p> <ul style="list-style-type: none"> <li>- Can cause hypo- hyperthyroidism, interstitial pneumonitis and pulmonary fibrosis</li> <li>- Can cause hypotension which may respond to reducing the infusion rate.</li> </ul>
	IV	<p>For Pulseless VF/VT: Boluses of 5 mg/kg may be repeated up to 2 times (Max. 15 mg/kg total)</p> <p>For SVT, perfusing VT: LD: 5 mg/kg IV infusion given over 20 to 60 minutes can be repeated up to 2 times. (Max: 15 mg/kg, 300 mg/dose), preferably in a central vein.</p>	
		<p>Maintenance Dose: 5 – 15 mcg/kg/minute IV continuous infusion (10 to 20 mg/kg/day). (Max: 2200 mg /day)</p> <p>Duration of maintenance infusion is usually 24 to 72 hours, followed by oral maintenance therapy if indicated.</p>	
	PO	<p>LD: 10 to 15 mg/kg/day, followed by maintenance dose.</p>	
<p>P.O: Maintenance Dose: 5 to 10 mg/kg/day orally given once daily or in divided doses twice daily 7 to 10 days.</p>			
<p>Amlodipine</p> <ul style="list-style-type: none"> <li>• Antihypertensive Agent</li> <li>• Calcium Channel Blocker</li> <li>• Dihydropyridine</li> </ul> 	Hypertension:		<p>Comments:</p> <ul style="list-style-type: none"> <li>- Dose titration should be made at 5 to 7 day intervals</li> </ul>
	<p>1 year to ≤6 years of age:</p> <p>Initial 0.05 – 0.1 mg/kg/day orally once or divided twice daily</p> <p>Maintenance dose: 0.1 to 0.3 mg/kg orally once or divided twice daily. (Max: 0.6 mg/kg/day)</p>		
	<p>Children &gt; 6 years:</p> <p>2.5 – 5 mg once daily (Max: 10 mg/day).</p>		
<p>Amoxicillin</p> <ul style="list-style-type: none"> <li>• Antibiotic</li> <li>• Penicillin</li> </ul> 	General dosing:		
	Neonate: P.O: 20 – 30 mg/kg/day divided every 12 hours		
	<p>Otitis media, acute:</p> <p>Infant &lt; 2 months: 30 – 40 mg/kg/ day divided every 8 hours</p> <p>infant ≥ 2 months and children oral 80 – 90 mg/kg/divided every 12hours</p>		
	UTI prophylaxis (hydronephrosis vesicoureteral reflux):		
	10 – 15 mg/kg once daily		
	Mild to moderate infection		
	Infant & children: 25 – 50 mg/kg/day divided every 8 hours (Max: 500 mg/dose)		
	Severe infection:		
	80 – 100 mg/kg/day divided every 8 hours		
	Endocarditis, prophylaxis:		
	infant, children & adolescent: P.O 50 mg/kg 1 hour before procedure (Max: 2g/ dose)		


Amoxicillin and Clavulanate • Antibiotic • Penicillin  	General dosing: Dose based on amoxicillin content		
	PO	Infants < 3 months: 30 mg /kg/day divided every 12 hours Infants ≥ 3 months, children & adolescents: 25 – 45mg /kg/day divided every 8 – 12 hours Otitis media: 90mg/kg/day divided every 12 hours	
	IV	Infant < 3 months: <4 kg: 30mg/kg/dose every 12 hours, >4kg: 30mg/kg/dose every 8 hours Infant >3 months – 12 years: 30mg/kg/dose every 8 hours OR every 6 hours in severe infection Children > 40kg: 1.2 g every 8 hours	
Amphotericin B (Conventional) • Antifungal Agent  	General dosing:		Comments: - Can cause allergy (IV infusion should be over 2 – 6 hours) - Can cause hypokalemia - Can cause nephrotoxicity (need good hydration).
	IV	1mg/kg/day once daily (Max. 1.5 mg/kg/day for very sick patient).  Consider liposomal amphotericin B if there is renal insufficiency.	
Amphotericin B (Liposomal)  	General dosing:		
	IV: 3 – 5 mg/kg/dose once daily		
Ampicillin: • Antibiotic • Penicillin	General dosing: infants, children and adolescents.		Comments: - Can cause hypersensitivity and anaphylactic reaction
	Mild to moderate infection: IM, IV	100 – 200 mg/kg/day divided every 6 hours. Max: 4 g/day	
	Severe infection: IM, IV	200 – 400 mg/kg/day divided every 6 hours Max: 12 g/day	
	Endocarditis: IV	200 mg/kg/day divided every 4 – 6 hours in combination with other antibiotics (Max. 12 g/day)	
	Intra-abdominal infection, complicated: IV	200mg/kg/day divided every 6 hours (Max. single dose 2000 mg)	
	Meningitis: IV	200 – 400mg/kg/day divided every 6 hours (Max: 12g/day)	









	Peritonitis (CAPD) Continuous ambulatory peritoneal dialysis:	Intraperitoneal 125 mg per liter of dialysate for 2 weeks	
Arginine	Pituitary function test: infant, children and adolescents:		Comment: The dose is based on Arginine hydrochloride product.
		IV: 0.5 g/kg over 30 minutes (Max dose: 30 g)	
	Hyperammonemia, acute:		
	Argininosuccinic acid lyase (ASL) or argininosuccinic acid synthetase (ASS) deficiency:		
		IV: LD: 600 mg/kg followed by a continuous IV infusion of 600 mg/kg/day	
	Carbamyl phosphate synthetase (CPS) ornithine transcarbamylase (OTC), N-Acetyl glutamate synthetase (VAGS) deficiency:		
		IV: LD: 200 mg/kg followed by a continuous IV infusion of 200 mg/kg/day	
	Unconfirmed/pending diagnosis:		
		IV LD: 600 mg/kg followed by a continuous IV infusion of 600 mg/kg/day If ASS and ASL are excluded as diagnostic possibilities reduce dose to 200 mg/kg/day	
Urea cycle disorders, chronic therapy:			
	ASL or ASS: Oral: 400 – 700 mg/kg/day in 3 to 4 divided doses CPS: Oral: 170 mg/kg/day in 3 to 4 divided doses		





<p>Aspirin Non-steroidal Anti-inflammatory</p> 	<p><b>Analgesic:</b></p> <p>Infant, children and adolescent &lt;50 kg: PO: 10 – 15 mg/kg/dose every 4 – 6 hours. Max: the lesser value of 90 mg/kg/day or 4000 mg/day Children and adolescent ≥50 kg: 325 – 650 mg every 4 – 6 hours Max: 4000 mg/day</p> <p><b>Antiplatelet effect:</b></p> <p>1 – 5 mg/kg/dose once daily</p> <p>Fontan surgery, postoperative primary prophylaxis: 1 – 5 mg/kg/dose once</p> <p><b>Kawasaki disease:</b></p> <p>Oral: 80 – 100 mg/kg/day divided every 6 hours for up to 14 days until fever resolves for at least 48 hours then decrease dose to 1 – 5 mg/kg/day once daily</p>		<p><b>Comment:</b> It is not recommended to use aspirin in - Children &lt; 12 years who are recovering from chickenpox or having flu like symptoms</p>					
<p>Atropine Anticholinergic</p>	<p><b>Bardycardia: infant, children and adolescents:</b></p> <table border="1" data-bbox="239 644 940 762"> <tr> <td data-bbox="239 644 335 728">IV, IO</td> <td data-bbox="335 644 940 728">0.01 – 0.02 mg/kg/dose (Max dose: 0.5 mg, Max total dose: 1 mg) (minimum dose of 0.1 mg for infants less than 5 kg is no longer recommended as per new AHA/PALS 2015 guidelines)</td> </tr> <tr> <td colspan="2" data-bbox="239 728 940 762">Endotracheal: 0.04 – 0.06 mg/kg/dose may repeat once if needed</td> </tr> </table> <p><b>Organophosphate or carbamate insecticide:</b></p> <table border="1" data-bbox="239 762 940 862"> <tr> <td data-bbox="239 762 335 862">IV, IM</td> <td data-bbox="335 762 940 862">Initial: 0.05 – 0.1 mg/kg repeat every 5 to 10 minutes as needed. (Doubling the dose if previous dose does not induce atropinization)</td> </tr> </table>		IV, IO	0.01 – 0.02 mg/kg/dose (Max dose: 0.5 mg, Max total dose: 1 mg) (minimum dose of 0.1 mg for infants less than 5 kg is no longer recommended as per new AHA/PALS 2015 guidelines)	Endotracheal: 0.04 – 0.06 mg/kg/dose may repeat once if needed		IV, IM	Initial: 0.05 – 0.1 mg/kg repeat every 5 to 10 minutes as needed. (Doubling the dose if previous dose does not induce atropinization)
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Endotracheal: 0.04 – 0.06 mg/kg/dose may repeat once if needed								
IV, IM	Initial: 0.05 – 0.1 mg/kg repeat every 5 to 10 minutes as needed. (Doubling the dose if previous dose does not induce atropinization)							
<p>Azithromycin • Antibiotic • Macrolide</p> 	<p><b>Mild to moderate infection:</b></p> <table border="1" data-bbox="239 902 940 1000"> <tr> <td data-bbox="239 902 335 1000">PO</td> <td data-bbox="335 902 940 1000">5 day regimen: 10 – 12 mg/kg/dose (Max: 500 mg), on day 1 followed by 5 – 6 mg/kg (Max: 250 mg) once daily for whole duration 3 day regimen: 10 mg/kg/day once daily for 3 days (Max: 500mg/dose)</td> </tr> </table> <p><b>Serious infection:</b></p> <table border="1" data-bbox="239 1000 940 1069"> <tr> <td data-bbox="239 1000 335 1069">IV</td> <td data-bbox="335 1000 940 1069">10 mg/kg once daily (Max. 500 mg/day)</td> </tr> </table>		PO	5 day regimen: 10 – 12 mg/kg/dose (Max: 500 mg), on day 1 followed by 5 – 6 mg/kg (Max: 250 mg) once daily for whole duration 3 day regimen: 10 mg/kg/day once daily for 3 days (Max: 500mg/dose)	IV	10 mg/kg once daily (Max. 500 mg/day)		
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IV	10 mg/kg once daily (Max. 500 mg/day)							




Bosentan Endothelin Receptor Antagonist  	Pulmonary arterial hypertension:		Comments: Monitor LFT's. May cause hypotension, peripheral edema and thrombocytopenia.
	Neonates: persistent pulmonary hypertension (PPHN)		
	- PO: 1mg/kg/dose every 12 hours		
	Infant and children:		
	- weight based dosing:		
	Initial dose: 0.75 – 1 mg/kg/dose twice daily for 4 weeks (Max dose: 62.5 mg) Maintenance dose: 2mg/kg/dose twice daily (Max dose ≤ 40kg: 62.5 mg, >40 kg: 125mg)		
	Fixed dosing:		
	<ul style="list-style-type: none"> <li>• 5 to &lt; 10kg: initial 15.6 mg daily for 4 weeks, increase to maintenance dose of 15.6 mg twice daily</li> <li>• 10 to 20 kg: initial: 31.25 mg daily for 4 weeks, increase to maintenance dose of 31.25 mg twice daily</li> <li>• &gt;20 to 40 kg: initial: 31.25mg twice daily for 4 weeks, increase to maintenance dose of 62.5 mg twice daily</li> <li>• &gt;40kg: initial: 62.5 mg twice daily for 4 weeks, increase to maintenance dose of 125 mg twice daily</li> </ul>		
Benzotropine • Anticholinergic Agent	Drug induced extrapyramidal symptoms:		Comments: - May cause anhidrosis, hyperthermia and tachycardia - May cause anticholinergic effects
	PO IM IV	Children ≥3 years:	
		Adolescents: 1 – 4mg every 12 -24 hours	
Budesonide • Corticosteroid	Asthma: Nebulization:		
	Infants: Initial: 0.25mg twice daily or 0.5mg once daily (Max: 1mg/day) Children and adolescents: initial: 0.25 mg twice daily (Max: 1mg/day)		
Calcium Chloride • Calcium Salt, Electrolyte Supplement	Hypocalcemia:		Comments: Monitor: serum calcium, serum magnesium, heart rate and site for extravasation
	Infant and children: 10 – 20 mg/kg/dose (0.1 – 0.2 ml/kg) every 4 -6 hours if needed Max dose: 1000 mg  Equation: (Ca CL 10% = 1.36 meq/ml = 0.7 mmol/ml = 27.2 mg elemental Ca/ml)		

<p>Calcium Gluconate</p> <ul style="list-style-type: none"> <li>Calcium Salt, Electrolyte Supplement</li> </ul>	<p><b>Hypocalcemia:</b></p> <p>Infants, children and adolescents: dose expressed as calcium gluconate IV: 200 – 500 mg/kg/day as a continuous infusion or in 4 divided doses</p> <p>Max dose: infants and children: 1000 mg/dose</p> <p>Max dose: adolescents: 2000 mg/dose</p> <p><b>Symptomatic (seizure, tetany):</b></p> <p>Infants, children and adolescents: dose expressed as calcium gluconate IV: 100 – 200 mg/kg/dose over 5 to 10 minutes</p> <p><b>Hyperkalemia:</b></p> <p>Calcium gluconate 100 mg/kg/dose over 5 minutes. May repeated in 10 minutes</p>	<p>Comments:</p> <p>Calcium gluconate 10% = 100 mg/mL= elemental calcium 9 mg/mL = 0.46 mEq/mL</p> <p>Monitor: serum calcium, serum magnesium, heart rate</p>
<p>Calcium Polystyrene Sulfonate (Resonium Calcium):</p>	<p><b>Hyperkalemia:</b></p> <p>Neonates, Children: Oral/Rectal: 0.5 to 1 g/kg/dose</p> <p>May repeat the dose Q4-6H PRN (usual max. 30 – 60 g/dose)</p>	<p>Comments:</p> <p>Powder resin must be mixed with water prior to administration</p>
<p>Captopril</p> <ul style="list-style-type: none"> <li>Angiotensin converting enzyme inhibitor (ACEI)</li> </ul> 	<p><b>Heart failure (afterload reduction):</b></p> <p>Infants: PO 0.3 – 2.5 mg/kg/day divided every 8 – 12 hours</p> <p>Children and adolescent: 0.3 – 6 mg/kg/day divided every 8 – 12 hours (Max: 150mg/day)</p> <p><b>Hypertension:</b></p> <p>Infants: initial: 0.15 – 0.3 mg/kg/dose in 1 – 4 divided doses (Max: 6mg/kg/day)</p> <p>Children and adolescents: initial: 0.3 – 0.5 mg/kg/dose every 8 hours (Max: 6 mg/kg/day) (Max daily dose: 450 mg/day)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Can cause hyperkalemia, hypotension and cough</li> <li>- Heart failure indication: Initiate therapy at lower end of range and titrate upward to prevent symptomatic hypotension.</li> </ul> <p><i>Contraindication:</i> in patient with bilateral renovascular disease unilateral/bilateral renal artery stenosis</p>





<p>Carbamazepine</p> <ul style="list-style-type: none"> <li>Anticonvulsant</li> </ul> 	Epilepsy:		<p>Comments:</p> <ul style="list-style-type: none"> <li>You may need to adjust the dose after first month following initiation of therapy because Carbamazepine undergoes hepatic autoinduction.</li> <li>Therapeutic level: 17 – 51 mcml/L equivalent to 4 – 12 mcg/ml</li> </ul>
	<p>Infants and children: &lt;6 years</p>	<p>initial 10 – 20 mg/kg/day divided twice or 3 times daily as immediate release tablets or 4 time daily as suspension. Increase dose every week until optimal response and therapeutic level achieved. Max daily dose: 35 mg/kg/day</p>	
	<p>6 to 12 years:</p>	<p>initial: 100 mg twice daily (immediate release tablets or extended release tablets or 50 mg of suspension 4 times daily (200 mg/day) increase by up to 100 /day at weekly intervals Usual maintenance dose: 400 – 800 mg/ day (Max daily dose: 1000 mg/day)</p>	
<p>Caspofungin</p> <ul style="list-style-type: none"> <li>Antifungal Agent, Echinocandin</li> </ul> 	<p>Infants 1 to &lt;3 months: IV 25mg/m2/dose once daily</p>		<p>Comments:</p> <p>May cause decreased serum albumin, increased serum alkaline phosphatase, increased serum ALT, increased serum AST and increased bilirubin</p>
	<p>Infants and children 3 months to 17 years: loading dose: IV: 70 mg/m2/dose on day 1, maintenance dosing: IV: 50 mg/m2/dose once daily May increase the dose to 70 mg/m2/dose once daily if clinical response inadequate (Max: 70 mg)</p>		
	<p>Caution:</p>		
	<p>Patient receiving carbamazepine, dexamethasone, efavirenz, nevirapine, phenytoin or rifampin and any other enzyme inducers consider 70mg/m2/dose once daily (Max:70mg)</p>		
<p>Cefazolin</p> <ul style="list-style-type: none"> <li>Antibiotic, Cephalosporin, 1st Generation</li> </ul> 	<p>General dosing, susceptible infection:</p>		
	<p>Infants, children and adolescents: IV or IM</p>		
	<p>mild to moderate infections:</p>	<p>50 – 100 mg/kg/day divided every 8 hours. Max dose: 1000 mg/dose (3g/day)</p>	
	<p>Severe infections:</p>	<p>100 – 150 mg/kg/day divided every 8 hours. Max dose: 2000mg/dose (6g/day)</p>	
	<p>Peritonitis: Intra-peritoneal:</p>	<p>Intermittent: 20 mg/kg every 24 hours in the long dwell Continuous: loading dose: 500mg/ liter of dialysis maintenance: 125 mg/liter of dialysis</p>	



Cefepime Antibiotic, Ceph- alosporin, 4th Generation  	<b>General dosing:</b> Infants, children and adolescents:		<b>Comments:</b> Cystic fibrosis patients with more resistant pseu- domonas isolations (MIC $\geq 16$ mg/L) may require 50 mg/kg/dose every 6 hours (consult ID when using this dose)
	Mild to moderate infection:	IV: 50 mg/kg/dose every 12 hours Max dose: 2000 mg/dose	
	Severe infection:	50 mg/kg/dose every 8 – 12 hours Max dose: 2000 mg/dose	
	Meningitis, Cystic fibrosis, acute pulmonary exacerbation:	50 mg/kg/dose every 8 hours	
Cefixime Antibiotic, Ceph- alosporin, 3rd Generation  	<b>General dosing: PO</b>		
	Infants, children $\leq$ 45kg:	8mg/kg/day divided every 12 to 24 hours, Max daily dose: 400mg/day	
	Children weighing >45kg and adolescents:	400mg daily	
Cefotaxime Antibiotic, Ceph- alosporin, 3rd Generation  	<b>General dosing:</b>		
	<b>Neonate:</b>		
	$\leq 7$ days old: <2 kg: 100 mg/kg/day divided every 12 hours, >2 kg: 100 – 150 mg/kg/day divided every 8 – 12 hours		
	$\geq 7$ days old: 150 – 200 mg/kg/day divided every 6 – 8 hours		
	Infants, children and adolescents: IV, IM		
	Mild to moderate infection:	100 – 150 mg/kg/day divided every 6 – 8 hours ( $\geq 50$ kg: 1000 – 2000 mg every 6 – 8 hours) Max daily dose: 6 g/day	
	Severe infection/Pneumonia:	150 – 200 mg/kg/day in divided doses every 6 – 8 hours (Max: 2 g per dose)	
Peritonitis:	Intraperitoneal: intermittent: 30 mg/kg/dose every 24 hours Continuous: LD: 500 mg/liter of dialysate, maintenance: 125 – 250 mg/liter		
Meningitis:	IV: 200 – 300 mg/kg/day divided every 6 – 8 hours (Max: 2 g per dose)		




<b>Ceftazidime</b> Antibiotic, Cephalosporin, 3rd Generation 	<b>General dosing:</b>		
	Infants, children and adolescents:		
	mild to moderate infection: IV, IM	90 – 150 mg/kg/day divided every 8 hours (Max daily dose: 3 g/day)	
	Severe infection/ Meningitis/ Cystic fibrosis: IV	150 – 200 mg/kg/day in divided doses every 8 hours (Max daily dose: 6 g/day)	
	Urinary tract infection:	infant and children (2 – 24 month) IV: 100 – 150 mg/kg/day every 8 hour	
Peritonitis:	Intraperitoneal: intermittent: 20 mg/kg/dose every 24 hours in the long dwell Continuous: LD: 500 mg/liter of dialysate, maintenance: 125 mg/liter		
<b>Ceftriaxone</b> • Antibiotic, Cephalosporin, 3rd Generation 	<b>General dosing: Infants, children and adolescents:</b>	<b>Comments:</b> May cause cholelithiasis, sludging in gall bladder	
	Mild to moderate infection:		IV: 50 – 75 mg/kg/dose once daily Max dose: 1 g/day
	Severe infection/ Meningitis: IV:	100 mg/kg/day divided every 12 – 24 hours Max daily dose: 4 g/day	
<b>Cefprozil</b> • Antibiotic, 2nd generation cephalosporin 	<b>General dosing: PO</b>		
	mild to moderate infection:	7.5 – 15mg/kg/dose twice daily, Max single dose: 500mg	
<b>Cefuroxime</b> • Antibiotic, Cephalosporin, 2nd Generation 	<b>General dosing: Infants, children and adolescents:</b>		
	Mild to moderate infection:	P.O: 20 – 30 mg/kg/day divided twice daily. Max dose: 500 mg/dose IV, IM: 75 – 100 mg/kg/day divided every 8 hours. Max dose: 1500 mg/dose	
	Severe infection:	IM, IV: 100 – 150 mg/kg/day divided every 6 – 8 hours Max dose: 1500 mg/dose.	


<p>Chloral Hydrate</p> <ul style="list-style-type: none"> <li>Hypnotic, Sedative</li> </ul>  	<p>Sedation, anxiety:</p> <p>Infants and children: Oral, rectal: 25 - 50 mg/kg/dose every 6 - 8 hours as needed, Max dose: 500 mg/dose</p> <p>Hypnotic:</p> <table border="1" data-bbox="241 244 499 326"> <tr> <td data-bbox="241 244 333 326"></td> <td data-bbox="333 244 499 326">Oral, rectal: 50 mg/kg/dose at bed time.</td> </tr> </table> <p>Sedation, non-painful procedure:</p> <table border="1" data-bbox="241 363 723 495"> <tr> <td data-bbox="241 363 333 495"></td> <td data-bbox="333 363 723 495">Oral, rectal: 50 - 75 mg/kg/dose 30 - 60 minutes prior to procedure, may repeat 30 minutes after initial dose if needed, Total Max dose: 120 mg/kg or (1 g total for infant, 2g total for children)</td> </tr> </table>		Oral, rectal: 50 mg/kg/dose at bed time.		Oral, rectal: 50 - 75 mg/kg/dose 30 - 60 minutes prior to procedure, may repeat 30 minutes after initial dose if needed, Total Max dose: 120 mg/kg or (1 g total for infant, 2g total for children)	<p>Comments:</p> <p>May cause cardiac arrhythmia, hypotension</p>								
	Oral, rectal: 50 mg/kg/dose at bed time.													
	Oral, rectal: 50 - 75 mg/kg/dose 30 - 60 minutes prior to procedure, may repeat 30 minutes after initial dose if needed, Total Max dose: 120 mg/kg or (1 g total for infant, 2g total for children)													
<p>Ciprofloxacin</p> <p>Antibiotic, Fluoroquinolone</p> 	<p>General dosing, susceptible infection:</p> <table border="1" data-bbox="241 541 723 652"> <tr> <td data-bbox="241 541 333 593">Oral:</td> <td data-bbox="333 541 723 593">20 - 30 mg/kg/day divided every 12 hours, Max dose: 500 mg/dose</td> </tr> <tr> <td data-bbox="241 593 333 652">IV:</td> <td data-bbox="333 593 723 652">20 - 30 mg/kg/day divided every 12 hours, Max dose: 400 mg/dose</td> </tr> </table> <p>Complicated UTI or pyelonephritis:</p> <table border="1" data-bbox="241 690 723 808"> <tr> <td data-bbox="241 690 333 749">Oral:</td> <td data-bbox="333 690 723 749">20 - 40 mg/kg/day divided every 12 hours for 10 to 21 days, Max dose: 1.5 g/day</td> </tr> <tr> <td data-bbox="241 749 333 808">IV:</td> <td data-bbox="333 749 723 808">18 - 30 mg/kg/day divided every 8 hours for 10 to 21 days, Max dose: 1.2 g/day</td> </tr> </table> <p>Cystic fibrosis:</p> <table border="1" data-bbox="241 845 723 973"> <tr> <td data-bbox="241 845 333 912">Oral:</td> <td data-bbox="333 845 723 912">40 mg/kg/day divided every 12 hours, Max dose: 2g/day</td> </tr> <tr> <td data-bbox="241 912 333 973">IV:</td> <td data-bbox="333 912 723 973">30 mg/kg/day divided every 8 to 12 hours, Max dose: 1.2 g/day</td> </tr> </table>	Oral:	20 - 30 mg/kg/day divided every 12 hours, Max dose: 500 mg/dose	IV:	20 - 30 mg/kg/day divided every 12 hours, Max dose: 400 mg/dose	Oral:	20 - 40 mg/kg/day divided every 12 hours for 10 to 21 days, Max dose: 1.5 g/day	IV:	18 - 30 mg/kg/day divided every 8 hours for 10 to 21 days, Max dose: 1.2 g/day	Oral:	40 mg/kg/day divided every 12 hours, Max dose: 2g/day	IV:	30 mg/kg/day divided every 8 to 12 hours, Max dose: 1.2 g/day	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause gastric upset, diarrhea, dyspepsia, nausea, vomiting and headache</li> <li>- May enhance the QTc prolonging effect of moderate or high risk QTc prolonging agents.</li> </ul>
Oral:	20 - 30 mg/kg/day divided every 12 hours, Max dose: 500 mg/dose													
IV:	20 - 30 mg/kg/day divided every 12 hours, Max dose: 400 mg/dose													
Oral:	20 - 40 mg/kg/day divided every 12 hours for 10 to 21 days, Max dose: 1.5 g/day													
IV:	18 - 30 mg/kg/day divided every 8 hours for 10 to 21 days, Max dose: 1.2 g/day													
Oral:	40 mg/kg/day divided every 12 hours, Max dose: 2g/day													
IV:	30 mg/kg/day divided every 8 to 12 hours, Max dose: 1.2 g/day													
<p>Cisatracurium</p> <ul style="list-style-type: none"> <li>Neuromuscular Blocker Agent, Non-depolarizing</li> </ul>	<p>Paralysis skeletal muscle relaxation: IV:</p> <table border="1" data-bbox="241 1009 723 1283"> <tr> <td data-bbox="241 1009 333 1120">infant &amp; children &lt;2 years old:</td> <td data-bbox="333 1009 723 1120">0.15 mg/kg over 5 - 10 seconds</td> </tr> <tr> <td data-bbox="241 1120 333 1202">Children ≥ 2 years old:</td> <td data-bbox="333 1120 723 1202">0.1 - 0.15 mg/kg over 5 - 10 seconds</td> </tr> <tr> <td data-bbox="241 1202 333 1283">Continuous IV infusion:</td> <td data-bbox="333 1202 723 1283">1 - 4 mcg/kg/ minute Max: 10 mcg/kg/minute</td> </tr> </table>	infant & children <2 years old:	0.15 mg/kg over 5 - 10 seconds	Children ≥ 2 years old:	0.1 - 0.15 mg/kg over 5 - 10 seconds	Continuous IV infusion:	1 - 4 mcg/kg/ minute Max: 10 mcg/kg/minute	<p>Comments:</p> <p>Rare but important life threatening side effect are: bradycardia, bronchospasm, flushing and hypotension</p>						
infant & children <2 years old:	0.15 mg/kg over 5 - 10 seconds													
Children ≥ 2 years old:	0.1 - 0.15 mg/kg over 5 - 10 seconds													
Continuous IV infusion:	1 - 4 mcg/kg/ minute Max: 10 mcg/kg/minute													




Clarithromycin Antibiotic, Mac- rolide  	General dosing:		Comments: - Prolonged QT interval on ECG - May increase serum levels of carbamazepine, cyclosporine and tacrolimus
	Infants, children and adolescents:	PO: 15 mg/kg/day divided every 12 hours (Max. single dose: 500 mg)	
	Mycobacterium avium complex infection (MAC):		
	Prophylaxis: P.O:	15 mg/kg/day divided every 12 hours	
	Treatment: P.O:	15 – 30 mg/kg/day divided every 12hours. Max. single dose: 500 mg	
Clindamycin • Antibiotic, Anaerobic  	General dosing:		Comments: May cause diarrhea, pseudomembranous colitis, rash, thrombophlebitis, thrombocytopenia, abnormal hepatic function tests and jaundice
	Infants, children and adolescent: IM, IV:	20 – 40 mg/kg/day divided every 6 – 8 hours Max daily dose: 2700mg/day	
	P.O:	10 – 40 mg/kg/day divided every 6 – 8 hours, Max daily dose: 1800 mg/day	
Clobazam • Anticonvulsant, Benzodiaz- epine   	Lennox-Gastaut syndrome:		Comments: May increase dosage slowly every 5 – 7 days.
	Children and adolescents: ≤ 30 kg:	initial: 5mg once daily for ≥ 1 week, may increase to 5 mg twice daily for ≥ 1 week, then increase to 10 mg twice daily (Max daily dose: 20 mg/day).	
	>30kg: initial:	5 mg twice daily for ≥ 1 week, may increase to 10 mg twice daily for ≥ 1 week then increase to 20 mg twice daily (Max daily dose: 40 mg/day).	
	Seizure, generalized or partial, monotherapy or adjunctive therapy:		
	Infants and children:	initial: PO: 0.5 – 1 mg/kg/day in two divided doses, (Max initial dose: 5 mg/day) Max daily dose: 10 mg/day	
Children 2 -16 years:	initial: 5 mg once daily, usual range: 10 – 20 mg/day or (0.3 – 1 mg/kg/day in divided doses twice daily. Max daily dose: 40 mg/day		


<p>Clonazepam</p> <ul style="list-style-type: none"> <li>Anticonvulsant, Benzodiazepine</li> </ul> 	<p><b>Seizure disorders:</b></p> <p>Infants and children &lt; 10 years old or ≤ 30 kg:</p> <p>initial daily dose: 0.01 – 0.03 mg/kg/day (Max initial dose: 0.05 mg/kg/day) in 2 - 3 divided doses, increase by no more than 0.5 mg every third day until seizures are controlled or adverse effect seen. Maintenance dose: 0.1 – 0.2 mg/kg/day in 3 divided doses</p> <p>Children and adolescent &gt; 30 kg:</p> <p>initial dose not to exceed 1.5 mg given in 3 divided doses, may increase by 0.5 – 1 mg every third day until seizures are controlled or adverse effects seen Maintenance dose: 0.05 – 0.2 mg/kg/day. (Max: 20 mg/day).</p>		<p>Comments:</p> <p>May cause behavior change, increase secretions</p>						
<p>Clonidine</p> <ul style="list-style-type: none"> <li>Analgesic</li> <li>Antihypertensive (Alpha Adrenergic Agonist)</li> </ul>	<p><b>Hypertension:</b></p> <p>children and adolescents:</p> <p>initial: P.O: 5 – 10 mcg/kg/day in divided doses every 6 – 12 hours, increase gradually as needed Usual range: 5 – 25 mcg/kg/day in divided doses every 6 hours. Max dose: 0.9 mg/day</p> <p><b>Opioid withdrawal:</b></p> <p>P.O: 1 – 5 mcg/kg/dose every 6 hours (Max. 200 mcg/dose)</p>		<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause hypotension.</li> <li>- Do not discontinue clonidine abruptly (can cause rebound hypertension or withdrawal).</li> </ul>						
<p>Cloxacillin</p> <ul style="list-style-type: none"> <li>Antibiotic, Penicillin (Antistaphylococcal)</li> </ul>	<p><b>Infants and children: P.O, IV:</b></p> <table border="1" data-bbox="239 808 723 1028"> <tr> <td>Mild to moderate infections</td> <td>100 – 150 mg/kg/day in divided doses every 6 hours. Max daily dose: 4 g /day</td> </tr> <tr> <td>Severe infections</td> <td>150 – 200 mg/kg/day in divided doses every 4 – 6 hours. Max: 2 g/dose (12 g/day)</td> </tr> <tr> <td>Meningitis: IV:</td> <td>200 mg/kg/day in divided doses every 6 hours. Max: 12 g/day</td> </tr> </table>		Mild to moderate infections	100 – 150 mg/kg/day in divided doses every 6 hours. Max daily dose: 4 g /day	Severe infections	150 – 200 mg/kg/day in divided doses every 4 – 6 hours. Max: 2 g/dose (12 g/day)	Meningitis: IV:	200 mg/kg/day in divided doses every 6 hours. Max: 12 g/day	
Mild to moderate infections	100 – 150 mg/kg/day in divided doses every 6 hours. Max daily dose: 4 g /day								
Severe infections	150 – 200 mg/kg/day in divided doses every 4 – 6 hours. Max: 2 g/dose (12 g/day)								
Meningitis: IV:	200 mg/kg/day in divided doses every 6 hours. Max: 12 g/day								
<ul style="list-style-type: none"> <li>Codeine and Acetaminophen</li> <li>Analgesic, Narcotic</li> </ul> 	<p><b>Children and adolescents:</b></p> <p>dose based on codeine: 0.5 – 1 mg/kg/dose every 4 – 6 hours Max: 60 mg/dose</p>								




<p>Colistin</p> <ul style="list-style-type: none"> <li>Antibiotic, Miscellaneous</li> </ul> 	<p>General dosing: Infants, children and adolescents:</p> <p>75,000 – 150,000 unit/kg/day in divided doses every 6 – 12 hours</p> <p>Cystic fibrosis, pulmonary infection:</p> <p>90,000 – 150,000 unit/kg/day in divided doses every 8 hours</p> <p>Intraventricular/Intrathecal:</p> <p>Intrathecal: 150,000 - 300,000 units/day Intraventricular: 60,000 – 300,000 units/day diluted in 1 – 2 ml of preservative free normal saline once daily</p> <p>Inhalation:</p> <p>Children &lt; 2 years: 0.5-1 Million Units (MIU) Q 8 HR (Max: 2 MIU/ day), Pre-medicate with salbutamol</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>Intraventricular: Via an external ventricular drain (EVD), which is clamped for 1 h &amp; released</li> <li>May cause CNS toxicity: dose reduction may reduce neurologic symptoms</li> </ul>										
<p>Cotrimoxazole</p> <ul style="list-style-type: none"> <li>Antibiotic, Sulfonamide Derivative</li> </ul> 	<p>Dose is based on the trimethoprim (TMP) component</p> <p>Infants ≥ 2 months, children and adolescents:</p> <table border="1" data-bbox="260 598 736 679"> <tr> <td>General dosing:</td> <td>P.O, IV: 6 – 12 mg TMP/kg/day in divided doses every 12 hours Max: 160mg TMP/ dose</td> </tr> </table> <p>Pneumocystis jirovecii pneumonia (PCP):</p> <table border="1" data-bbox="260 724 736 776"> <tr> <td>Treatment:</td> <td>P.O/ IV: 15 – 20 mg TMP/kg/day in divided doses every 6 – 8 hours for 21 days</td> </tr> </table> <table border="1" data-bbox="260 790 736 865"> <tr> <td>Prophylaxis:</td> <td>P.O: 5mg TMP/kg/day in divided doses every 12 hours for 3 consequent or alternative day. Max daily dose: 320 mg TMP/ day</td> </tr> </table> <p>UTI:</p> <table border="1" data-bbox="260 909 736 961"> <tr> <td>Treatment: P.O, IV:</td> <td>8 – 12 mg TMP/kg/day in divided doses every 12 hours for 7 – 14 days</td> </tr> </table> <table border="1" data-bbox="260 969 736 1013"> <tr> <td>Prophylaxis: P.O:</td> <td>2 mg TMP/kg/dose once daily</td> </tr> </table>	General dosing:	P.O, IV: 6 – 12 mg TMP/kg/day in divided doses every 12 hours Max: 160mg TMP/ dose	Treatment:	P.O/ IV: 15 – 20 mg TMP/kg/day in divided doses every 6 – 8 hours for 21 days	Prophylaxis:	P.O: 5mg TMP/kg/day in divided doses every 12 hours for 3 consequent or alternative day. Max daily dose: 320 mg TMP/ day	Treatment: P.O, IV:	8 – 12 mg TMP/kg/day in divided doses every 12 hours for 7 – 14 days	Prophylaxis: P.O:	2 mg TMP/kg/dose once daily	<p>Comments:</p> <ul style="list-style-type: none"> <li>Not recommended for use in infants &lt; 2 months</li> <li>May cause kernicterus in newborns, blood dyscrasias</li> </ul>
General dosing:	P.O, IV: 6 – 12 mg TMP/kg/day in divided doses every 12 hours Max: 160mg TMP/ dose											
Treatment:	P.O/ IV: 15 – 20 mg TMP/kg/day in divided doses every 6 – 8 hours for 21 days											
Prophylaxis:	P.O: 5mg TMP/kg/day in divided doses every 12 hours for 3 consequent or alternative day. Max daily dose: 320 mg TMP/ day											
Treatment: P.O, IV:	8 – 12 mg TMP/kg/day in divided doses every 12 hours for 7 – 14 days											
Prophylaxis: P.O:	2 mg TMP/kg/dose once daily											
<p>Dantrolene</p> <ul style="list-style-type: none"> <li>Skeletal Muscle Relaxant</li> </ul> 	<p>Management of malignant hyperthermia:</p> <table border="1" data-bbox="260 1058 736 1221"> <tr> <td>IV:</td> <td>2.5 mg/kg continuous repeated till symptoms subside or cumulative dose of 10 mg/kg</td> </tr> </table>	IV:	2.5 mg/kg continuous repeated till symptoms subside or cumulative dose of 10 mg/kg									
IV:	2.5 mg/kg continuous repeated till symptoms subside or cumulative dose of 10 mg/kg											

<p>Desmopressin</p> <ul style="list-style-type: none"> <li>Hormone, Vasopressin Analog</li> </ul> 	<p><b>Diabetes insipidus: children and adolescents:</b></p> <p>oral: 0.05 mg twice daily titrate to desired response Dose range: 0.1 – 0.8 mg/day in 2 to 3 divided doses</p> <p>Intranasal: DDAVP nasal spray: can only deliver fixed doses in 10 mcg (0.1 ml) increments.</p> <table border="1" data-bbox="236 268 723 498"> <tr> <td data-bbox="236 268 332 375">Infants: <math>\geq</math> 3 months and children:</td> <td data-bbox="332 268 723 375">initial: 5 mcg/day in 1 to 2 divided doses, usual range: 5 – 30 mcg/day in two divided doses.</td> </tr> <tr> <td data-bbox="236 375 332 434">Adolescent:</td> <td data-bbox="332 375 723 434">5 – 40 mcg/day in 1 - 3 divided doses.</td> </tr> <tr> <td data-bbox="236 434 332 498">Adult:</td> <td data-bbox="332 434 723 498">20 mcg/day in 2 divided dose.</td> </tr> </table> <p>IV, SubQ: Initial dosage range: 0.1 to 1 mcg in 1 or 2 divided doses</p>	Infants: $\geq$ 3 months and children:	initial: 5 mcg/day in 1 to 2 divided doses, usual range: 5 – 30 mcg/day in two divided doses.	Adolescent:	5 – 40 mcg/day in 1 - 3 divided doses.	Adult:	20 mcg/day in 2 divided dose.	<p>Comments:</p> <p>Closely monitor serum sodium levels and urine output.</p>				
Infants: $\geq$ 3 months and children:	initial: 5 mcg/day in 1 to 2 divided doses, usual range: 5 – 30 mcg/day in two divided doses.											
Adolescent:	5 – 40 mcg/day in 1 - 3 divided doses.											
Adult:	20 mcg/day in 2 divided dose.											
<p>Dexamethasone</p> <ul style="list-style-type: none"> <li>Corticosteroid, Glucocorticoid</li> </ul>	<p><b>Infants, children and adolescents</b></p> <table border="1" data-bbox="236 590 723 1062"> <tr> <td data-bbox="236 590 332 701">Airway edema or extubation:</td> <td data-bbox="332 590 723 701">P.O, IM, IV: 0.25 - 0.5 mg/kg/dose every 6 hour (Max dose: 10 mg/dose).</td> </tr> <tr> <td data-bbox="236 701 332 783">Anti-inflammatory:</td> <td data-bbox="332 701 723 783">P.O, IM, IV: initial dose range: 0.02 – 0.3 mg/kg/day in divided doses every 6 - 12 hours Usual adult daily dose: 0.75 – 9 mg/day</td> </tr> <tr> <td data-bbox="236 783 332 865">Asthma exacerbation:</td> <td data-bbox="332 783 723 865">P.O, IM, IV: 0.6 mg/kg once daily for 2 days. Max dose: 16mg/dose</td> </tr> <tr> <td data-bbox="236 865 332 1006">Cerebral edema:</td> <td data-bbox="332 865 723 1006">P.O, IM, IV: LD: 1 – 2 mg/kg/dose as a single dose Maintenance: 1- 1.5 mg/kg/day in divided doses every 4 – 6 hours Max daily dose: 16 mg/day</td> </tr> <tr> <td data-bbox="236 1006 332 1062">Croup:</td> <td data-bbox="332 1006 723 1062">P.O, IM, IV: 0.6 mg/kg once daily, Max dose: 16 mg</td> </tr> </table>	Airway edema or extubation:	P.O, IM, IV: 0.25 - 0.5 mg/kg/dose every 6 hour (Max dose: 10 mg/dose).	Anti-inflammatory:	P.O, IM, IV: initial dose range: 0.02 – 0.3 mg/kg/day in divided doses every 6 - 12 hours Usual adult daily dose: 0.75 – 9 mg/day	Asthma exacerbation:	P.O, IM, IV: 0.6 mg/kg once daily for 2 days. Max dose: 16mg/dose	Cerebral edema:	P.O, IM, IV: LD: 1 – 2 mg/kg/dose as a single dose Maintenance: 1- 1.5 mg/kg/day in divided doses every 4 – 6 hours Max daily dose: 16 mg/day	Croup:	P.O, IM, IV: 0.6 mg/kg once daily, Max dose: 16 mg	<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause hypertension, hyperglycemia, gastrointestinal hemorrhage</li> <li>For extubation: use 2 doses before extubation and 2 – 4 after extubation</li> </ul>
Airway edema or extubation:	P.O, IM, IV: 0.25 - 0.5 mg/kg/dose every 6 hour (Max dose: 10 mg/dose).											
Anti-inflammatory:	P.O, IM, IV: initial dose range: 0.02 – 0.3 mg/kg/day in divided doses every 6 - 12 hours Usual adult daily dose: 0.75 – 9 mg/day											
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Croup:	P.O, IM, IV: 0.6 mg/kg once daily, Max dose: 16 mg											
<p>Dexmedetomidine</p> <ul style="list-style-type: none"> <li>Alpha2-Adrenergic Agonist; Sedative</li> </ul>	<p><b>Sedation</b></p> <p>LD: 0.5 – 1 mcg/kg/hour followed by maintenance infusion 0.2 – 1 mcg/kg/ hour</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause bradycardia</li> </ul>										
<p>Dextrose:</p>	<p><b>Hypoglycemia:</b></p> <p>Dextrose 25 - 50%: IV/IO: 0.5 – 1 g/kg/dose (2 - 4 ml/kg/dose of 25% dextrose, 1 - 2 ml/kg/dose of 50% dextrose)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause localized phlebitis and extravasation. Central line is preferred</li> </ul>										




<ul style="list-style-type: none"> <li>Diazepam Benzodiazepine</li> </ul>	<b>Convulsive disorder: Acute treatment:</b>  <b>Rectal gel:</b> children 2 -5 years: 0.5 mg/kg 6 – 11 years: 0.3 mg/kg ≥ 12 years: 0.2 mg/kg		<b>Comments:</b> Round dose to the nearest 2.5 mg increment, not exceeding a 20 mg/dose, may be repeated in 4 to 12 hours if needed								
<ul style="list-style-type: none"> <li>Digoxin</li> <li>Antiarrhythmic agent, Cardiac Glycoside</li> </ul>	<b>Infants, children and adolescents:</b> <b>Total Digitalizing dose (TDD):</b>  Initial dose: **Give ½ of the TDD for the initial dose, then give ¼ of the TDD for each of two subsequent doses at 6 – 8 hour intervals  <table border="1" data-bbox="256 397 743 614"> <tr> <td data-bbox="256 397 353 506">P.O</td> <td data-bbox="353 397 743 506">           infants 1 – 24 months: 35 - 60 mcg/kg            2 – 5 years: 30 – 45 mcg/kg            5 – 10 years: 20 – 35 mcg/kg            &gt;10 years: 10 – 15 mcg/kg         </td> </tr> <tr> <td data-bbox="256 506 353 614">IV:</td> <td data-bbox="353 506 743 614">           infants 1 – 24 months: 30 – 50 mcg/kg            2 – 5 years: 25 – 35 mcg/kg            5 – 10 years: 15 – 30 mcg/kg            &gt;10 years: 8 – 12 mcg/kg         </td> </tr> </table> Maintenance dose: **maintenance dose: if < 10 year every 12 hour, if > 10 year once/day  <table border="1" data-bbox="256 673 743 887"> <tr> <td data-bbox="256 673 353 783">P.O:</td> <td data-bbox="353 673 743 783">           Infants 1 – 24 months: 10 – 15 mcg/kg/day            2 – 5 years: 8 – 10 mcg/kg/day            5 – 10 years: 5 – 10 mcg/kg/day            &gt; 10 years: 2.5 – 5 mcg/kg/day         </td> </tr> <tr> <td data-bbox="256 783 353 887">IV:</td> <td data-bbox="353 783 743 887">           infants 1 – 24 months: 7.5 – 12 mcg/kg/day            2 – 5 years: 6 – 9 mcg/kg/day            5 – 10 years: 4 – 8 mcg /kg/day            &gt;10 years: 2 – 3 mcg/kg/day         </td> </tr> </table>		P.O	infants 1 – 24 months: 35 - 60 mcg/kg 2 – 5 years: 30 – 45 mcg/kg 5 – 10 years: 20 – 35 mcg/kg >10 years: 10 – 15 mcg/kg	IV:	infants 1 – 24 months: 30 – 50 mcg/kg 2 – 5 years: 25 – 35 mcg/kg 5 – 10 years: 15 – 30 mcg/kg >10 years: 8 – 12 mcg/kg	P.O:	Infants 1 – 24 months: 10 – 15 mcg/kg/day 2 – 5 years: 8 – 10 mcg/kg/day 5 – 10 years: 5 – 10 mcg/kg/day > 10 years: 2.5 – 5 mcg/kg/day	IV:	infants 1 – 24 months: 7.5 – 12 mcg/kg/day 2 – 5 years: 6 – 9 mcg/kg/day 5 – 10 years: 4 – 8 mcg /kg/day >10 years: 2 – 3 mcg/kg/day	<b>Comments:</b> - Based on lean body weight and normal renal function - May cause nausea vomiting, abdominal pain and thrombocytopenia
P.O	infants 1 – 24 months: 35 - 60 mcg/kg 2 – 5 years: 30 – 45 mcg/kg 5 – 10 years: 20 – 35 mcg/kg >10 years: 10 – 15 mcg/kg										
IV:	infants 1 – 24 months: 30 – 50 mcg/kg 2 – 5 years: 25 – 35 mcg/kg 5 – 10 years: 15 – 30 mcg/kg >10 years: 8 – 12 mcg/kg										
P.O:	Infants 1 – 24 months: 10 – 15 mcg/kg/day 2 – 5 years: 8 – 10 mcg/kg/day 5 – 10 years: 5 – 10 mcg/kg/day > 10 years: 2.5 – 5 mcg/kg/day										
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<ul style="list-style-type: none"> <li>Diphenhydramine</li> <li>Antihistamine, Sedative</li> </ul>	<b>Dystonic reaction, Allergic reaction (severe) &amp; anaphylaxis:</b>  <table border="1" data-bbox="256 951 743 1047"> <tr> <td data-bbox="256 951 353 1047">IV, IM, P.O</td> <td data-bbox="353 951 743 1047">           1 – 2 mg/kg/dose given every 6 hours            Max single dose: 50 mg/dose         </td> </tr> </table>		IV, IM, P.O	1 – 2 mg/kg/dose given every 6 hours Max single dose: 50 mg/dose	<b>Comments:</b> - May cause sedation, paradoxical excitement in children - Not recommended for use in neonates						
IV, IM, P.O	1 – 2 mg/kg/dose given every 6 hours Max single dose: 50 mg/dose										
<ul style="list-style-type: none"> <li>Dobutamine</li> <li>Adrenergic Agonist Agent</li> </ul>	<b>Infants, children and adolescents:</b>  Continuous IV infusion: 2 – 20 mcg/kg/minute titrate to desired response		<b>Comments:</b> - Compatible with: D5W, NaCl 0.9%, D5 NaCl 0.45%, D5 NaCl 0.9% May cause arrhythmias								
<ul style="list-style-type: none"> <li>Domperidone</li> <li>Dopamine Antagonist, Gastrointestinal Agent, Prokinetic</li> </ul>	<b>Children:</b>  <table border="1" data-bbox="256 1240 743 1377"> <tr> <td data-bbox="256 1240 353 1377">P.O:</td> <td data-bbox="353 1240 743 1377">           0.2 – 0.4 mg/kg/dose every 6 – 8 hours            Max: 30 mg/day         </td> </tr> </table>		P.O:	0.2 – 0.4 mg/kg/dose every 6 – 8 hours Max: 30 mg/day	<b>Comments:</b> - May increase QTc interval - Consider close ECG monitoring in patients on other drugs cause QTC prolongation						
P.O:	0.2 – 0.4 mg/kg/dose every 6 – 8 hours Max: 30 mg/day										


Dopamine • Adrenergic Agonist Agent	<b>Infants, children and adolescents:</b>  Continuous IV infusion:  - 5 – 20 mcg/kg/minute titrate to desired response - Intermediate dosage: 5 -10 mcg/kg/minute, beta effect (mainly inotropic effects with some chronotropic effects) - High dosage: 10 – 20 mcg/kg/minute. Alpha adrenergic effects, potent vasoconstriction		Comments: - The hemodynamic effects of dopamine are dose dependent - May cause arrhythmias
Enoxaparin • Anticoagulant, Low Molecular Weight Heparin (LMWH)  	<b>Infants 1 to &lt;2 months:</b>  <b>Infants ≥ 2 months, children &amp; adolescent:</b>	Treatment: Subcutaneous (Sub Q): 1.5 mg/kg/dose every 12 hours  Prophylaxis: Sub Q: 0.75 mg/kg/dose every 12 hours  Treatment: Sub Q: 1 mg/kg/dose every 12 hours  Prophylaxis: Sub Q: 0.5 mg/kg/dose every 12 hours	Comments: - Monitor antifactor Xa levels 4 hours after the dose - Adjust dosage to achieve target antifactor Xa levels (for the treatment 0.5 – 1 unit/ml, for prophylaxis 0.1 – 0.3 unit/ml).
Epinephrine • Adrenergic Agonist Agent	<b>Infants, children and adolescents:</b>  <b>Nebs:</b> Racemic epinephrine (2.25%),  Croup: (laryngotracheobronchitis), airway edema: Nebs:  Hypersensitivity/ Allergic reaction: IM, SubQ:  Asystole/pulseless arrest and Bradycardia:  Bradycardia, Hypotension/shock, fluid resistant		Comments: - Dose <0.3 mcg/kg/minute generally produce β adrenergic effects - Dose >0.3 mcg/kg/minute generally produce alpha adrenergic effect - May cause tachycardia, arrhythmia, pulmonary edema and extravasation



<ul style="list-style-type: none"> <li>• Epoprostenol (Flolan)</li> </ul> <p>Prostacyclin, PGI<sub>2</sub></p>	<p><b>Pulmonary hypertension:</b></p> <p>Infants, children and adolescents:</p> <table border="1" data-bbox="260 160 736 379"> <tr> <td data-bbox="260 160 353 290"></td> <td data-bbox="353 160 736 290">           Continues infusion: initial: 1 – 2 ng/kg/minute titrate the dose by 1 to 2 ng/kg/minute every 15 minutes until dose limiting side effects are noted or tolerance limit to epoprostenol is observed         </td> </tr> <tr> <td data-bbox="260 290 353 335"></td> <td data-bbox="353 290 736 335">           Usual range: 2 – 60 ng/kg/minute         </td> </tr> <tr> <td data-bbox="260 335 353 379"></td> <td data-bbox="353 335 736 379">           Chronic dosing ≥ 1 year of therapy: 50 – 80 ng/kg/minute         </td> </tr> </table>		Continues infusion: initial: 1 – 2 ng/kg/minute titrate the dose by 1 to 2 ng/kg/minute every 15 minutes until dose limiting side effects are noted or tolerance limit to epoprostenol is observed		Usual range: 2 – 60 ng/kg/minute		Chronic dosing ≥ 1 year of therapy: 50 – 80 ng/kg/minute	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause flushing, jaw pain, headache, hypotension and nausea</li> </ul>
	Continues infusion: initial: 1 – 2 ng/kg/minute titrate the dose by 1 to 2 ng/kg/minute every 15 minutes until dose limiting side effects are noted or tolerance limit to epoprostenol is observed							
	Usual range: 2 – 60 ng/kg/minute							
	Chronic dosing ≥ 1 year of therapy: 50 – 80 ng/kg/minute							
<p>Erythromycin</p> <ul style="list-style-type: none"> <li>• Antibiotic, Macrolide</li> </ul> 	<p>Infants, children and adolescents:</p> <p>General dosing, susceptible infection:</p> <p>P.O base: 30 – 50 mg/kg/day divided every 6 – 8 hours (Max: 2 g/day)</p> <p>IV as lactobionate: 15 – 50 mg/kg/day divided every 6 hours Max daily dose: 4 g/day</p> <table border="1" data-bbox="260 609 736 790"> <tr> <td data-bbox="260 609 353 669">Pertussis:</td> <td data-bbox="353 609 736 669">           Infant and child: PO 10 mg/kg/dose every 6 hour, Max daily dose: 2 g/day         </td> </tr> <tr> <td data-bbox="260 669 353 790">Prokinetic (GI motility) agent:</td> <td data-bbox="353 669 736 790">           P.O: 3 mg/kg/dose 4 times daily may increase as needed to effect. Max dose: 10 mg/kg or 250mg         </td> </tr> </table>	Pertussis:	Infant and child: PO 10 mg/kg/dose every 6 hour, Max daily dose: 2 g/day	Prokinetic (GI motility) agent:	P.O: 3 mg/kg/dose 4 times daily may increase as needed to effect. Max dose: 10 mg/kg or 250mg	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause abdominal cramping, nausea and vomiting</li> <li>- May cause hypertrophic pyloric stenosis and pseudomembranous colitis</li> </ul>		
Pertussis:	Infant and child: PO 10 mg/kg/dose every 6 hour, Max daily dose: 2 g/day							
Prokinetic (GI motility) agent:	P.O: 3 mg/kg/dose 4 times daily may increase as needed to effect. Max dose: 10 mg/kg or 250mg							
<p>Esmolol</p> <ul style="list-style-type: none"> <li>• Antiarrhythmic Agent (Class II), Beta Adrenergic Blocker)</li> </ul>	<p>Infants, children and adolescents:</p> <p><b>Hypertensive emergency/urgency:</b></p> <table border="1" data-bbox="260 877 736 1032"> <tr> <td data-bbox="260 877 353 1032"></td> <td data-bbox="353 877 736 1032">           Continuous IV infusion: 100 – 500 mcg/kg/minute            Bolus: 100 – 500 mcg/kg over 1 minute, followed by an infusion of 25 – 100 mcg/kg/minute titrating as needed. Max: 500 mcg/kg/minute         </td> </tr> </table> <p><b>Supraventricular tachycardia (SVT):</b></p> <table border="1" data-bbox="260 1069 736 1188"> <tr> <td data-bbox="260 1069 353 1188"></td> <td data-bbox="353 1069 736 1188">           IV bolus: 100 – 500 mcg/kg over one minute followed by a continuous IV 25 – 500 mcg/kg/minute titrate in 25 to 50 mcg/kg/minute increment            Max: 1000 mcg/kg/minute         </td> </tr> </table>		Continuous IV infusion: 100 – 500 mcg/kg/minute Bolus: 100 – 500 mcg/kg over 1 minute, followed by an infusion of 25 – 100 mcg/kg/minute titrating as needed. Max: 500 mcg/kg/minute		IV bolus: 100 – 500 mcg/kg over one minute followed by a continuous IV 25 – 500 mcg/kg/minute titrate in 25 to 50 mcg/kg/minute increment Max: 1000 mcg/kg/minute	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Monitor blood pressure</li> <li>- May cause extravasation, thrombophlebitis, necrosis and blistering</li> </ul>		
	Continuous IV infusion: 100 – 500 mcg/kg/minute Bolus: 100 – 500 mcg/kg over 1 minute, followed by an infusion of 25 – 100 mcg/kg/minute titrating as needed. Max: 500 mcg/kg/minute							
	IV bolus: 100 – 500 mcg/kg over one minute followed by a continuous IV 25 – 500 mcg/kg/minute titrate in 25 to 50 mcg/kg/minute increment Max: 1000 mcg/kg/minute							




Etomidate • General Anesthetic  	<b>Induction &amp; maintenance of anesthesia:</b>  Children > 10 years Initial: 0.2 to 0.6 mg/kg over 30 to 60 seconds.  <b>Procedure sedation:</b> 0.1 – 0.3 mg/kg (repeated doses may be needed)	Comment: - It may cause adrenal suppression
Factor VIIa (Novo-Seven) • Antihemophilic Agent	<b>Children and adolescents:</b> <b>Hemophilia A or B with inhibitor:</b>  Dose range: 35 – 90 mcg/kg Usual dose: 90 mcg/kg every 2 hours until hemostasis is achieved or until the treatment judged ineffective  <b>Surgical interventions:</b>  90 mcg/kg immediately before surgery repeat at 2 hours intervals as needed  <b>Congenital factor VII deficiency:</b>  Bleeding episodes and surgical interventions: 15 – 30 mcg/kg every 4 – 6 hours	Comments: - Dose and interval may be adjusted based upon the severity of bleeding and degree of hemostasis achieved - Rounding factor VII dose to nearest vial size
Factor VIII (Kogenate®) Antihemophilic Agent	<b>Children and adolescents: General dosing:</b> <b>Minor hemorrhage:</b>  10 – 20 units/kg repeat every 12 -24 hours until bleeding resolve or healing achieved  <b>Moderate hemorrhage:</b>  15 -30 units/kg repeat every 12 -24 hours  <b>Severe/life-threatening hemorrhage</b>  30 -50 units/kg repeat every 8 – 24 hours until threat is resolved	Comments: - Calculated dosage should be adjusted to the actual vial size
Fentanyl Opioid, Analgesic    	<b>Infants, children and adolescents:</b>  <b>Intermittent dose:</b> 1 – 2 mcg/kg/dose every 2 – 4 hours as needed   <b>Continuous infusion:</b> 0.5 – 5 mcg/kg/hour titrate to effect	Comments: May cause respiratory depression and apnea







Flecainide Antiarrhythmic Agent, Class Ic  	Infants ≤ 6 months: P.O:	initial 50 mg/m <sup>2</sup> /day divided every 8 – 12 hours	Comments: - May titrate dose at 4 day intervals - Higher doses have been associated with an increased risk of proarrhythmic effects - Reserved for resistant dysrhythmias - Milk products may decrease bioavailability
	Infants > 6 months, children & adolescent: P.O:	initial 100 mg/m <sup>2</sup> /day divided every 8 – 12 hours Max daily dose: 200 mg/m <sup>2</sup> /day	
	Alternate dose:		
	Children: P.O: initial 1 – 3 mg/kg/day divided every 8 hours, usual range: 3 – 6 mg/kg/day divided every 8 hours Max daily dose: 8 mg/kg/day		
Fluconazole • Antifungal Agent  	General dosing:	IV, P.O: 6 – 12 mg/kg/dose once daily Max daily dose: 600 mg/day	Comments: - May cause nausea, vomiting, hypokalemia and elevations in liver function tests
	Oro-pharyngeal candidiasis:	6 mg/kg/dose on day 1 once daily, followed by 3 mg/kg/dose once daily (Max. day one: 200 mg/day, Max. subsequent dose: 100 mg/day)	
	Peritonitis:	intraperitoneal, IV, P.O: 6 – 12 mg/kg/dose every 24 – 48 hours Max single dose: 400 mg /dose	
Hydrocortisone • Corticosteroid	Pediatric:		Comments: Sodium retention, hypokalemia, hypertension, fluid retention causing edema, growth suppression
	Adrenal insufficiency, autoimmune, Addison's disease:		
		P.O: 0.05 – 0.2 mg daily	
	Congenital adrenal hyperplasia:		
		infants and children: 0.05 – 0.2 mg daily in 1 -2 divided doses. Max: 0.3mg/day	
Flumazenil • Antidote, Benzodiazepine  	Infants, children, adolescents		Comments: Does not reverse effects of narcotics
	Reversal of benzodiazepine sedation/ overdose:		
		0.01 mg/kg (Max dose: 0.2mg/dose) given over 15 seconds with repeat doses of 0.01 mg/kg given every minute. Maximum total cumulative dose of 0.05 mg/kg or 1 mg whichever is lower	



Fosphenytoin • Anticonvulsant, Hydantoin	Status epileptics:		Comments: - May cause lethargy, nystagmus, hirsutism, gingival hyperplasia and cardiac arrhythmia  - Rate of intravenous administration 1 – 3 mg PE/kg/minute
		LD: IM, IV: 15 – 20 mg PE/kg (Maximum rate: 150 mg PE/minute) Max dose: 1500 mg PE  - Fosphenytoin should always be prescribed and dispensed in mg of phenytoin equivalents (PE) - Phenytoin 1 mg = fosphenytoin 1 mg PE - Start the maintenance therapy 12 hours after the loading dose - Free (unbound) phenytoin serum concentrations should be monitored closely in patients with renal/hepatic disease or in those with hypoalbuminemia - Monitor phenytoin therapeutic level (10-20 mcg/ml = 40 – 79 mcml/L)	
Furosemide • Loop Diuretic	Edema: Infants, children		Comments: - Start oral furosemide by 1 – 2 mg/kg/day then gradually increase to the desired effect. - Don't exceed adult dose (20 mg) unless the desired effect was not achieved. - Monitor serum electrolytes (May cause hypokalemia, hypercalciuria, hypomagnesemia and metabolic alkalosis)
		PO: 1 – 6 mg/kg/dose every 12 – 24 Hours (Max dose: 6 mg/kg/dose)	
		IV, IM: 1 – 2 mg/kg/dose every 6 – 12 hours  Continuous IV infusion: 0.05 mg/kg/hour; titrate dosage to clinical effect (Max: 1 mg/kg/hour)	
Gentamicin • Antibiotic, Aminoglycoside  	General dosing: Infants, children and adolescents		Comments: - Level should be taken 30 min. pre 3rd dose (trough level should be less than 2 mcg/mL) - May cause ototoxicity and nephrotoxicity, monitor renal function - Loop diuretics may potentiate ototoxicity
	Conventional dosing:	IM, IV: 2.5 mg/kg/dose every 8 hours	
	Extend interval dosing:	4.5 – 7.5 mg/kg/dose every 24 hours in patient with normal renal function	
	VP-shunt infection, ventriculitis:	intraventricular/intrathecal (use a preservative free preparation) 1 – 2 mg/day	
	Cystic fibrosis, pulmonary infection:	Conventional dosing: IM, IV: 3.3 mg/kg/dose every 8 hours Extend interval dosing: IV: 10 – 12 mg/kg/dose every 24 hours	




Glucagon • Antihypoglycemic Agent	<b>Hypoglycemia, persistent:</b> IM, IV, SubQ: 0.02 – 0.03 mg/kg/dose (Max dose: 1 mg) may repeat dose in 20 minutes if needed  Fixed dose: age directed: < 6 years 0.5 mg, > 6 years 1 mg				Comments: Monitor blood glucose closely																																			
Glycopyrrolate • Anticholinergic Agent	<b>Control of secretions (chronic):</b>  P.O: 40 – 100 mcg/kg/dose every 6 – 8 hours not to exceed 1500 mcg to 3000 mcg per dose.  IM, IV: 4 – 10 mcg/kg/dose every 3 – 4 hours (Max dose: 200 mcg/dose)				Comments: May cause tachycardia, mucous plugs																																			
Haloperidol • Antipsychotic	<b>Agitation (acute); psychosis:</b>  IM, IV 0.05 – 0.15mg/kg; may be repeated hourly as needed. Max: 5mg/dose.																																							
Heparin Anticoagulant  	<b>Systemic heparinization:</b>  Loading Dose: 75 units/kg; given over 10 minutes followed by the Maintenance dose  Maintenance dose: Infants < 1 year: 28 units/kg/hour Children >1 year: 20 units/kg/hour  <table border="1" data-bbox="260 691 726 921"> <thead> <tr> <th>APTT</th> <th>Bolus, U/kg</th> <th>Hold, Mints</th> <th>rate change%</th> <th>Repeat APTT</th> </tr> </thead> <tbody> <tr> <td>&lt;50</td> <td>50</td> <td>0</td> <td>+10</td> <td>4 h</td> </tr> <tr> <td>50-59</td> <td>0</td> <td>0</td> <td>+10</td> <td>4 h</td> </tr> <tr> <td>60-85</td> <td>0</td> <td>0</td> <td>0</td> <td>Next day</td> </tr> <tr> <td>86-95</td> <td>0</td> <td>0</td> <td>-10</td> <td>4 h</td> </tr> <tr> <td>96-120</td> <td>0</td> <td>30</td> <td>-10</td> <td>4 h</td> </tr> <tr> <td>&gt;120</td> <td>0</td> <td>60</td> <td>-15</td> <td>4 h</td> </tr> </tbody> </table>				APTT	Bolus, U/kg	Hold, Mints	rate change%	Repeat APTT	<50	50	0	+10	4 h	50-59	0	0	+10	4 h	60-85	0	0	0	Next day	86-95	0	0	-10	4 h	96-120	0	30	-10	4 h	>120	0	60	-15	4 h	Comments: - APTT therapeutic level 60 – 85 seconds, antifactor Xa level of (0.35 – 0.7 units/ml) - Antidote: protamine sulfate - May cause thrombocytopenia, vasospasm and hyperkalemia
APTT	Bolus, U/kg	Hold, Mints	rate change%	Repeat APTT																																				
<50	50	0	+10	4 h																																				
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96-120	0	30	-10	4 h																																				
>120	0	60	-15	4 h																																				
Hyaluronidase Antidote, Extravasation  	<b>Infants, children and adolescents:</b>  <b>Extravasation:</b>  SubQ, intradermal: use 5 separate 0.2 ml injection of a 150 units/ml solution into extravasation site at the leading edge				Comments: - Antidote for hyperosmotic solution (calcium, potassium ...etc.) - Administer as soon as possible (preferably within one hour) after extravasation is recognized																																			

<p>Hydralazine</p> <ul style="list-style-type: none"> <li>• Antihypertensive;</li> <li>Vasodilator</li> </ul>	<p><b>Hypertension:</b></p> <p>P.O: initial: 0.75 mg/kg/day in 2 to 4 divided doses, (Max initial dose: 10mg/dose)</p> <p>Dose range: 0.75 – 7.5 mg/kg/day in 2 to 4 divided doses, increase gradually over 3 to 4 weeks (Max: 200 mg/day)</p> <p><b>Hypertensive emergency/urgency:</b></p> <p>IM, IV: initial: 0.1 – 0.2 mg/kg/dose</p> <p>Usual range: 0.2 – 0.6 mg/kg/dose every 4 to 6 hours as needed. Max dose: 20 mg/dose</p>		<p>Comments:</p> <p>May cause orthostatic hypotension, paradoxical hypertension and transient agranulocytosis</p>				
<p>Hydrochlorothiazide</p>  <ul style="list-style-type: none"> <li>• Antihypertensive, Diuretic, Thiazide</li> </ul>	<p><b>Edema and hypertension:</b></p> <p>P.O: 1 – 2 mg/kg/day once or twice per day</p> <p>Max. dose: infant &amp; up to 2 years 37.5 mg/day &gt; 2 years 100 mg/day).</p> <p><b>Bronchopulmonary dysplasia (BPD):</b></p> <p>infant: 3 -4 mg/kg/day</p>		<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause hyperglycemia, hyperuricemia, hypercalcemia, hypochloremic alkalosis, hypokalemia, hyponatremia and hypomagnesemia.</li> <li>- Administer with food improves absorption</li> </ul>				
<p>Hydrocortisone</p> <ul style="list-style-type: none"> <li>• Corticosteroid</li> </ul>	<p>Adrenal insufficiency (Acute):</p>	<p>IM, IV: infant and children: 1 – 2 mg/kg/dose IV bolus, then 25 – 150 mg/day in divided doses every 6 – 8 hours</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause edema, hypokalemia, hyperglycemia, sodium and water retention and growth suppression</li> <li>- Oral dosage form can be administer with food or milk to decrease GI upset</li> <li>- Withdraw therapy with gradual tapering of dose if the duration more than one week</li> </ul>				
<p>Anti-inflammatory:</p>	<p>P.O: 2.5 – 10 mg/kg/day or 75 – 300 mg/m2/day divided every 6 – 8 hours</p> <p>IM, IV: 1 – 5 mg/kg/day or 30 – 150 mg/m2/day divided every 12 – 24 hours</p>						
<p>Septic shock:</p>	<p>IV: initial: 1 – 2 mg/kg/day (100 mg/m2/day) in divided doses every 6 hours (in catecholamine-resistant shock and suspected or proven adrenal insufficiency)</p>						
<p>HYDROmorphone Analgesic, Opioid</p>  	<p><b>Acute pain, moderate to severe:</b></p> <p>Infants &gt; 6 months weighing &gt; 10kg::</p> <table border="1" data-bbox="239 1114 723 1207"> <tr> <td data-bbox="239 1114 335 1169">P.O</td> <td data-bbox="338 1114 723 1169">Immediate release: 0.03 – 0.06 mg/kg/dose every 4 hours as needed</td> </tr> <tr> <td data-bbox="239 1173 335 1207">IV</td> <td data-bbox="338 1173 723 1207">0.01mg/kg/dose every 3 to 6 hours</td> </tr> </table> <p><b>Continuous IV infusion:</b></p> <p>0.003 – 0.005 mg/kg/hour</p>		P.O	Immediate release: 0.03 – 0.06 mg/kg/dose every 4 hours as needed	IV	0.01mg/kg/dose every 3 to 6 hours	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause CNS and respiratory depression</li> <li>- May cause nausea, vomiting, constipation, hypotension, bradycardia and urinary retention</li> <li>- Naloxone is the antidote</li> </ul>
P.O	Immediate release: 0.03 – 0.06 mg/kg/dose every 4 hours as needed						
IV	0.01mg/kg/dose every 3 to 6 hours						



Ibuprofen • Nonsteroidal Anti-inflammatory Drug (NSAID)  	<b>Analgescic and Antipyretic:</b>  P.O: 5 – 10 mg/kg/dose every 6 to 8 hours as needed, (Max single dose: 400mg, Max daily dose: 40 mg/kg/day)	<b>Comments:</b> - Use with caution in patients with renal or hepatic failure and low platelet - Contraindicated in patients with active GI bleeding and ulcer disease - To be given after meal
Imipenem • Antibiotic, Carbapenem  	<b>General dosing, susceptible infection:</b> IV: 60 – 100 mg/kg/day divided every 6 hours (Max daily dose: 4000 mg/ day)  <b>Peritonitis:</b> Intraperitoneal: continuous: LD: 250 mg/liter of dialysate MD: 50 mg/liter	
Immune globulin (IVIG) • Blood Product Derivative)	<b>Guillain-Barre syndrome/ immune thrombocytopenia (ITP):</b> IV: 1000 mg/kg/dose once daily for 2 days, or 400 mg/kg/dose once daily for 5 days  <b>Kawasaki disease:</b> IV: 2000 mg/kg as single dose with 10 days of disease onset  <b>Acute Disseminated Encephalomyelitis (ADEM):</b> IV 1000 mg/kg/day once/day for 2 days  <b>Myocarditis:</b> limited date, IV 2000mg/kg single dose	<b>Comments:</b> - May cause shock, tachycardia, respiratory distress - Use hospital preset order
Insulin Regular • Antidiabetic Agent  	<b>Infants, children and adolescents:</b>  <b>DKA</b> continuous IV infusion: 0.05 – 0.1 units/kg/ hour titrate to desired effect (concentration 50 unit/ 50ml)	<b>Comments:</b> May cause hypoglycemia
Ipratropium • Anticholinergic Agent	<b>Bronchospasm, wheezing, Asthma:</b>  <b>infants:</b> Nebulization: 0.125 – 0.25 mg (125 -250 mcg) every 4 hours  <b>Children:</b> Nebulization: 0.25 – 0.5 mg (250 – 500 mcg) every 20 minutes for 3 doses then as needed every 6 – 8 hours for 24 hour	






Iron	<b>Iron deficiency anemia:</b>  3 – 6 mg elemental iron/kg/day divided every 8 – 24 hours		<b>Comments:</b> - May cause constipation, dark stools, epigastric pain - May administer with food if GI upset occurs - Do not administer with milk or milk products						
Kayexalate (sodium polystyrene) • Antidote, Hyperkalemia	P.O: 1 g/kg/dose every 6 hours as needed (Max: 15 g/dose)  Rectal: 1 g/kg/dose every 2 – 6 hours as needed (Max. 30 – 50 g/dose)		<b>Comments:</b> - May cause hypokalemia, hypomagnesemia and hypocalcemia - Mixed with water						
Ketamine • Sedative, Anesthetic	<b>Sedation for minor procedure:</b>  <table border="1" data-bbox="336 516 723 615"> <tr> <td data-bbox="336 516 336 615"></td> <td data-bbox="336 516 723 556">IV: 0.5 – 2 mg/kg</td> </tr> <tr> <td data-bbox="336 556 723 615"></td> <td data-bbox="336 556 723 615">Induction dose: 1 – 2 mg/kg as part of rapid sequence sedation</td> </tr> </table> <b>Sedation:</b>  <table border="1" data-bbox="336 652 723 709"> <tr> <td data-bbox="336 652 336 709"></td> <td data-bbox="336 652 723 709">continuous IV infusion: 5 – 20 mcg/kg/minute, start at lower dose and titrate to effect</td> </tr> </table>			IV: 0.5 – 2 mg/kg		Induction dose: 1 – 2 mg/kg as part of rapid sequence sedation		continuous IV infusion: 5 – 20 mcg/kg/minute, start at lower dose and titrate to effect	<b>Comments:</b> - Increased blood pressure (BP) - Increase oral secretion (risk of airway obstruction & apnea)
	IV: 0.5 – 2 mg/kg								
	Induction dose: 1 – 2 mg/kg as part of rapid sequence sedation								
	continuous IV infusion: 5 – 20 mcg/kg/minute, start at lower dose and titrate to effect								
Labetalol • Alpha/Beta Adrenergic Blocker  	<b>Hypertension:</b>  <table border="1" data-bbox="336 749 723 897"> <tr> <td data-bbox="336 749 336 838">P.O:</td> <td data-bbox="336 749 723 838">initial: 1 – 3 mg/kg/day in two divided doses (Max daily dose: 10 – 12 mg/kg/day up to 1200 mg/day)</td> </tr> <tr> <td data-bbox="336 838 336 897">IV:</td> <td data-bbox="336 838 723 897">intermittent bolus: 0.2 – 1 mg/kg/dose (Max dose: 40 mg)</td> </tr> </table> <b>Hypertension emergency:</b>  <table border="1" data-bbox="336 942 723 1016"> <tr> <td data-bbox="336 942 336 1016">continuous IV infusion:</td> <td data-bbox="336 942 723 1016">0.25 – 3 mg/kg/hour initiate at lower end of rang and titrate up slowly</td> </tr> </table>		P.O:	initial: 1 – 3 mg/kg/day in two divided doses (Max daily dose: 10 – 12 mg/kg/day up to 1200 mg/day)	IV:	intermittent bolus: 0.2 – 1 mg/kg/dose (Max dose: 40 mg)	continuous IV infusion:	0.25 – 3 mg/kg/hour initiate at lower end of rang and titrate up slowly	
P.O:	initial: 1 – 3 mg/kg/day in two divided doses (Max daily dose: 10 – 12 mg/kg/day up to 1200 mg/day)								
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Lactulose • Laxative	<b>Constipation:</b>  <table border="1" data-bbox="336 1061 723 1113"> <tr> <td data-bbox="336 1061 336 1113">P.O:</td> <td data-bbox="336 1061 723 1113">1 – 2 g/kg/day (1.5 to 3 ml/kg/day) once or twice daily (Max daily dose: 60 ml/day)</td> </tr> </table>		P.O:	1 – 2 g/kg/day (1.5 to 3 ml/kg/day) once or twice daily (Max daily dose: 60 ml/day)					
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<p>Levetiracetam</p> <ul style="list-style-type: none"> <li>• Anticonvulsant</li> </ul> 	<p><b>Partial onset seizures:</b></p> <table border="1"> <tbody> <tr> <td data-bbox="262 130 353 204">Infants 1 to &lt;6 months:</td> <td data-bbox="353 130 736 204">P.O / IV: initial: 7 mg/kg/dose twice daily, usual dose: 21 mg/kg/dose twice daily</td> </tr> <tr> <td data-bbox="262 204 353 338">Infants&gt;6 months and children &lt; 4 years:</td> <td data-bbox="353 204 736 338">P.O / IV initial: 10 mg/kg/dose twice daily, usual dose: 25 mg/kg/dose twice daily</td> </tr> <tr> <td data-bbox="262 338 353 419">Children ≥ 4 years:</td> <td data-bbox="353 338 736 419">P.O / IV: initial: 10 mg/kg/dose twice daily, usual dose: 30 mg/kg/dose twice daily. (Max daily dose: 3000 mg/day)</td> </tr> </tbody> </table> <p><b>Status epilepticus:</b></p> <p>IV: LD: 50 mg/kg/dose, (Max. dose 2500 mg / dose) followed by IV or P.O maintenance dosing: 30 – 60 mg/ kg/day divided twice daily</p>	Infants 1 to <6 months:	P.O / IV: initial: 7 mg/kg/dose twice daily, usual dose: 21 mg/kg/dose twice daily	Infants>6 months and children < 4 years:	P.O / IV initial: 10 mg/kg/dose twice daily, usual dose: 25 mg/kg/dose twice daily	Children ≥ 4 years:	P.O / IV: initial: 10 mg/kg/dose twice daily, usual dose: 30 mg/kg/dose twice daily. (Max daily dose: 3000 mg/day)	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Increase dosage gradually every 2 weeks as tolerated (7 – 10 mg till reach recommended dose)</li> <li>- May cause neutropenia, leukopenia, thrombocytopenia and pancytopenia</li> </ul>				
Infants 1 to <6 months:	P.O / IV: initial: 7 mg/kg/dose twice daily, usual dose: 21 mg/kg/dose twice daily											
Infants>6 months and children < 4 years:	P.O / IV initial: 10 mg/kg/dose twice daily, usual dose: 25 mg/kg/dose twice daily											
Children ≥ 4 years:	P.O / IV: initial: 10 mg/kg/dose twice daily, usual dose: 30 mg/kg/dose twice daily. (Max daily dose: 3000 mg/day)											
<p>Levothyroxine</p> <ul style="list-style-type: none"> <li>• Thyroid Product</li> </ul>	<p><b>Hypothyroidism (acquired or congenital):</b></p> <p>P.O:</p> <table border="1"> <tbody> <tr> <td data-bbox="262 617 353 676">1 to 3 months</td> <td data-bbox="353 617 736 676">10 – 15 mcg/kg once daily</td> </tr> <tr> <td data-bbox="262 676 353 736">3 to 6 months</td> <td data-bbox="353 676 736 736">8 – 10 mcg/kg once daily</td> </tr> <tr> <td data-bbox="262 736 353 795">6 to 12 months</td> <td data-bbox="353 736 736 795">6 – 8 mcg/kg once</td> </tr> <tr> <td data-bbox="262 795 353 854">1 – 12 years</td> <td data-bbox="353 795 736 854">4 – 6 mcg/kg once daily</td> </tr> <tr> <td data-bbox="262 854 353 891">&gt;12 years</td> <td data-bbox="353 854 736 891">2 - 3 mcg/kg once daily</td> </tr> </tbody> </table>	1 to 3 months	10 – 15 mcg/kg once daily	3 to 6 months	8 – 10 mcg/kg once daily	6 to 12 months	6 – 8 mcg/kg once	1 – 12 years	4 – 6 mcg/kg once daily	>12 years	2 - 3 mcg/kg once daily	<p>Comments:</p> <ul style="list-style-type: none"> <li>- IV, IM dose (50 – 70%) of the oral dose</li> <li>- May cause hypertension, arrhythmias, palpitation and cardiac arrest</li> <li>- May cause diarrhea and weight loss.</li> <li>- May cause behavior problems (includes aggression, agitation &amp; anxiety)</li> </ul>
1 to 3 months	10 – 15 mcg/kg once daily											
3 to 6 months	8 – 10 mcg/kg once daily											
6 to 12 months	6 – 8 mcg/kg once											
1 – 12 years	4 – 6 mcg/kg once daily											
>12 years	2 - 3 mcg/kg once daily											
<p>Lidocaine</p> <ul style="list-style-type: none"> <li>• Antiarrhythmic Agent, Class Ib</li> </ul> 	<p><b>Anesthesia: local injection (children &amp; adolescent):</b></p> <table border="1"> <tbody> <tr> <td data-bbox="262 936 353 973"></td> <td data-bbox="353 936 736 973">5 mg/kg/dose (Max. 300 mg/dose)</td> </tr> </tbody> </table> <p><b>Antiarrhythmic: Pulseless Ventricular Tachycardia (VTAC), shock resistant ventricular fibrillation(VF)</b></p> <table border="1"> <tbody> <tr> <td data-bbox="262 1032 353 1092"></td> <td data-bbox="353 1032 736 1092">IV, I.O: LD: 1 mg/kg/dose over 2 minutes follow with continuous IV infusion</td> </tr> <tr> <td data-bbox="262 1092 353 1151"></td> <td data-bbox="353 1092 736 1151">Continuous IV infusion: 20 – 50 mcg/kg/ minute</td> </tr> <tr> <td data-bbox="262 1151 353 1225"></td> <td data-bbox="353 1151 736 1225">E.T: 2 – 3 mg/kg/dose flush with 5 ml NS and follow with 5 assisted manual ventilations.</td> </tr> </tbody> </table>		5 mg/kg/dose (Max. 300 mg/dose)		IV, I.O: LD: 1 mg/kg/dose over 2 minutes follow with continuous IV infusion		Continuous IV infusion: 20 – 50 mcg/kg/ minute		E.T: 2 – 3 mg/kg/dose flush with 5 ml NS and follow with 5 assisted manual ventilations.	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Patients with reduced hepatic function or decreased hepatic blood flow (CHF, postcardiac surgery) should receive ½ the usual loading dose with maximum maintenance dose of (20 mcg/kg/minute)</li> <li>- For cutaneous injection: use &lt; 2% concentration</li> </ul>		
	5 mg/kg/dose (Max. 300 mg/dose)											
	IV, I.O: LD: 1 mg/kg/dose over 2 minutes follow with continuous IV infusion											
	Continuous IV infusion: 20 – 50 mcg/kg/ minute											
	E.T: 2 – 3 mg/kg/dose flush with 5 ml NS and follow with 5 assisted manual ventilations.											





Linezolid • Antibiotic, Oxazolidinone	General dosing, susceptible infection:		Comments: - May cause anemia, leukopenia, pancytopenia, eosinophilia, neutropenia and thrombocytopenia - May increased serum bilirubin
		P.O, IV: 10 mg/kg/dose every 8 hours (Max dose: 600 mg)	
	Tuberculosis, multidrug-resistant:		
		P.O: 10 – 12 mg/kg/dose twice daily (Max dose: 600 mg)	
Lorazepam Benzodiazepine	Anxiety/ sedation	P.O, IV: 0.05 – 0.1 mg/kg/dose (Max dose: 4 mg/dose) every 4 to 8 hours	Comments: - May cause respiratory depression, sedation - Flumazenil is the antidote
	Status epileptics:	IV: 0.05 – 0.1 mg/kg (Max dose: 4 mg/dose) administer over 2 -5 minutes, may repeat in 5 to 15 minutes if needed	
Magnesium oxide Electrolyte Supplement  	Hypomagnesemia:		Comments: - 400 mg tablet = magnesium 20 mEq = elemental magnesium 242 mg - May cause diarrhea (dose related)
	P.O:	children: 10 – 20 mg/kg elemental magnesium /dose, 1 – 4 times /day	
Magnesium sulfate • Electrolyte Supplement  	Hypomagnesemia:		Comments: - May cause diarrhea with high doses - May cause hypotension - 1 g of magnesium sulfate ~100 mg elemental magnesium = 8 mEq elemental magnesium = 4 mmol of magnesium
	IV. I.O:	Dose expressed as magnesium sulfate 25 – 50 mg/kg/dose (0.1 – 0.2 mmol/kg/dose) every 6 hours for 2 to 3 doses (Max dose:2 g/dose) Dose expressed as elemental magnesium: IV: 2.5 – 5 mg/kg/dose every 6 hours for 2 to 3 doses	
	P.O:	elemental magnesium: 0.2 – 0.4 meq/ kg/ dose every 6 – 8 hours	
	Status Asthmaticus:		
		25 – 50 mg/kg/dose as single dose (Max. 2g/ dose)	
	Torsade de pointes:		
	25 – 50 mg/kg/dose (Max. 2 g/ dose)		
Mannitol Diuretic, Osmotic  	High ICP:		Comments: - Contraindicated in patient with severe pulmonary edema or congestion - Use with caution in patient with underlying renal disease May cause extravasation
	IV:	0.25 – 1 g/kg/dose infused over 20 – 30 min. PRN (Max dose: 2 g/kg/dose), repeat as needed every 4 – 6 hours	
	Should NOT be given if serum osmolality more than 320 mOsm/kg		









<p>Meropenem</p> <ul style="list-style-type: none"> <li>Antibiotic, Carbapenem</li> </ul> 	<p>General dosing susceptible infection:</p> <table border="1" data-bbox="256 130 741 182"> <tr> <td>IV:</td> <td>20 – 40 mg/kg /dose every 8 hours (Max dose: 1000 mg/dose)</td> </tr> </table> <p>Meningitis / severe infection:</p> <table border="1" data-bbox="256 241 741 316"> <tr> <td></td> <td>40 mg/kg/dose every 8 hours (Max dose: 2000 mg/dose)</td> </tr> </table>	IV:	20 – 40 mg/kg /dose every 8 hours (Max dose: 1000 mg/dose)		40 mg/kg/dose every 8 hours (Max dose: 2000 mg/dose)	<p>Comments:</p> <ul style="list-style-type: none"> <li>Adjust dose in renal impairment</li> </ul>		
IV:	20 – 40 mg/kg /dose every 8 hours (Max dose: 1000 mg/dose)							
	40 mg/kg/dose every 8 hours (Max dose: 2000 mg/dose)							
<p>Methylene Blue</p> <ul style="list-style-type: none"> <li>Antidote</li> </ul>	<p>Methemoglobinemia:</p> <table border="1" data-bbox="256 360 741 612"> <tr> <td>I.O, IV</td> <td>1 – 2 mg/kg; may be repeated every 30 to 60 minutes.</td> </tr> </table>	I.O, IV	1 – 2 mg/kg; may be repeated every 30 to 60 minutes.	<p>Comments:</p> <ul style="list-style-type: none"> <li>Use with caution in G6PD deficiency or renal insufficiency.</li> <li>May cause nausea, vomiting, dizziness headache, diaphoresis, stained skin and abdominal pain.</li> <li>Cause blue-green discoloration urine and feces.</li> </ul>				
I.O, IV	1 – 2 mg/kg; may be repeated every 30 to 60 minutes.							
<p>Methylprednisolone</p> <ul style="list-style-type: none"> <li>Corticosteroid</li> </ul>	<p>Asthma, exacerbation:</p> <table border="1" data-bbox="256 657 741 709"> <tr> <td>IV:</td> <td>LD: 2 mg/kg/dose (once), then 0.5 – 1 mg/kg/dose every 6 hours (Max. dose 60 mg/day)</td> </tr> </table> <p>Anti-inflammatory/immunosuppressive:</p> <table border="1" data-bbox="256 753 741 805"> <tr> <td>IV:</td> <td>0.5 – 1.7 mg/kg/day in divided doses every 6 – 12 hours</td> </tr> </table> <p>Pulse therapy:</p> <table border="1" data-bbox="256 850 741 931"> <tr> <td>IV:</td> <td>15 – 30 mg/kg/dose or 600 – 1000 mg/m<sup>2</sup>/dose once daily for 3 days (Max dose: 1000 mg)</td> </tr> </table>	IV:	LD: 2 mg/kg/dose (once), then 0.5 – 1 mg/kg/dose every 6 hours (Max. dose 60 mg/day)	IV:	0.5 – 1.7 mg/kg/day in divided doses every 6 – 12 hours	IV:	15 – 30 mg/kg/dose or 600 – 1000 mg/m <sup>2</sup> /dose once daily for 3 days (Max dose: 1000 mg)	<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause hypertension, hyperglycemia and adrenal suppression</li> <li>May increase tacrolimus level</li> <li>In rare cases can cause anaphylactic reaction</li> <li>Use with caution in patients with GI disease</li> </ul>
IV:	LD: 2 mg/kg/dose (once), then 0.5 – 1 mg/kg/dose every 6 hours (Max. dose 60 mg/day)							
IV:	0.5 – 1.7 mg/kg/day in divided doses every 6 – 12 hours							
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<p>Metoclopramide</p> <ul style="list-style-type: none"> <li>Antiemetic, Prokinetic Agent</li> </ul> 	<p>Postpyloric feeding tube placement:</p> <table border="1" data-bbox="256 976 741 1028"> <tr> <td>IV:</td> <td>&lt; 6 years: 0.1 mg/kg as single dose 6 to 14 years: 2.5 – 5 mg as single dose</td> </tr> </table> <p>Gastroesophageal reflux:</p> <table border="1" data-bbox="256 1072 741 1184"> <tr> <td>IV, P.O:</td> <td>0.1 – 0.2 mg/kg/dose every 6 to 8 hours (Max dose: 10 mg)</td> </tr> </table>	IV:	< 6 years: 0.1 mg/kg as single dose 6 to 14 years: 2.5 – 5 mg as single dose	IV, P.O:	0.1 – 0.2 mg/kg/dose every 6 to 8 hours (Max dose: 10 mg)	<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause extrapyramidal effect and tardive dyskinesia</li> <li>Administer on empty stomach at least 30 minutes prior to food</li> </ul>		
IV:	< 6 years: 0.1 mg/kg as single dose 6 to 14 years: 2.5 – 5 mg as single dose							
IV, P.O:	0.1 – 0.2 mg/kg/dose every 6 to 8 hours (Max dose: 10 mg)							




<p>Metolazone</p> <ul style="list-style-type: none"> <li>• Diuretic</li> </ul>	<p><b>Edema refractory:</b></p> <p>P.O: 0.2 – 0.4 mg/kg/day divided every 12 – 24 hours (in combination with furosemide) (Max. adult dose: 20 mg)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Contraindicated in patients with anuria or hepatic coma or hypersensitivity to sulfonamides</li> <li>- May cause hypokalemia and/or hyponatremia</li> </ul>
<p>Metronidazole</p> <ul style="list-style-type: none"> <li>• Antibiotic, Anaerobic</li> </ul>  	<p><b>General dosing, susceptible infection:</b></p> <p>P.O: 30 – 50 mg/kg/day divided every 8 hours (Max daily dose: 2250 mg/day)</p> <p>IV: 22 – 40 mg/kg/day divided every 8 hours (Max daily dose: 1500 mg/day)</p> <p><b>Clostridium difficile diarrhea:</b></p> <p>P.O: 30 – 50 mg/kg/day in divided doses 4 times daily (Max daily dose: 2000 mg/day)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Use with caution in patients with end stage renal disease</li> <li>- May cause aseptic meningitis , leukopenia and thrombocytopenia</li> </ul>
<p>Midazolam</p> <ul style="list-style-type: none"> <li>• Benzodiazepine</li> </ul>  	<p><b>Sedation, anxiolytic:</b></p> <p>intermittent IV: initial: 0.05 – 0.1mg/kg/dose</p> <p><b>Sedation, mechanically ventilated patient:</b></p> <p>continuous infusion: 0.5 – 2 mcg/kg/minute Maximum dose: 6 mcg/kg /minute (titrate to desired clinical response)</p> <p><b>Status epilepticus:</b></p> <p>Continuous infusion: 1 – 24 mcg/kg/minute. begin at lower end of range and titrate to lowest effective dose</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause hypotension, respiratory depression</li> <li>- Flumazenil is the antidote</li> </ul>
<p>Milrinone</p> <ul style="list-style-type: none"> <li>• Phosphodiesterase – 3 Enzyme Inhibitor</li> </ul> 	<p>LD: 50 mcg/kg administered over 15 minutes followed by a continuous infusion of 0.25 – 1 mcg/kg/ minute titrate dose to effect</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause hypotension (you could omit LD in case of hypotention)</li> <li>- Use with caution in patient with renal impairment</li> <li>- Reduce loading dose or omit in patients at risk for hypotension</li> </ul>






<p>Morphine</p> <ul style="list-style-type: none"> <li>Analgesic, Narcotic</li> </ul> 	<p><b>Analgesia, moderate to severe:</b></p> <table border="1"> <tbody> <tr> <td data-bbox="262 130 353 184">P.O:</td> <td data-bbox="353 130 736 184">Infant &lt; 6 month: 0.1 mg/kg/dose every 3 – 4 hour</td> </tr> <tr> <td data-bbox="262 184 353 268"></td> <td data-bbox="353 184 736 268">Infants &gt;6 month and children: 0.2 – 0.5 mg/kg/dose every 3 – 4 hours (Max. dose: 15 – 20 mg)</td> </tr> <tr> <td data-bbox="262 268 353 446">IM, IV:</td> <td data-bbox="353 268 736 446">initial: 0.05 – 0.2 mg/kg/dose every 2 – 4 hours as needed Maximum dose: infant 2mg/dose, 1 – 6 years 4 mg/dose 7 -12 years 8 mg/dose adolescent 10 mg/dose</td> </tr> <tr> <td colspan="2" data-bbox="262 446 736 500">Continuous IV infusion: 10 – 40 mcg/kg/hours, titrate dose to effect</td> </tr> </tbody> </table>	P.O:	Infant < 6 month: 0.1 mg/kg/dose every 3 – 4 hour		Infants >6 month and children: 0.2 – 0.5 mg/kg/dose every 3 – 4 hours (Max. dose: 15 – 20 mg)	IM, IV:	initial: 0.05 – 0.2 mg/kg/dose every 2 – 4 hours as needed Maximum dose: infant 2mg/dose, 1 – 6 years 4 mg/dose 7 -12 years 8 mg/dose adolescent 10 mg/dose	Continuous IV infusion: 10 – 40 mcg/kg/hours, titrate dose to effect		<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause CNS and respiratory depression</li> <li>May cause nausea, vomiting, constipation, hypotension, bradycardia and urinary retention</li> <li>May cause pruritus (may be dose related), rash and urticarial</li> <li>Naloxone is the antidote</li> </ul>
P.O:	Infant < 6 month: 0.1 mg/kg/dose every 3 – 4 hour									
	Infants >6 month and children: 0.2 – 0.5 mg/kg/dose every 3 – 4 hours (Max. dose: 15 – 20 mg)									
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Continuous IV infusion: 10 – 40 mcg/kg/hours, titrate dose to effect										
<p>Naloxone</p> <ul style="list-style-type: none"> <li>Antidote for Narcotic Agonists</li> </ul>	<p><b>Opioid intoxication:</b></p> <table border="1"> <tbody> <tr> <td data-bbox="262 555 353 605">IV, I.O:</td> <td data-bbox="353 555 736 605">0.1 mg/kg/dose repeat every 2 – 3 minutes if needed (Max dose: 2 mg/dose)</td> </tr> <tr> <td colspan="2" data-bbox="262 605 736 682">Reversal of respiratory depression from therapeutic opioid dosing: IV: 0.001 – 0.01 mg/kg/dose, repeated every 2 – 3 min. if needed.</td> </tr> </tbody> </table>	IV, I.O:	0.1 mg/kg/dose repeat every 2 – 3 minutes if needed (Max dose: 2 mg/dose)	Reversal of respiratory depression from therapeutic opioid dosing: IV: 0.001 – 0.01 mg/kg/dose, repeated every 2 – 3 min. if needed.		<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause arrhythmias, ventricular fibrillation, pulmonary edema, hepatotoxicity and opiate withdrawal symptoms</li> </ul>				
IV, I.O:	0.1 mg/kg/dose repeat every 2 – 3 minutes if needed (Max dose: 2 mg/dose)									
Reversal of respiratory depression from therapeutic opioid dosing: IV: 0.001 – 0.01 mg/kg/dose, repeated every 2 – 3 min. if needed.										
<p>Nifedipine</p> <ul style="list-style-type: none"> <li>Calcium Channel Blocker, Dihydropyridine</li> </ul>	<p><b>Hypertensive urgency:</b></p> <table border="1"> <tbody> <tr> <td data-bbox="262 743 353 796">P.O:</td> <td data-bbox="353 743 736 796">0.1 – 0.25 mg/kg/dose, Max single dose: 10 mg, (Max daily dose: 2 mg/kg/day) may repeat if needed every 4 – 6 hours</td> </tr> </tbody> </table>	P.O:	0.1 – 0.25 mg/kg/dose, Max single dose: 10 mg, (Max daily dose: 2 mg/kg/day) may repeat if needed every 4 – 6 hours	<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause flushing, palpitation, tachycardia and hypotension</li> </ul>						
P.O:	0.1 – 0.25 mg/kg/dose, Max single dose: 10 mg, (Max daily dose: 2 mg/kg/day) may repeat if needed every 4 – 6 hours									
<p>Nitroglycerin</p> <ul style="list-style-type: none"> <li>Vasodilator, Antianginal, Antihypertensive Agent</li> </ul> 	<p><b>Dose: continuous IV infusion:</b></p> <p>initial: 0.25 – 0.5 mcg/kg/minute, titrate by 0.5 mcg/kg/minute every 3 to 5 minutes as needed (Max dose:10 mcg/kg/minute)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>Use with caution in severe renal impairment</li> <li>Tolerance to hypodynamic and antianginal effects can develop within 24 to 48 hours of continuous use</li> <li>May cause methemoglobinemia, thrombocytopenia</li> </ul>								

<p>Nitroprusside</p> <ul style="list-style-type: none"> <li>• Antihypertensive Agent, Vasodilator</li> </ul>  	<p>Continuous IV infusion:</p> <p>0.3 – 0.5 mcg/kg/minute (Max dose: 10 mcg/kg/minute) titrate to effect</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause cyanide toxicity and thiocyanate toxicity can occur in patients with renal impairment or those on prolonged infusions (i.e., &gt; 3 mcg/kg/minute for &gt; 72 hours)</li> <li>- May cause hypotension</li> <li>- Use with caution in patients with elevated intracranial pressure, hepatic and renal impairment</li> </ul>
<p>Norepinephrine</p> <ul style="list-style-type: none"> <li>• Alpha – Adrenergic Agonist</li> </ul>	<p>Continuous IV infusion:</p> <p>initial: 0.05 – 0.1mcg/kg/minute, titrate to desired effect (Max dose: 2mcg/kg/minute)</p>	
<p>Nystatin</p> <p>Antifungal Agent</p>	<p>Infant dose: 200,000 – 400,000 units/dose every 6 hours</p> <p>Child &amp; adult: 400,000 – 600,000 unit/dose every 6 hours</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause diarrhea, nausea, stomach pain and vomiting</li> <li>- Give half of the dose to each side of the mouth.</li> </ul>
<p>Octreotide</p> <ul style="list-style-type: none"> <li>• Somatostatine, Analog</li> </ul> 	<p>Chyl thorax:</p> <p>continuous IV infusion: 0.3 – 10 mcg/kg/hour titrate to response</p> <p>Esophageal varices/GI bleeding:</p> <p>1 – 2 mcg/kg initial IV bolus followed by 1 – 2 mcg/kg/hour Taper dose by 50% every 12 hours when no active bleeding occurs for 24 hours</p> <p>Persistent hyperinsulinemic:</p> <p>SubQ: 2 – 10 mcg/kg/day divided 3 – 4 times daily (Max daily dose: 40 mcg/kg/day)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause hyperglycemia</li> <li>- May cause tachyphylaxis</li> </ul>
<p>Omeprazole</p> <ul style="list-style-type: none"> <li>• Proton Pump Inhibitor</li> </ul> 	<p>GERD:</p> <p>P.O.: 0.7 – 3.3 mg/kg/day every 12 -24 hours (Max daily dose: 20 mg/day)</p> <p>IV: 0.5 – 1 mg/kg/day divided every 12 -24 hours</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Administer all doses before meals</li> <li>- May cause nausea, vomiting and diarrhea</li> </ul>

<p>Ondansetron</p> <ul style="list-style-type: none"> <li>• Antiemetic</li> </ul> 	<p><b>Gastroenteritis, acute; treatment:</b></p> <p>Infants and children: IV: 0.15 – 0.3 mg/kg/dose</p> <p>Infants and children <math>\geq</math> 6 months <math>\geq</math> 8 kg:</p> <table border="1" data-bbox="256 224 741 305"> <tr> <td data-bbox="256 249 353 305">PO</td> <td data-bbox="353 224 741 305">           8 – 15 kg: 2 mg/dose once            &gt;15 to 30 kg: 4 mg/dose once            &gt;30 kg: 8 mg/dose once         </td> </tr> </table> <p><b>Chemotherapy induced nausea and vomiting:</b></p> <table border="1" data-bbox="256 305 741 451"> <tr> <td data-bbox="256 372 353 451">P.O., IV:</td> <td data-bbox="353 305 741 451">           0.15 mg/kg/dose every 4 – 8 hours (Max dose: 16 mg/dose, 3 doses total), administer first dose 30 minutes before the start chemotherapy.         </td> </tr> </table> <p><b>Cyclic vomiting syndrome:</b></p> <table border="1" data-bbox="256 451 741 569"> <tr> <td data-bbox="256 506 353 569">IV:</td> <td data-bbox="353 451 741 569">           0.15 – 0.4 mg/kg/dose every 4 – 6 hours as needed for up to 3 doses (Max dose: 16 mg/dose)         </td> </tr> </table>		PO	8 – 15 kg: 2 mg/dose once >15 to 30 kg: 4 mg/dose once >30 kg: 8 mg/dose once	P.O., IV:	0.15 mg/kg/dose every 4 – 8 hours (Max dose: 16 mg/dose, 3 doses total), administer first dose 30 minutes before the start chemotherapy.	IV:	0.15 – 0.4 mg/kg/dose every 4 – 6 hours as needed for up to 3 doses (Max dose: 16 mg/dose)	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause Q – T prolongation</li> <li>- Use with caution in patients with hepatic impairment</li> </ul>																																																						
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<p>Oseltamivir</p> <ul style="list-style-type: none"> <li>• Antiviral Agent</li> </ul> 	<table border="1" data-bbox="256 580 741 1359"> <tr> <td colspan="2" data-bbox="256 580 519 605">Treatment:</td> <td data-bbox="519 580 741 605">PO:</td> </tr> <tr> <td data-bbox="256 605 353 669"></td> <td colspan="2" data-bbox="353 605 741 669">infants 1 to 8 months: 3 mg/kg/dose twice daily</td> </tr> <tr> <td data-bbox="256 669 353 709"></td> <td colspan="2" data-bbox="353 669 741 709">9 to 11 months: 3.5 mg/kg/dose twice daily</td> </tr> <tr> <td colspan="2" data-bbox="256 709 519 743">Fixed dosing:</td> <td data-bbox="519 709 741 743">PO:</td> </tr> <tr> <td data-bbox="256 743 353 783"></td> <td colspan="2" data-bbox="353 743 741 783">&lt; 3 months: 12 mg twice daily for 5 days</td> </tr> <tr> <td data-bbox="256 783 353 823"></td> <td colspan="2" data-bbox="353 783 741 823">3 to 5 months: 20 mg twice daily for 5 days</td> </tr> <tr> <td data-bbox="256 823 353 863"></td> <td colspan="2" data-bbox="353 823 741 863">6 to 11 months: 25 mg twice daily for 5 days</td> </tr> <tr> <td data-bbox="256 863 353 918"></td> <td colspan="2" data-bbox="353 863 741 918">Children: <math>\leq</math> 15 kg: 30 mg twice daily (for 5 days)</td> </tr> <tr> <td data-bbox="256 918 353 958"></td> <td colspan="2" data-bbox="353 918 741 958">&gt; 15 to 23 kg: 45 mg twice daily (for 5 days)</td> </tr> <tr> <td data-bbox="256 958 353 998"></td> <td colspan="2" data-bbox="353 958 741 998">&gt; 23 to 40 kg: 60 mg twice daily (for 5 days)</td> </tr> <tr> <td data-bbox="256 998 353 1038"></td> <td colspan="2" data-bbox="353 998 741 1038">&gt; 40 kg: 75 mg twice daily (for 5 days)</td> </tr> <tr> <td colspan="3" data-bbox="256 1038 741 1072">Prophylaxis: PO:</td> </tr> <tr> <td data-bbox="256 1072 353 1113"></td> <td colspan="2" data-bbox="353 1072 741 1113">3 to 11 months: 3 mg/kg/dose once daily</td> </tr> <tr> <td colspan="3" data-bbox="256 1113 741 1147">Fixed dosing: PO:</td> </tr> <tr> <td data-bbox="256 1147 353 1187"></td> <td colspan="2" data-bbox="353 1147 741 1187">3 to 5 months: 20 mg once daily</td> </tr> <tr> <td data-bbox="256 1187 353 1227"></td> <td colspan="2" data-bbox="353 1187 741 1227">6 to 11 months: 25 mg once daily</td> </tr> <tr> <td data-bbox="256 1227 353 1267"></td> <td colspan="2" data-bbox="353 1227 741 1267">Children: <math>\leq</math> 15 kg: 30 mg once daily</td> </tr> <tr> <td data-bbox="256 1267 353 1307"></td> <td colspan="2" data-bbox="353 1267 741 1307">&gt; 15 to 23 kg: 45 mg once daily</td> </tr> <tr> <td data-bbox="256 1307 353 1347"></td> <td colspan="2" data-bbox="353 1307 741 1347">23 to <math>\leq</math> 40 kg: 60 mg once daily</td> </tr> <tr> <td data-bbox="256 1347 353 1359"></td> <td colspan="2" data-bbox="353 1347 741 1359">&gt; 40 kg: 75 mg once daily</td> </tr> </table>		Treatment:		PO:		infants 1 to 8 months: 3 mg/kg/dose twice daily			9 to 11 months: 3.5 mg/kg/dose twice daily		Fixed dosing:		PO:		< 3 months: 12 mg twice daily for 5 days			3 to 5 months: 20 mg twice daily for 5 days			6 to 11 months: 25 mg twice daily for 5 days			Children: $\leq$ 15 kg: 30 mg twice daily (for 5 days)			> 15 to 23 kg: 45 mg twice daily (for 5 days)			> 23 to 40 kg: 60 mg twice daily (for 5 days)			> 40 kg: 75 mg twice daily (for 5 days)		Prophylaxis: PO:				3 to 11 months: 3 mg/kg/dose once daily		Fixed dosing: PO:				3 to 5 months: 20 mg once daily			6 to 11 months: 25 mg once daily			Children: $\leq$ 15 kg: 30 mg once daily			> 15 to 23 kg: 45 mg once daily			23 to $\leq$ 40 kg: 60 mg once daily			> 40 kg: 75 mg once daily		<p>Comments:</p> <ul style="list-style-type: none"> <li>- Treatment should ideally begin within 48 hours however initiation after 48 hours may decrease mortality or duration of illness</li> </ul>
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Palivizumab: (SYNAGIS) • Monoclonal Antibody	<b>RSV prevention:</b>  IM: 15 mg/kg once monthly throughout RSV season (Max: 5 doses/ season)		Comments: - May cause rash, pain rhinitis, cough, wheeze - May cause diarrhea, vomiting and increase liver enzyme
<hr/>			
Pantoprazole: • Proton Pump Inhibitor  	<b>GERD:</b>  Children <5 years: 0.6 - 1.2mg/kg/day  <b>P.O.:</b> Children ≥5 years: ≥ 15 to <40 kg: 20 mg once daily for up to 8 weeks >40 kg: 40 mg once daily for up to 8 weeks  <b>IV:</b> Gastric acid suppression: IV: 0.8 – 1.6 mg/kg once daily. Max: 80mg		
Penicillin G • Antibiotic, Penicillin  	Mild to moderate infections:	IM, IV: 100,000 – 150,000 units/kg/day divided doses every 6 hours (Max daily dose: 8 million units/day)	Comments: - May cause urticarial and anaphylaxis - May cause interstitial nephritis and hemolytic anemia
Severe infections:	IM, IV: 200,000 – 300,000 units/kg/day in divided doses every 4 – 6 hours (Max daily dose: 24 million units/day)		
GBS (group B streptococcus):	infant IV 450,000 – 500,000 unit/kg/day divided every 6 hours		
Meningococcal disease:	infant, children & adolescent: IV: 300,000 unit/kg/day divided every 4 – 6 hours (Max. 12 million unit/day)		
PENTobarbital    	<b>Reduction of elevated ICP:</b>  5mg/kg every 4-6 hours (Other dosing options available)  <b>Status epilepticus refractory to standard therapy (pentobarbital coma with strongly recommended continuous EEG recording):</b>  IV, LD: 5 – 15 mg/kg; maintenance infusion: initial: 1mg/kg/hour, may increase up to 5 mg/kg/hour.		Comments: - Tapering rate by 0.5 mg/kg every 12 hours - May cause respiratory depression, hypotension



<p>Phenobarbital</p> <ul style="list-style-type: none"> <li>• Barbiturate, Anticonvulsant</li> </ul> 	<p>Status epilepticus:</p> <p>IV: initial: 15 -20 mg/kg (Max dose: 1 g) may repeat once after 10 – 15 minutes if needed (Max total dose: 40 mg/kg)</p> <p>Maintenance dose: P.O, IV: 3 – 6 mg/kg/day divided every 12 hours</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Start maintenance dose 12 hours after loading dose</li> <li>- May cause respiratory depression, hypotension</li> <li>- Monitor phenobarbital therapeutic level (15 – 40 mcg/ml = 65 – 172 mcmol/L)</li> </ul>
<p>Phentolamine</p> <ul style="list-style-type: none"> <li>• Alpha – adrenergic Blocking Agent, Antidote – Extravasation</li> </ul>	<p>Extravasation of vasopressor:</p> <p>SubQ: infiltrate area with 1 ml of 0.5 – 1 mg/ml solution (made by diluting 5 mg in 10 ml of NS) within 12 hours of extravasation (Do not exceed 0.1 – 0.2 mg/kg/dose or 5 mg total)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Inject 1 ml (in 5 divided doses of 0.2 ml around site of extravasation)</li> </ul>
<p>Phenylephrine</p> <ul style="list-style-type: none"> <li>• Alpha – Adrenergic Agonist</li> </ul>	<p>Hypotension low cardiac output:</p> <p>IV bolus: 5 – 20 mcg/kg/dose every 10 to 15 minute (Max: 500mcg/dose)</p> <p>Continuous IV infusion: initial: 0.1 – 0.5 mcg/kg/minute, titrate to desired response (Max: 2 mcg/kg/minute)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause peripheral and visceral vasoconstriction</li> <li>- May cause extravasation</li> </ul>
<p>Phenytoin</p> <ul style="list-style-type: none"> <li>• Anticonvulsant, Antiarrhythmic Agent, Class IB</li> </ul>  	<p>Status epilepticus:</p> <p>LD: IV: 15 – 20 mg/kg/dose (Max: 1 g)</p> <p>Maintenance dose: P.O, IV: initial: 5 mg/kg/day divided in 2 – 3 doses Usual range: 4 – 8 mg/kg/day divided in 2 – 3 doses (Max daily dose: 300 mg/day)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- Start the maintenance therapy 12 hours after the loading dose</li> <li>- Free (unbound) phenytoin serum concentrations should be monitored closely in patients with renal/hepatic disease or in those with hypoalbuminemia</li> <li>- Monitor phenytoin therapeutic level (10 – 20 mcg/ml = 40 – 79 mcmol/L)</li> <li>- May cause lethargy, nystagmus, hirsutism, gingival hyperplasia and cardiac arrhythmia</li> <li>- Rate of intravenous administration 0.5 mg/kg/minute</li> </ul>




Phosphate • Electrolyte Supplement  	Hypophosphatemia:		Comments: - Order as sodium or potassium phosphate - Potassium phosphate: (Potassium 4.4 mEq and phosphorus 3 mmol per mL) - Sodium phosphate: (Phosphate 3 mmol/mL and sodium 4 mEq/mL)
	IV:	0.16 – 0.36 mmol/kg over 6 hours, repeat dose as needed.	
	P.O.:	1 -2 mmol/kg/day divided every 6 – 12 hours	
Piperacillin/Tazobactam • Antibiotic, Penicillin) (dose based on piperacillin  	General dosing, susceptible infection:		Comments: - May cause thrombocytopenia - Adjust dose in renal impairment
		100mg/kg/dose every 8 hours (Max dose: 4 g/dose)	
	Cystic fibrosis, pseudomonal lung infection:		
		100 mg/kg/dose every 6 hours (Max daily dose: 18 - 24 g/day)	
Potassium Chloride • Electrolyte Supplement  	Hypokalemia:		Comments: - Infusion rate: 0.3 – 0.5 meq/kg/hour - Continuous cardiac monitoring recommended for rate > 0.5 meq/kg/hour - Rapid intravenous administration may cause cardiac arrhythmias - Monitor potassium level frequently
	P.O.:	2 – 5 meq/kg/day in divided doses every 2 – 8 hours not to exceed 1 -2 meq/Kg/dose (In the presence of severe hypokalemia see electrolyte guidelines for potassium IV bolus)	
	Intermittent IV:	(must be diluted prior to administration) 0.5 – 1 meq/kg/dose (Max dose: 40 meq), repeated as needed based on lab values	
	For more information see hypokalemia guideline		
Procainamide • Antiarrhythmic agent, Class I-A   	Antiarrhythmic:		
	IM:	children and adolescents: 20 – 30mg/kg/day divided every 4 – 6 hours, Max daily dose: 4g/day	
	IV, I.O.:	infants, children and adolescents: LD: 10 – 15mg/kg over 30 to 60 minutes, Max dose range in adult (1000 – 1500 mg). MD: continuous infusion: 20 – 80 mcg/kg/minute; Max daily dose: 2000mg/24hours	






Prednisolone • Corticosteroid	Asthma:		Comments: - May cause hypertension, hyperglycemia, gastrointestinal hemorrhage
	P.O:	1 – 2 mg/kg/day in divided doses 1 to 2 times/day (Max: 60 mg/day)	
	Anti – inflammatory or immunosuppressive:		
	P.O:	0.1 – 2 mg/kg/day in divided doses 1 to 4 times /day	
Propofol • General Anesthetic	Induction/ LD:	IV: 1 – 3 mg/kg/ dose	Comments: - May cause hypertriglyceridemia - May cause arrhythmia, bradycardia and hypotension - Contraindication: in patient with hypersensitivity to eggs, egg products, soybeans, or soy products
	Maintenance:	IV infusion: 0.5 – 4 mg/kg/hours	
	<ul style="list-style-type: none"> <li>- May cause propofol related infusion syndrome (Do not exceed 4mg /kg /hour for 24 hour).</li> <li>- (20 mcg /kg /minute = 1.2 mg /kg /hour)</li> </ul>		
Propranolol • Beta Adrenergic Blocker	Hypertension:	P.O: initial: 1 – 2 mg/kg/day divided in 2 to 3 doses titrate dose to effect (Max: 4 mg/kg/ day) (up to 600 mg/day)	Comments: - Start by low dose then increase gradually. - May cause bradycardia, hypotension, heart block, bronchospasm and hypoglycemia - Use with caution in patient with hepatic impairment
	Tachyarrhythmias:	P.O: initial: 0.5 – 1 mg/kg/day in divided doses every 6 – 8 hours; titrate dosage upward every 3 to 5 days Usual daily dose: 2 – 4 mg/kg/day (Max: 16 mg/kg/day (60 mg/ day) IV: 0.1 – 0.15 mg/kg over 10 minutes may repeat every 6 to 8 hours (Max. infant dose 1mg/dose, Max. child / adolescent 3mg/dose)	
Prostaglandin E1 See Alprostadiil			




Protamine • Antidote, Heparin	1 mg of protamine neutralizes 100 units of heparin		Comments: - Protamine dosage is determined by the most recent dosage of heparin or low molecular weight heparin (LMWH) - Too rapid administration can cause severe hypotensive and anaphylactoid – like reaction - Infusion rate should not exceed 5 mg/minute.
	1 mg protamine neutralizes 1 mg (100 units) LMWH (enoxaparin Sub Q) (Max dose: 50 mg)		
	• Regular heparin:		
	Heparin IV overdose		
	Time Since Last Heparin Dose (Minunte)	Dose of Protamine (mg) To Neutralize 100 Units of Heparin	
	<30	1	
30-60	0.5-0.75		
60-120	0.375-0.5		
>120	0.25-0.375		
Heparin SubQ overdose:	1 – 1.5 mg protamine/ 100 unit heparin		
• LMWH overdose:	If most recent dose has been administered within the last 4 hours, use 1 mg protamine/1 mg LMWH (100 units) Second dose of 0.5 mg protamine/ 1 mg (100 units) LMWH may be given if APTT remains prolonged 2 – 4 hours after the first dose		
Ranitidine • Histamine H2 Antagonist  	Infants, Children, and Adolescents ≤16 years:		Comments: - May cause headaches, mild gastrointestinal disturbances
	Duodenal or gastric ulcer/ Erosive esophagitis/ GERD:		
	Treatment:	4 to 10 mg/kg/day divided twice daily (Max daily dose: 300 mg/day)	
	Maintenance:	2 to 4 mg/kg/day once daily (Max daily dose: 150 mg/day)	
	IV:	2 to 4 mg/kg/day divided every 6 to 8 hours (Max dose: 50 mg/dose)	
	GI bleed or stress ulcer; prophylaxis:		
	IV:	Infants: 2 to 6 mg/kg/day divided every 8 hours (Max: 50 mg/dose)  Children and Adolescents: 3 to 6 mg/kg/day divided every 6 hours (Max daily dose: 300 mg/day)	
Rasburicase Uric Acid Lowering Agent	Hyperuricemia:		
	IV:	0.05 – 0.2 mg/kg/dose once daily for up to 5 days	



Rifampin • Antibiotic, Antitubercular Agent  	Antituberculosis:		Comments: - May cause thrombocytopenia and hyperbilirubinemia - Use with caution in patient with liver impairment - Causes red/ orange discoloration of body secretion (Urine, feces, saliva, tears and CSF fluid)
	P.O, IV:	10 – 20 mg/kg/day given once daily (Max dose: 600 mg)	
Staphylococcus infection:			
P.O, IV:	15 mg/kg/day divided every 12 hours (Must use in combination with systemic antistaphylococcal antibiotic) (Max dose: 600 mg)		
Risperidone: • Antipsychotic	Delirium:		Comments: - May cause anticholinergic effects - (constipation, urinary retention, blurred vision)
	Children < 5years:	P.O: initial: 0.1 – 0.2 mg once daily at bedtime	
	Children > 5years and adolescents:	P.O: 0.2 – 0.5 mg once daily at bedtime, may titrate to lowest effective dose every 1 – 2 days	
Maximum daily dose	dependent upon patient weight: <20kg: 1mg/day, 20 to 45kg: 2.5mg/day, >45kg: 3mg/day		
Rocuronium (Neuromuscular Blocker Agent, Nondepolarizing)  	Rapid sequence intubation:		Comments: - Use with caution in patients with hepatic impairment - Use with caution with patient with pulmonary hypertension
	IV:	0.6 – 1.2 mg/kg/dose	
	Intermittent IV dosing:	0.075 to 0.15 mg/kg; repeat as needed	
Continuous IV infusion:	5 to 12 mcg/kg/minute (0.42 to 0.72 mg/kg/hour)		

<p>Salbutamol</p> <ul style="list-style-type: none"> <li>Beta2-Adrenergic Agonist, Bronchodilator</li> </ul> 	<p>Asthma, acute exacerbation: Oral inhalation:</p> <p>Inhalation aerosol (metered dose inhaler): 90 mcg/puff: 4 to 8 puffs every 20 minutes for 3 doses then every 1 to 4 hour</p> <p>Nebulization, Intermittent:</p> <p>0.15 mg/kg (minimum dose: 2.5 mg) every 20 minutes for 3 doses then 0.15 to 0.3 mg/kg not to exceed 10 mg every 1 to 4 hours</p> <p>Nebulization, Continuous:</p> <p>0.3 – 0.5 mg/kg/hour, higher doses of 3 mg/kg/hour (Max dose: 15mg/hour)</p> <p>Continuous IV infusion:</p> <p>0.5 – 10 mcg/kg/minute</p> <p>Hyperkalemia:</p> <p>Oral inhalation: Nebulization: 10 mg/dose or 0.3 to 0.5 mg/kg/dose</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>Round the dose to the nearest dosage form</li> <li>May cause tachycardia, hypokalemia and hyperglycemia</li> <li>Use with caution in patient with renal impairment</li> </ul>
<p>Sildenafil</p> <ul style="list-style-type: none"> <li>Phosphodiesterase Type – 5 (PDE5) Inhibitor</li> </ul>  	<p>Pulmonary hypertension:</p> <p>P.O.: Initial: 0.25 – 0.5 mg/kg/dose every 8 hours; titrate as needed; (Max dose: 1 mg/kg/dose every 8 hours)</p> <p>Children and Adolescents:</p> <p>8 to 20 kg: 10 mg three times daily</p> <p>&gt;20 kg to 45 kg: 20 mg three times daily (Max recommended dose: 20 mg 3 times daily)</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause flushing, hypotension and increase liver enzyme</li> <li>Use with caution in patient with hepatic impairment</li> <li>Use with caution in patient with renal impairment</li> <li>Avoid sudden cessation of sildenafil may result in an exacerbation of PAH</li> </ul>
<p>Sodium Bicarbonate</p> <ul style="list-style-type: none"> <li>Alkalinizing Agent, Electrolyte Supplement</li> </ul>	<p>Metabolic acidosis:</p> <p>Dosage should be based on the following formula if blood gases and pH measurements are available:  <math>\text{HCO}_3^- \text{ (mEq)} = 0.3 \times \text{weight (kg)} \times \text{base deficit (mEq/L)}</math>  or <math>\text{HCO}_3^- \text{ (mEq)} = 0.5 \times \text{weight (kg)} \times [24 - \text{serum HCO}_3^- \text{ (mEq/L)}]</math></p> <p>Usual dose: 1 – 4 meq/kg/dose IV infusion over 4-8 hours; subsequent doses should be based on patient's acid-base status</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>May cause hypernatremia, severe pulmonary edema and hypocalcemia</li> <li>May cause extravasation</li> <li>For IV infusion dilute in a dextrose solution to maximum concentration (0.5 meq/ml)</li> </ul>



Sodium Benzoate • Hyperammonemia Agent	Infants and Children:		Comments: - May cause hyperammonemia and hypokalemia - Use with caution in patient with Reye's syndrome and hyperbilirubinemia - Do not repeat loading dose
	Initial loading dose:	P.O., IV: 0.25 g/kg/dose over 90 minutes	
	Followed by	P.O: 0.25 g/kg/day divided every 6-8 hours OR IV continuous infusion: 0.25 g/kg over 24 hours	
Sodium Chloride • Electrolyte Supplement	Hyponatremia:		Comments: - 3 % hypertonic saline (sodium content of 513mEq/L) - (0.9% sodium chloride Na content 154 mEq/L) - Pretreatment the hypertonic nebulization with a bronchodilator is recommended to prevent potential bronchospasm - Prefer to infuse the Hypertonic saline through central line - Avoid rapid correction of Na > 1 mmol/hour unless emergency (e.g. hyponatremic seizure or increase ICP)
	To calculate the necessary dose: Dose (mEq sodium) = [desired plasma sodium (mEq/L) – actual sodium (mEq/L)] x 0.6 x weight (kg)		
	Maintenance dose: < 50 kg: 2 – 4 mmol /kg/day divided 2 – 8 hours > 50 kg: 1 -2 mmole /kg/day divided 2 – 8 hours		
	3% hypertonic solution		
		Increased intracranial pressure (ICP): continuous IV infusion: 0.1 – 1 ml/kg/hours titrated to maintain ICP and/or 6 – 10 ml/kg/dose over 20 min. (Max. bolus dose 250 ml/dose) (serum osmolality not exceed 360 mOsmol/L)	
		Nebulization: Bronchiolitis, viral: inhaled: 4 ml inhaled every 2 hours for 3 doses followed by every 4 – 6 hours	
	Bronchodilator diluent: 1 – 3 ml to dilute bronchodilator solution in nebulizer before administration		
	Cystic fibrosis: 7 % solution: 4 ml inhaled twice daily		
Sodium Polystyrene sulfonate	See Kayexalate		
Spironolactone • Diuretic, Potassium Sparing  	Diuretic, hypertension:		Comments: - May cause hyperkalemia, acidosis, nausea and vomiting
		1 – 4 mg/kg/day or 60 mg/m2/day in divided doses every 6 -12 hours (Max: 100 mg/day)	

<p>Sotalol</p> <ul style="list-style-type: none"> <li>• Antiarrhythmic Agent, Class II, III, Beta-Adrenergic Blocker</li> </ul> 	<p>Initial: 2 mg/kg/day divided every 8 hours; if needed, increase dosage gradually by 1 to 2 mg/kg/day increments; allow 3 days between dosage increments to achieve new steady-state  Max: 10 mg/kg/day (if no limiting side effects occur) do not exceed adult doses (Max adult daily dose: 320 mg/day)</p>		<p>Comments:</p> <ul style="list-style-type: none"> <li>- Monitor clinical response, heart rate, and QTc intervals</li> <li>- It is not necessary to increase to target dosage if desired clinical effect has been achieved at a lower dosage</li> </ul>
<p>Succinylcholine (Neuromuscular Blocker Agent, Depolarizing)</p>	<p>Endotracheal intubation: infants, children and adolescents:</p>		<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause hypotension, bradycardia, arrhythmia malignant hyperthermia and hyperkalemia</li> <li>- Contraindicated with previous history of malignant hyperthermia severe burns, spinal cord injury, neuromuscular disease or myopathies and hyperkalemia.</li> </ul>
<p>IV</p>	<p>Infants: 2 – 3 mg/kg/dose  Children: 1 – 2 mg/kg/dose  Adolescents: 1 – 1.5 mg/kg/dose</p>		
<p>IM</p>	<p>4 – 5 mg/kg/dose (Max. dose 150 mg/dose)</p>		
<p>Thiopentone</p> <ul style="list-style-type: none"> <li>• Short – acting Barbiturate</li> </ul>	<p>Intermittent dose:</p>	<p>IV: 1 – 4 mg/kg/dose</p>	<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause hypotension</li> <li>- High alkaline pH will cause tissue necrosis upon extravasation</li> <li>- Use with caution in patient with hepatic and renal impairment</li> </ul>
<p>Continuous IV infusion:</p>	<p>1 mg/kg/ hour and increase as needed up to a maximum of 8mg/kg/hour.</p>		
<p>Topiramate</p> <p>Anticonvulsant, Miscellaneous</p> 	<p>Infantile spasms/ Anticonvulsant, adjunctive therapy/ Primary generalized tonic – clonic seizures:</p>		<p>Comments:</p> <ul style="list-style-type: none"> <li>- Use with caution in patient with hepatic and renal impairment</li> <li>- May cause cognitive dysfunction</li> <li>- May cause metabolic acidosis</li> <li>- Don't discontinue abruptly, therapy should be withdrawn gradually</li> </ul>
<p>P.O</p>	<p>Initial: 1 to 3 mg/kg/day divided every 12 – 24 hours (Max: 25 mg/dose), titrate every week in 1 to 3 mg/kg/day increments as tolerated until seizures controlled</p>		
<p>Usual maintenance (P.O):  5 to 9 mg/kg/day in 2 divided doses  Max daily dose: 50 mg/kg/day</p>			

<p>Tramadol Analgesic, Opioid</p> 	Moderate to severe pain: P.O:		<p>Comments:</p> <ul style="list-style-type: none"> <li>- Use with caution in patient with hepatic and renal impairment</li> </ul>
<p>Tranexamic Acid • Antifibrinolytic Agent, Hemostatic Agent</p> 	Intermittent dose:		<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause Venous and arterial thrombosis or thromboembolism</li> <li>- May cause Hypotension (with rapid IV injection)</li> </ul>
		<p>IV: 10 mg/kg immediately before procedure, then 10 mg/kg/dose 3 to 4 times daily; may be used for 2 to 8 days</p>	
	Infusion rate:		
	In children 5 to 40 kg:		
		<p>IV: Loading dose: 6.4 mg/kg over 5 minutes followed by a weight-adjusted continuous infusion in the range of 2 to 3.1 mg/kg/hour, up to 10 mg/kg/hour as needed.</p>	
<p>Tromethamine (THAM) • Alkalinizing Agent</p> 	Metabolic acidosis:		<p>Comment:</p> <ul style="list-style-type: none"> <li>- May cause respiratory depression, hypoglycemia, and hyperkalemia</li> <li>- May cause extravasation</li> <li>- Use with caution in patients with renal impairment; reduce dose and monitor pH carefully</li> </ul>
	<p>IV: Empiric dosage based upon base deficit: Dose (mL) of THAM = body weight (kg) x base deficit (mEq/L) x 1.1* Usual range: 1 – 2 mEq/kg/dose; Maximum dose: 15 mEq/kg/24 hours (15 mmol/kg/24 hours)</p>		
	<p>Each mL of THAM = 0.3 nmol= 36 mg= 0.3 mEq</p>		
<p>Terbutaline • Beta2 Agonist</p>	Asthma:		<p>Comments:</p> <ul style="list-style-type: none"> <li>- May cause tachycardia, hypokalemia and hyperglycemia</li> </ul>
	<p>Continuous IV infusion:</p>	<p>LD: 2 – 10 mcg/kg, followed by 0.1 – 0.4 mcg/kg/minute depending upon the clinical response. Titrate in increment of 0.1 – 0.2 mcg/kg/min Q 30 minute. (Max: 10 mcg/kg/minute)</p>	

Ursodcoxycholic Acid • Gallstone Dissolution Agent	<b>Parenteral nutrition induce cholestasis/improvement in the hepatic metabolism of essential fatty acid in cystic fibrosis:</b>		<b>Comments:</b> - May cause GI upset, biliary obstruction and increase liver enzyme
	30 mg/kg/day in 3 divided doses		
<b>Biliary atresia:</b>	10 – 20 mg/kg/day in 2 - 3 divided dose		
<b>Pruritis secondary to cholestasis:</b>	P.O. 15 -20 mg/kg/day OD or BID up to 30 mg/kg/day		
Valproic Acid • Anticonvulsant  	<b>Seizures disorders:</b>		<b>Comments:</b> - Children receiving more than 1 anticonvulsant may require doses up to 100 mg/kg/day in 3 to 4 divided doses - Total daily IV dose is equivalent to the total daily oral dose but IV dose should be divided every 6 hours - May cause hepatotoxicity - Therapeutic level 50- 100 mcg/ml (350- 690 micromoles/L)
<b>P.O:</b>	<b>Initial:</b> 10 to 15 mg/kg/day in 1 to 3 divided doses; increase by 5 to 10 mg/kg/day at weekly intervals  <b>Maintenance:</b> 30 to 60 mg/kg/day in 2 to 3 divided dose.		
<b>Status epilepticus; refractory:</b>			
<b>IV:</b>	<b>LD: Initial:</b> 20 to 40 mg/kg		
Vancomycin • Antibiotic, Glycopeptide  	<b>General dosing, susceptible infection:</b>		
<b>Mild to moderate infection:</b>	<b>IV:</b> 40 – 45 mg/kg/day divided every 6 – 8 hours (Max daily dose: 2000 mg/day)		
<b>Menigitis/ Severe infection:</b>	<b>IV:</b> 45 – 60 mg/kg/day divided every 6 – 8 hours (Max daily dose: 4000 mg/day)		
<b>C. difficile associated diarrhea (CDAD):</b>			
	<b>P.O:</b> 40 mg/kg/day divided every 6 – 8 hours for 7 to 10 days , (Max daily dose: 2000 mg/day)		
<b>Intrathecal/intraventricular (use a preservative free preparation):</b>			
	5 – 20 mg/day		



Vasopressin • Antidiuretic Hormone Analog	Diabetes insipidus:		Comments: - May cause extravasation - Use with caution in patients with renal impairment
		Continuous IV infusion: initial: 0.5 milliunits/kg/hour (0.0005 units/kg/hour) Max: 10 milliunits/kg/hour (0.01 units/kg/hour)	
	Vasodilatory shock with hypotension:		
	continuous IV infusion: 0.17 – 8 milliunits/kg/minute (0.01 – 0.48 units/kg/ hour)		
Vitamin B6 (Pyridoxine) • Vitamin, Water Soluble	Pyridoxine dependent seizures treatment:		Comments: - Don't discontinue abruptly, therapy should be withdrawn gradually - May cause GI disturbance, sedation and folic acid deficiency - May cause seizure (following very large IV doses)
	P.O, IM, IV:	initial: 50 – 100 mg one dose	
	P.O:	Maintenance: 50 – 200 mg/day (30 mg/kg/day)	
Vitamin K (Phytonadione) • Vitamin, Fat Soluble	Vitamin K deficiency: (prevention, supplement & prolonged INR):		Comments: - May cause hyperbilirubinemia - May cause anaphylactic reaction
	P.O, IV, SubQ, IM:	2 – 5 mg once daily (max: 10 mg/dose)	
Voriconazole Antifungal Agent    	Treatment:		Comments: - Use with caution in patients with hepatic and renal impairment - QT interval Prolongation has been associated with voriconazole - May cause hypokalemia and hypomagnesemia
	P.O, IV:	LD: 9 mg/kg/dose every 12 hours for 2 doses	
		MD: 9 mg/kg/dose every 12 hours (Max single dose: 350 mg)	
	P.O:	LD: (if baseline INR 1 -1.3)0.2 mg/kg (max dose: 10 mg)	
		MD: 0.1 mg/kg/day	
Usual range: 0.05 - .34 mg/kg/day			

# ElectrolyteS

Hyperkalemia:	
<b>Management:</b> Obtain 12 lead ECG.	<b>ECG Changes:</b> (sensitivity of ECG to detect hyperkalemia is not very reliable)
If K level < 6.5 and no ECG changes:	
a. Discontinue exogenous sources of K (IV& oral) b. Discontinue medications that limit its excretion (e.g. Spironolactone). c. Na Polystyrene Sulfonate (Kayexalate): 1 g/kg orally or rectally in sorbitol solution d. Follow up of level every 4-6 hours with continuous ECG monitoring till normalized .	
<b>If K level &gt; 6.5 and/or ECG changes:</b>	
<b>Stabilize cardiac cell membrane:</b> <ol style="list-style-type: none"> <li>Ca gluconate: 100mg/kg (1ml of 10%) IV over 2 – 3 minutes (over 20 – 30 minutes in Digitalis toxicity), can be repeated in 5 minutes if ECG abnormalities persist.</li> </ol>	
<b>Lower the plasma K<sup>+</sup> level by redistribution:</b> <ol style="list-style-type: none"> <li>Glucose (0.5 – 1g/kg) + regular insulin (0.2 unit /g glucose or 0.1 – 0.2 units/kg) IV infusion over 30 min.</li> <li>Consider Inhaled B2 agonist 2.5 mg for child &lt;25kg, 5 mg for children &gt;25 kg every 1 – 2 hours.</li> <li>Consider NaHCO<sub>3</sub> 1 – 2 mEq/kg over 5 – 10 minutes</li> </ol>	
<b>Definitive removal of plasma K<sup>+</sup>:</b> <ol style="list-style-type: none"> <li>Kayexalate (alternative: calcium resin) 1 g/kg orally or rectally</li> <li>Consider Loop (furosemide) or Thiazide diuretics to increase renal excretion</li> <li>Consider dialysis in setting of renal failure or refractory hyperkalemia not responsive to all above measures</li> </ol>	

Hypokalemia: (Defined as serum K < 3.5mEq/l)	
<b>Management: general considerations</b>	<b>ECG Changes:</b>
<ul style="list-style-type: none"> <li>The most important complication of hypokalemia is hyperkalemia from rapid correction</li> <li>Use oral route whenever possible</li> <li>Check K level soon after IV loading dose (within 1 – 2 hours)</li> <li>Check stat Mg<sup>++</sup> level when K &lt; 3.5, replace Mg if low to treat hypokalemia</li> <li>Use below with normal renal function only</li> </ul>	<ul style="list-style-type: none"> <li>Flattening or inversion of T waves</li> <li>ST depression</li> <li>Development of U waves</li> </ul>

Use IV route If level is less than 2.5 mEq/l or with symptomatic hypokalemia

Use bolus if symptomatic or with high risk of arrhythmias

Rate of infusion: Preferred not to exceed 0.5 meq/kg/hr (may rarely use up to Max Rate 1 meq/kg/hr)

Peripheral vs central: PIV max. 60 meq/l while CVL max 120 meq/l (Lexicom)

K-Level	Oral	IV
3.0 – 3.5 mEq/l	Increase oral intake or	Increase KCl in IVF or
	0.5 mEq/kg/dose max 20 mEq/dose Can Be repeated every 6 – 8 hours	0.25mEq/kg KCl over 1 hour
2.5 – 3.0 mEq/l	1 mEq/kg/dose max 20 mEq/dose Can Be repeated every 6 – 8 hours	0.5mEq/kg KCl over 2 hours
2.0 – 2.5 mEq/l	2 mEq/kg/dose max 20 mEq/dose Can Be repeated every 6 – 8 hours	0.75mEq/kg KCl over 3 hours
< 2.0 mEq/l or Hypokalemia induced paralysis or Hypokalemia induced ECG changes	2 mEq/kg/dose max 20 mEq/dose Can Be repeated every 4 – 6 hours	0.5 mEq/kg over 60 minutes

### Hypernatremia (Na > 145 mEq/l):

#### Hypernatremia with dehydration/hypovolemia:

- ▶ Give isotonic (0.9 NS) fluid bolus for resuscitation
- ▶ Replacement therapy (e.g. gastroenteritis):
  - a. Estimate total fluid needed: Maintenance, deficit (dehydration %) and ongoing loss
  - b. Do not start with ¼ NS hypotonic fluid (use 0.9 NS or ½ NS till proper fluid identified)
  - c. Estimate extra free water needed: 4ml x weight (kg) x desired Na change
  - d. **Correct hypernatremia slowly (brain edema risk)**
    - I. Chronic hypernatremia (> 24hours): decrease plasma Na<sup>+</sup> by 0.5 mEq/l every hour (10 – 12 mEq/l/24h).
    - II. Usually 4ml/kg of free water drop Na by 1mEq/l
  - e. Replace free water via oral/NG tube whenever possible.
  - f. IV free water administration is prohibited.
  - g. Measure serum and urine electrolytes and monitor serum Na drop frequently (every 2 – 4 hrs)
  - h. Hourly neurologic examination
- ▶ For Diabetes Insipidus (DI):
  - a. Free water replacement as per ongoing loss (monitor U.O closely)
  - b. Consider IV Desmopressin or Vasopressin to control rapid water loss and hypernatremia

#### Hypernatremia with Euovolemia or Hypervolemia:

- a. Withdraw Na<sup>+</sup> source and consider adding free water
- b. For severe compromised patients add furosemide and free water
- c. Usually 4ml/kg of free water drop Na by 1mEq/l
- d. Patient with renal failure, consider dialysis.

## Hyponatremia:

### Hyponatremia with dehydration/hypovolemia:

- Give isotonic (0.9 NS) fluid bolus for resuscitation
- If presenting with active seizure: 6 ml/kg of 3% NaCl over 20 – 30 minutes.
- Correct fluid and Na<sup>+</sup> deficits
- Total Na deficit (mEq/l) can be calculated as = (desired Na – plasma Na) x (Wt x 0.6)
- Generally, Na<sup>+</sup> deficit replaced at rate of 0.5 mEq/hour
- Determine the type and amount of IVF replacement (maintenance and deficit of Na<sup>+</sup> and water)
- Follow hydration and biochemical parameters 4 – 6 hourly.
- Replacement of ongoing salt losses is paramount.

### Hyponatremia with Euvolemia or hypervolemia:

- Treat symptomatic hyponatremia with infusion of hypertonic saline
- Restrict water only or in combination with hypertonic NaCl and a loop diuretic.
- Correct the cause of hyponatremia
- In asymptomatic child, the target rate of rise should not exceed 0.5 – 1 mEq/l/hour to avoid central pontine lysis demyelination

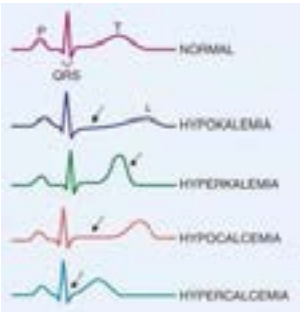
## Hypercalcemia:


### Treatment:

- ▶ Restore intravascular volume and enhance renal excretion by administration of normal saline at 2 to 3 X maintenance fluid rate.
- ▶ If adequately hydrated and Ca<sup>++</sup> do not decrease, administer loop diuretics.
- ▶ Consider Calcitonin and bisphosphonates as adjunct treatment in severe hypercalcemia
- ▶ Consider hemodialysis using a low Ca<sup>++</sup> dialysate in severe case in which hydration and medication fail.

### ECG Changes:

- ▶ Shortened QT interval
- ▶ Ventricular dysrhythmias

Hypocalcemia:	
Treatment:	ECG Changes:
<ul style="list-style-type: none"> <li>▶ Acute symptomatic hypocalcemia (i.e. tetany, muscle twitching, carpopedal spasm, laryngospasm, or seizure):</li> </ul>	<ul style="list-style-type: none"> <li>▶ Prolongation of QT interval</li> <li>▶ Non-specific ST – T wave changes</li> <li>▶ Rarely cause ventricular arrhythmias</li> </ul>
<p>a. Calcium Gluconate bolus (100-200 mg/kg to a maximum of 3 gm, preferred through central line) over 10 – 20 minutes.</p> <p>b. Then start a continuous infusion of Ca Gluconate at 10 – 30 mg/kg/h to maintain adequate Ca<sup>++</sup> levels. Rate of infusion then titrated based on serial Ca<sup>++</sup> measurements</p> <ul style="list-style-type: none"> <li>▶ Once symptoms resolve or in asymptomatic patient who can take enteral Ca<sup>++</sup>, start on 50mg/kg body weight/24h of elemental Ca<sup>++</sup> into 3 or 4 doses.</li> <li>▶ In hypocalcemic patient with hypomagnesemia, correct mg with IV mg sulfate or oral mg oxide.</li> <li>▶ In patient with concurrent hyperphosphatemia, correct elevated phosphate by phosphate binders ( risk of tissue deposition of Ca phosphate if Ca-phosphate product exceeds 80 mg<sup>2</sup>/dl<sup>2</sup> = 6.4 mmol<sup>2</sup>/L<sup>2</sup>)</li> </ul>	 <p>The image displays five ECG strips illustrating different electrolyte-related changes. From top to bottom: 1. NORMAL: shows a standard ECG with a narrow QRS complex and a T wave. 2. HYPOKALEMIA: shows a prolonged QT interval and a prominent U wave. 3. HYPERKALEMIA: shows a tall, peaked T wave. 4. HYPOCALCEMIA: shows a prolonged QT interval. 5. HYPERCALCEMIA: shows a prolonged QT interval. Arrows in the hypokalemia, hyperkalemia, and hypercalcemia strips point to these specific changes.</p>

Hypomagnesaemia:	
Treatment:	ECG Changes:
<ul style="list-style-type: none"> <li>▶ Symptomatic patient or asymptomatic patient with Mg level &lt; 1mg/dl (&lt; 0.41mmol/l) require IV replacement with Mg sulfate at dose of 25 – 50 mg/kg (0.1 – 0.2 mMol) as a <b>slow IV infusion over 2 hours</b>.</li> <li>▶ Dose should be repeated every 6 hours until level stabilize.</li> <li>▶ Check Mg level 2 hours after infusion.</li> <li>▶ Treat mild to moderate hypomagnesemia of 1 – 1.5 mg/dl (0.41 – 0.61 mmol/l) with oral supplementation at doses of 20 – 40 mg/kg of elemental mg per dose. (Max. dose 400 mg in 24 hours).</li> <li>▶ Follow PALS recommendations for Torsade De Pointes.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Secondary hypokalemia can present with nonspecific T wave changes, u waves, a prolonged QT interval, widening of QRS complex, prolongation of PR interval and ventricular arrhythmias.</li> <li>▶ Hypomagnesemia predispose to cardiac dysrhythmias, particularly Torsade De Pointes.</li> </ul>  <p>The image shows an ECG strip with a pink grid background, labeled 'Torsade de Pointes'. The rhythm is characterized by a wide QRS complex and a prolonged QT interval, with the QRS complexes appearing to 'twirl' or rotate around the baseline, which is a classic sign of this arrhythmia.</p>

### Hyperphosphatemia (look for aluminum phosphate dosage)

- Review dietary intake, medications, and renal function.
- Volume expansion with normal saline does improve excretion.
- Phosphate chelators to decrease phosphate absorption.
- Consider dialysis in renal failure patient with severe hyperphosphatemia.

### Hypophosphatemia:

#### Treatment:

- ▶ Patients with serum phosphate  $> 2.2\text{mg/dl}$  ( $> 0.71\text{mMol/l}$ ): Increase intake of milk.
- ▶ Patients with serum phosphate levels  $< 1.5\text{mg/dl}$  ( $< 0.5\text{mMol/l}$ ) and/or symptomatic hypophosphatemia: treatment with IV phosphate preferred:
  - a. Asymptomatic severe hypophosphatemia ( $< 1.5\text{mg/dl}$ ) give  $2.5\text{mg/kg}$  ( $0.08\text{mMol}$ ) of elemental phosphorus over 6 hours.
  - b. Symptomatic patient, give  $5\text{mg/kg}$  ( $0.16\text{mMol}$ ) of elemental phosphorus over 6 hours.
    - N.B: Do not exceed the maximum dose of  $0.24\text{mMol/kg/dose}$ .
    - N.B: Check serum K, Ca, phosphate and Mg 2 hours after completing infusion.

## Septic shock in Children

0 - 5 minutes	<p>Recognition</p> <ul style="list-style-type: none"> <li>▶ Decreased level of consciousness</li> <li>▶ Persistent tachycardia</li> <li>▶ Decreased urine output</li> <li>▶ Hypotension (late sign)</li> </ul>	<p>Cold shock: cold &amp; prolonged capillary refill time</p> <p>Warm shock: warm &amp; brisk capillary refill</p>	<ul style="list-style-type: none"> <li>▶ Airway, Breathing, Circulation support (as per PALS guidelines)</li> <li>▶ Provide 100% O<sub>2</sub> using non-rebreather mask</li> <li>▶ Keep the patient NPO.</li> <li>▶ Establish 2 peripheral IV. If IV not achieved within 5 minutes insert IO (take blood sample/culture if possible)</li> <li>▶ Correct hypoglycemia &amp; hypocalcemia</li> <li>▶ Start fluid boluses</li> </ul>
5 - 15 minutes	<ul style="list-style-type: none"> <li>▶ PUSH 20 ml/kg of 0.9% saline (up to 60 ml/kg). Repeat as needed.</li> <li>▶ Use small boluses for cardiac patient (hepatomegaly, cardiomegaly, gallop, basal crepitation)</li> <li>▶ Administer 1st dose of broad spectrum.</li> <li>▶ DO NOT DELAY ANTIBIOTICS waiting for cultures to be taken</li> </ul>	<p>Initial therapeutic endpoint:</p> <ul style="list-style-type: none"> <li>▶ Capillary refill of <math>\leq 2</math> seconds &amp; Warm extremities (in cold shock)</li> <li>▶ Normal blood pressure for age.</li> <li>▶ Normal pulses with no difference between peripheral and central</li> <li>▶ Achieve threshold heart rate for age.</li> <li>▶ Urine output <math>\geq 1</math> mL/kg/hr.</li> <li>▶ Normal mental status.</li> </ul>	
15 - 60 minutes	<p>If shock not reversed:</p> <ul style="list-style-type: none"> <li>▶ Start dopamine (up to 10 mcg/kg/min) or epinephrine (0.05-0.3 mcg/kg/min) in peripheral IV or IO.</li> <li>▶ Consider elective intubation: suggest using ketamine (1-2 mg/kg) <math>\pm</math> atropine (if there is risk of bradycardia) (0.02mg/kg) (IV/IO).</li> </ul> <p>If still in shock:</p> <ul style="list-style-type: none"> <li>▶ Titrate up epinephrine for cold shock, norepinephrine for warm shock (through central line or IO)</li> </ul>	<p>Initial Lab and radiology request:</p> <ul style="list-style-type: none"> <li>▶ Blood Gases, Glucose, CBC, Electrolyte, Urea &amp; Creatinine, Lactate, Coagulation profile, Albumin, Liver Function Tests, Type &amp; Cross match</li> <li>▶ Blood C/S, Urine analysis &amp; C/S</li> <li>▶ Consider LP (for stable patients with suspicion of meningitis)</li> <li>▶ CX-Ray</li> </ul>	
> 60 minutes	<ul style="list-style-type: none"> <li>▶ Need CVL to be inserted <math>\pm</math> arterial line.</li> <li>▶ Consider hydrocortisone (2mg/kg loading then 1 mg/kg Q6hr) for persistent shock (send random cortisol level if possible)</li> <li>▶ Keep hemoglobin above 10 gm/dl.</li> <li>▶ Target mixed venous saturation. <math>\geq 70\%</math>.</li> <li>▶ Monitor Lactate level.</li> <li>▶ Early control of infection source.</li> <li>▶ Consider stress ulcer prophylaxis.</li> <li>▶ Strict in and out (insert foley's catheter)</li> <li>▶ Consider echocardiogram for sick patients on high inotropic/vasopressor support.</li> <li>▶ Consider Dobutamine or Milrinone for cardiac dysfunction and cold shock</li> </ul>		

**Pediatric Vital Sign Normal Ranges**

Age Group	Heart Rate	Respiratory Rate	Systolic BP	Weight in Kg
Newborn	120-160	30-50	50-70	2-3
Infant (1-12 months)	80-140	20-30	70-100	4-10
Toddler (1-3 yrs)	80-130	20-30	80-110	10-14
Preschooler (3-5 yrs)	80-120	20-30	80-110	14-18
School Age (6-12 yrs)	70-110	20-30	80-120	20-42
Adolescent ( $\geq$ 13 yrs)	55-105	12-20	110-120	>50

**Minimal Acceptable Systolic BP**

Age	Systolic BP
<1 month	>60 mmHg
1 month-1 year	>70 mmHg
>1 year-10 years	$(2 \times \text{age}) + 70$
>10 years	>90 mmHg



## Status epilepticus in Children

0 - 5 minutes	Recognition and initial stabilization	Investigations
	<ul style="list-style-type: none"> <li>▶ Maintain A, B, C + Neurologic exam</li> <li>▶ Give oxygen by cannula or mask</li> <li>▶ Connect to cardiorespiratory monitor</li> <li>▶ Connect to pulse oximeter (check O2 Sat)</li> <li>▶ Establish IV access</li> <li>▶ Prepare for possible intubation</li> <li>▶ Correct any electrolyte abnormalities (hypoglycemia, hyponatremia, hypocalcemia...etc)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Check bed side glucose</li> <li>▶ Point of care blood gases (including Na, iCa)</li> <li>▶ Send lab: Electrolyte, Mg, Ca, Po4, CBC, Urea &amp; Creatinine, LFT.</li> </ul>
		Consider when clinically indicated:
		<ul style="list-style-type: none"> <li>▶ Anticonvulsant drug level</li> <li>▶ Toxicology, metabolic screen.</li> <li>▶ Blood and urine cultures</li> <li>▶ Lumbar Puncture (if no contraindication)</li> <li>▶ CT/MRI brain</li> </ul>
<p style="color: red;">Start anticonvulsant treatment after 5 minute of seizure activity (Consider pre-arrival seizure duration)</p>		

5 - 20 minutes	Initial Therapy Phase is Benzodiazepine	
	<p style="text-align: center;">☐ If there is IV/IO:</p> <ul style="list-style-type: none"> <li>▶ Lorazepam 0.1 mg/kg/dose, max: 4 mg/dose OR</li> <li>▶ Midazolam 0.1-0.2 mg/kg Max 10mg)</li> <li>▶ Both of them can be repeated once</li> </ul> <p>If both not available use:</p> <ul style="list-style-type: none"> <li>▶ Diazepam (0.15-0.2 mg/kg/dose, max: 10 mg/dose)</li> </ul>	<p style="text-align: center;">☐ If No IV/IO:</p> <ul style="list-style-type: none"> <li>▶ IM midazolam (one dose) 0.2mg/kg</li> </ul> <p>If not available use:</p> <ul style="list-style-type: none"> <li>▶ Rectal diazepam 0.2 – 0.5 mg/kg maximum 20mg.</li> </ul>

20 - 40 minutes	Second Therapy Phase choose either options 1 or 2	
	(The patient must be on cardiorespiratory monitor)	
	<p><b>Option 1: choose one of the following:</b></p> <ul style="list-style-type: none"> <li>▶ Intravenous fosphenytoin (20 mg/kg/dose ) over 5 to 10 minutes or Phenytoin (20 mg/kg/dose) slowly over 30 minutes</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>▶ Intravenous valproic acid (40 mg/kg, max: 3000 mg/dose, single dose)</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>▶ Intravenous levetiracetam (20-60 mg/kg, max: 2500 mg/dose, single dose)</li> </ul>	<p><b>Option 2:</b></p> <p>Intravenous phenobarbital 20 mg/kg/dose single dose</p>

40 - 60 minutes

### Third Therapy Phase

- ▶ Call PICU and pediatric neurology
- ▶ Use the alternative choice of second therapy phase
  - if you choose option 1 in previous phase go for option 2 now and vice versa.

> 60 minutes

#### Refractory status epilepticus:

- ▶ Request for continuous EEG  
look for clinical or subclinical seizure, or non-convulsive status epilepticus (NCSE)
- ▶ Consider insertion of central venous line
- ▶ Be ready for intubation
- ▶ Monitor vital sign and check for arrhythmias

#### Midazolam infusion:

- ▶ Bolus with 0.2 mg/kg then
  - ▶ Start infusion at 1 microgram/kg/min
  - ▶ Increase by 2 every 10-15 min PRN (with seizure) up to 24 mcg/kg/min
  - ▶ Common side effects:  
Hypotension and loss of airway reflexes.
- If seizure persist:**
- ▶ Barbiturate coma

## Management of Status Asthmaticus in Children

Definition: Status asthmaticus is an asthma attack that fails to respond to initial doses of nebulized B2-agonist, anticholinergic agents and systemic corticosteroid and requires admission to the hospital for aggressive therapy

Be careful from asthma mimickers (e.g. foreign body, heart failure, pneumonia, airway diseases, aspiration...etc.)

Initial Management of Asthma	Simplified Ventolin dose	
<ul style="list-style-type: none"> <li>▶ O2 to maintain O2 Saturation &gt;90% ▶ Keep NPO</li> <li>▶ Short acting beta agonist:                             <ul style="list-style-type: none"> <li>• Nebulized Albuterol (Salbutamol): 0.15-0.3 mg/kg for 3 doses back to back mixed in 3-5 ml 0.9% saline (15-20 minutes each)</li> </ul> </li> </ul>	< 5yrs	2.5 mg
	≥ 5 yrs	5 mg
<ul style="list-style-type: none"> <li>▶ Nebulized Ipratropium Bromide (Atrovent): 0.5 mg (mix with above Ventolin)</li> </ul>	minimum 2.5 mg, max 10 mg (wean with improvement)	
<ul style="list-style-type: none"> <li>▶ Steroids:                             <ul style="list-style-type: none"> <li>• Methylprednisolone IV loading 2mg/kg then 2mg/kg/day (max 60 mg/day) divided every 6 hrs for 5 days</li> </ul> </li> </ul>	Alternative corticosteroid: Hydrocortisone IV 5 mg/kg/dose (maximum 300 mg) every 6 hrs	

High risk groups	Recommended investigations
<ul style="list-style-type: none"> <li>▶ Previous PICU admission (with or without intubation)</li> <li>▶ Patient on three or more classes of asthma medications</li> </ul> Repeated ER presentation/hospitalization for asthma	<ul style="list-style-type: none"> <li>▶ CBC: high WBC with neutrophilia could be stress or asthma medications effect</li> <li>▶ Chest radiograph: rule out pneumothorax, pneumonia, or aspiration of foreign body</li> <li>▶ Blood gases: Normal/high CO<sub>2</sub> may indicate worsening asthma exacerbation</li> <li>▶ Lactate: Metabolic acidosis with high lactate may occur following B2 agonist treatment</li> </ul>
<ul style="list-style-type: none"> <li>▶ Poor compliance with asthma medications (Caution: 25% of serious asthma present as 1st attack, &amp; up to 75% of mortalities as not known as bad asthma)</li> </ul>	

If failing to responds to above (Status Asthmaticus)	IV fluids
<ul style="list-style-type: none"> <li>▶ Notify PICU</li> <li>▶ Continuous short acting beta agonist</li> </ul> Nebulized Albuterol (Salbutamol): 0.5 mg/kg/hr through an infusion pump to deliver at the desired rate to the nebulizing chamber. (e.g. 5 mg/ Kg body weight of Ventolin mixed with 200ml 0.9% saline to run at rate of 20 ml/hr as nebulizer)	<ul style="list-style-type: none"> <li>▶ Fluid boluses if in shock (follow PALS guidelines)</li> <li>▶ IV maintenance D5 0.9% Saline if not in shock (patients are usually dehydrated due to poor oral intake and increased insensible fluid losses)</li> <li>▶ Avoid overhydrating as this may precipitate pulmonary edema.</li> <li>▶ Add KCl 20 mmol/L post 1st void and if K &lt;5 mmol/L</li> </ul>
If not available, continue back-to-back Salbutamol at the same dose above	
<ul style="list-style-type: none"> <li>▶ Ipratropium bromide nebulization 0.5 mg 4-6 hourly for 24 hr</li> <li>▶ May increase methylprednisolone dose to 4 mg/kg/day (divided Q 6 hrs)</li> <li>▶ Consider Magnesium Sulfate 25-50 mg/kg IV over 30 minutes (max 2 gm) (patient should be on monitor, watch for hypotension, apnea)</li> </ul>	

Monitoring: Check Electrolytes every 8-12 hrs  
 Monitor closely serum potassium values, which may decrease because of use of  $\beta_2$  receptor agonists.

**If no adequate response, consider:**

▶ MgSO<sub>4</sub>: 25 to 50 mg/kg/dose infused over 30 min(max 2 g), May repeat every 6 hrs for 24 hrs (consult PICU)

- ▶ Short acting beta agonist, IV infusions:  
 Terbutaline infusion: Loading dose 10 mcg/kg IV over 10 Minutes.  
 Initial infusion: 0.2 mcg/kg/min, increase by 0.1- 0.2 mcg/kg/min every 30 minutes  
 (Maximum dose 10 mcg/kg/min) OR  
 ▶ Salbutamol infusion: Initial 1 mcg/kg/min increase by 1 mcg/kg/min Q 15 minutes if needed (Maximum dose 10 mcg/kg/min)

Monitor:  
 ▶ Heart rate  
 ▶ BP  
 ▶ Arrhythmias  
 ▶ Potassium

Theophylline, usually, is not recommended due to modest effect, difficult monitoring, and narrow toxic to therapeutic window

**Failing to respond:**

<p>Non-invasive ventilation:           Can be used in awake, cooperative patient while awaiting the effect of medical therapy and to avoid intubation.</p>	<p>Invasive mechanical ventilation:  <b>Goals: Maintain oxygenation &amp; Permissive hypercapnia to maintain target PH &gt;7.2</b></p> <p>Intubation: should be done by an experienced physician by rapid sequence intubation.</p> <p>Preferred meds: Ketamine as induction agent with Rocuronium (avoid morphine, atracurium)          Complications (usually from air trapping): hypoxemia, hypotension, pneumothorax, surgical emphysema, and arrest (Prepare IV fluid bolus to support patient BP during intubation).</p>	
<p>Indication for intubation:</p>	<p>▶ Severe hypoxemia</p>	<p>▶ Deteriorating consciousness level</p>
	<p>▶ Respiratory arrest</p>	<p>▶ Fatigue with rising CO<sub>2</sub></p>

For mechanical ventilation settings, please refer to mechanical ventilation guidelines in this booklet.

## Management of Severe traumatic brain injury in Children (with Glasgow Coma Scale (GCS) ≤ 8)

Initial Stabilization	<ul style="list-style-type: none"> <li>▶ Maintain ABC support (as per PALS guidelines) &amp; Keep NPO</li> <li>▶ Continuous cardiopulmonary monitor &amp; pulse oximeter (O2 Sat)</li> <li>▶ Use appropriate size Cervical-Collar</li> </ul>	Early Neurosurgical Consultation
	<p style="text-align: center;"><b>Airway &amp; Breathing</b></p>	<p style="text-align: center;"><b>Investigations</b></p>
	<ul style="list-style-type: none"> <li>▶ Jaw thrust NO head tilt to open the airway (? cervical injury).</li> <li>▶ Secure the airway: Rapid Sequence Intubation (RSI) Suggested meds: Fentanyl &amp; Rocuronium OR Etomidate &amp; Rocuronium</li> <li>▶ Maintain SpO2 &gt; 92% and ≤ 98%.</li> <li>▶ Maintain CO2: 35-40 mmHg</li> </ul>	<ul style="list-style-type: none"> <li>▶ CBC</li> <li>▶ Coagulation (INR, PTT), blood type and cross match</li> <li>▶ Blood gases, Electrolyte, glucose, serum osmolality</li> <li>▶ LFT, urea and creatinine</li> </ul>
	<p style="text-align: center;"><b>Circulation</b></p>	<p style="text-align: center;"><b>Images</b></p>
<p>IV access (IO if three attempt failed) If hypotensive: 20 ml/kg 0.9% Saline, repeat 3 times. Consider inotropes/vasopressors Consider PRBCs transfusion for massive bleeding or if required &gt; 60ml/kg fluid boluses</p>	<ul style="list-style-type: none"> <li>▶ Chest X ray</li> <li>▶ Brain CT</li> <li>▶ Cervical CT scan (Cervical spine clearance by neurosurgery)</li> </ul>	

Standard Brain Protective Therapies	<ul style="list-style-type: none"> <li>▶ Elevate head of bed to 30o, in a midline, neutral position</li> <li>▶ Control Ventilation: Target low normal PaCO2 (35-40 mmHg)</li> <li>▶ Support circulation: Avoid hypotension (± arterial line)</li> <li>▶ Consider inotropes/vasopressors to maintain BP</li> <li>▶ Stress ulcer prophylaxis (e.g. ranitidine, omeprazole)</li> <li>▶ Naso-gastric tube (Oro-Gastric if suspecting basal skull fracture)*</li> <li>▶ IVF 0.9% saline at maintenance (add Dextrose if hypoglycemic)</li> <li>▶ Strict In/Out</li> <li>▶ Start feeding early if no contraindication</li> <li>▶ Avoid constipation (use lactulose)</li> <li>▶ Sodium: Maintain high normal Na (&gt;140)</li> <li>▶ Sedation: Start infusion (e.g. Fentanyl + Midazolam)</li> <li>▶ Pre-suction (or any manipulation) sedation with IV Fentanyl PRN</li> <li>▶ Maintain normal core temperature (Use cooling if needed).</li> <li>▶ Consider neuromuscular blocking if shivering.</li> <li>▶ Consider Seizure prophylaxis (phenytoin).</li> </ul>	DO NOT ALLOW	Acceptable value
		Hypoxemia	O2 Sat >92%
		Hypotension	Normal for age
		Hyperthermia	<37.5°C
		Hyponatremia	Na >140
		Hypo-Hyperglycemia	80-180 mg/dl
		High ICP	<20
		Low CPP**	>50 (>40 infant)
		Laboratory monitoring	
		<p>Blood gases Q 6 hours &amp; PRN Blood glucose Q 6 hours Electrolytes &amp; osmolality Q 6 hours. BUN &amp; Creatinine daily &amp; PRN CBC &amp; coagulation daily &amp; PRN</p>	

<p>If the ICP &gt;20 mmHg for &gt;5 min or for a rapidly rising ICP or patient is having clinical signs suggestive of high ICP (without ICP monitoring):</p> <ul style="list-style-type: none"> <li>▶ Drain CSF from EVD (if inserted) for 2-5 minutes then assess ICP</li> <li>▶ Consider bolus sedation, analgesia and muscle relaxant (do not allow moving/coughing)</li> <li>▶ Hyperventilation temporarily to PaCO<sub>2</sub> 30- 35.</li> <li>▶ Start hyperosmolar therapy:             <ul style="list-style-type: none"> <li>◊ NaCl 3% 5-10 ml/kg over 5-10 mins Q2-6h PRN (Hold if serum osmolality*** &gt;360 mmol/L) OR</li> <li>◊ Mannitol 0.5-1 g/kg over 20 minutes Q2-6h PRN (Hold if Serum osmolality &gt;320 mmol/L, and be cautious with diuretic effect and hypovolemia)</li> </ul> </li> </ul>	<p>Clinical signs suggestive of high ICP (without ICP monitoring):</p> <ul style="list-style-type: none"> <li>▶ Decrease in GCS &gt;2 from baseline</li> <li>▶ New loss of pupil reactivity</li> <li>▶ Development of pupil asymmetry</li> <li>▶ New focal motor deficit</li> <li>▶ Cushing's triad: Hypertension, Bradycardia, abnormal breathing</li> </ul> <ul style="list-style-type: none"> <li>▶ Start management</li> <li>▶ Consult neurosurgery</li> <li>▶ Consider Repeating CT scan at 48 hours and at 5th day to help guide your high ICP management duration</li> </ul>
<p>▶ Persistent elevated ICP (monitored or with clinical signs): Repeat CT scan</p>	
<p>▶ Barbiturate coma: Thiopental or Phenobarbital</p> <p>▶ Neurosurgical consultation for potential decompressive craniectomy.</p>	

\* Base of skull fracture: CSF leak, Blood from the nose, raccoon eye, battle sign

\*\*CPP = MAP - ICP

\*\*\*Osmolality = (Na x 2 + (BUN mg/dl /2.8) + (Glucose mg/dl /18)

## Management of DKA in CHILDREN

<b>RECOGNITION</b>	<b>History:</b>	<b>Clinical findings:</b>	<b>Investigations:</b>	<b>Confirm DKA by:</b>
	<ul style="list-style-type: none"> <li>▶ Polyuria</li> <li>▶ Polydipsia</li> <li>▶ Weight Loss</li> <li>▶ Abdominal Pain</li> <li>▶ Vomiting</li> </ul>	<ul style="list-style-type: none"> <li>▶ Kussmaul Breathing (No wheezing or rhonchi)</li> <li>▶ Lethargy</li> <li>▶ Dehydration</li> <li>▶ Confusion</li> </ul>	<ul style="list-style-type: none"> <li>▶ STAT bedside glucose</li> <li>▶ Blood gases, Electrolytes (Na, K, PO<sub>4</sub>, Cl), Urea, Creatinine &amp; Glucose</li> <li>▶ Urine Ketone/Glucose</li> </ul>	<ul style="list-style-type: none"> <li>▶ Ketonuria</li> <li>▶ Glucose &gt;200mg/dl (11.1 mmol/l)</li> <li>▶ pH &lt;7.30 &amp;/or Bicarbonate &lt;15mmol/L</li> </ul>

<b>1ST HOUR MANAGEMENT</b>	<b>Patient in Shock: start resuscitation</b>	<b>Patient not in Shock</b>
	<ul style="list-style-type: none"> <li>▶ Support airway and breathing (Do not intubate for respiratory distress only)</li> <li>▶ Start 100% O<sub>2</sub></li> <li>▶ 0.9% Saline, 10ml/Kg bolus over 1 hr</li> <li>▶ If hypotensive: 10 ml/kg bolus over 5-10 min (repeat as needed to maintain normal BP)</li> <li>▶ Consider Inotropes with poor response (? Sepsis)</li> <li>▶ Consult PICU URGENTLY</li> <li>Once Stabilized: Go to post 1st hour management</li> </ul>	<p>Start fluid of 0.9% Saline with fluid rate (over one hour):</p> <p>Weight ≤20kg 7ml/kg                      Weight &gt;20kg 5ml/kg</p>
		<b>DO NOT DO LIST</b>
		<b>DO NOT</b> Give Insulin bolus
		<b>DO NOT</b> Give NaHCO <sub>3</sub> (unless in life threatening conditions)
		<b>DO NOT</b> Give Unnecessary Fluid boluses
	<b>DO NOT</b> Give hypotonic fluid (0.225NS, 0.45NS)	
	<b>DO NOT</b> Stop Insulin (unless hypoglycemic on D10%)	
	<b>DO NOT</b> Insert Central Line (unless no line or on inotropes)	

<b>POST 1ST HOUR MANAGEMENT</b>	<b>Lab work (if not done):</b>	<b>Ongoing lab (till resolution)</b>	<b>Monitoring</b>
	<ul style="list-style-type: none"> <li>▶ Lactate</li> <li>▶ CBC/Differential</li> <li>▶ HgA1C</li> <li>▶ Serum osmolality</li> <li>▶ Urine Analysis</li> <li>Cultures (urine &amp; blood) if infection suspected</li> </ul>	<ul style="list-style-type: none"> <li>▶ Blood glucose .....Q1</li> <li>▶ Blood gases.....Q2</li> <li>▶ Serum osmolality, Anion gap &amp; electrolytes.....Q4</li> <li>▶ Urine for ketones, urea &amp; Creatinine .....</li> <li>Q12</li> <li>Decrease frequency if HCO<sub>3</sub> significantly improved</li> </ul>	<ul style="list-style-type: none"> <li>▶ Cardiorespiratory monitoring</li> <li>▶ Hourly neuro-signs (Pupillary reflex and GCS)</li> <li>▶ Hourly vital signs</li> <li>▶ Accurate fluids in &amp; out hourly (patient should stay in positive fluid balance, review Q4 hrs)</li> <li>▶ Total Fluid Intake includes ALL fluids (oral &amp; IV)</li> </ul>

Avoid drop of serum glucose >100mg/dl/hr (5.5 mmol/L/hr) & Avoid drop of effective osmolality >10mmol/L Q4

Fluid Management		Insulin	Potassium
Type of fluid is 0.9% Saline Total Fluid Intake (TFI) according to weight:		<ul style="list-style-type: none"> <li>▶ Mix 50 unit of soluble insulin (Regular) in 50 ml 0.9% saline (Alternatively: mix 50 unit in 500 ml 0.9% saline bag)</li> <li>▶ Insulin fluid volume to be included in the total rehydration calculation when using 500 ml bag</li> <li>▶ 0.1 U/Kg/hr (standard dose)</li> <li>▶ 0.05 U/kg/hr (newly diagnosed or <math>\leq 5</math> Years or recently received insulin injection)</li> </ul>	<ul style="list-style-type: none"> <li>▶ KCl 40mEq/L once patient is voiding (unless K <math>&gt;5.5</math>)</li> <li>▶ Increase KCl to 60mEq/L if serum K <math>&lt;3.5</math> (Repeat K after 2 hours from the change)</li> </ul>
Weight	TFI (ml/kg/hr)		
$\leq 15$ kg	5		
$> 15-35$ kg	4		
$> 35-50$ kg	3		
$> 50$ kg	2		
Dextrose			
<ul style="list-style-type: none"> <li>▶ Add D5 to IVF if serum Glucose <math>&lt;250</math>mg/dl Or with rapid drop of more than 100 mg/dl/hr</li> <li>▶ Add D10 to IVF if serum glucose <math>&lt;180</math>mg/dl</li> </ul>			
Always prepare the next fluid you are going to use			

<b>DKA RESOLUTION</b>	DKA resolves if: pH $>7.30$ , $HCO_3^- >15$ & normal Anion gap (keep in mind hyperchloremic metabolic acidosis: persistent acidosis with normal anion gap)	<b>If acidosis is NOT improving:</b>	
	<b>After resolution:</b>	▶ Recheck the insulin preparation & infusion	
		▶ Consider hyperchloremic acidosis	
		▶ Consider sepsis.	▶ Revise the TFI.
	<ul style="list-style-type: none"> <li>▶ Start oral fluids (do not allow uncontrolled fluid)</li> <li>▶ Start subcutaneous (SC) insulin</li> <li>▶ Stop Insulin infusion 30minutes after SC insulin</li> <li>▶ Start Diabetic diet</li> </ul> If DKA corrected before the usual time of SC insulin, drop IVF to maintenance and drop insulin to 0.02U/Kg/hr & monitor Glucose Q2	<b>Clinical Criteria for Cerebral Edema</b>	
		Headache, Irritability, Decrease LOC, Vomiting, Bradycardia, Hypertension, apnea/irregular breathing, Arrhythmia, Pupillary changes	
<b>Treatment (refer to high ICP management)</b>			
	Secure Airway		
	Neuro-protective measures Neurosurgical consultation	Rule out hypoglycemia Mannitol or 3% Saline IV Head CT	



## Management Guidelines OF Adrenal Crisis IN CHILDREN

Causes		
Primary Adrenal Insufficiency ▶ Usually salt wasting (Hyponatremia, Hyperkalemia) ▶ Hyperpigmentation	Neonatal Presentation (Congenital) ▶ $\pm$ Precocious puberty	Older Children (Acquired) ▶ Autoimmune ▶ Adrenoleukodystrophy
Secondary Adrenal Insufficiency ▶ Pituitary	Congenital ▶ Septo-optic defect	Acquired ▶ Craniopharyngioma ▶ Brain radiation ▶ Prolonged steroid use
Tertiary Adrenal Insufficiency ▶ Hypothalamus		

When to suspect it?		How to confirm it?
<ul style="list-style-type: none"> <li>▶ Volume depletion</li> <li>▶ Hypotension</li> <li>▶ Hypoglycemia</li> <li>▶ Hyponatremia</li> <li>▶ Hyperkalemia</li> </ul>	<ul style="list-style-type: none"> <li>▶ Hyperpigmentation</li> <li>▶ Abdominal pain</li> <li>▶ Fever</li> <li>▶ <math>\pm</math>Precocious puberty</li> </ul>	If the Patient Hemodynamically stable: <ul style="list-style-type: none"> <li>▶ Check Cortisol level baseline</li> <li>▶ Give Cosyntropin (ACTH) 1 mcg IV</li> <li>▶ Repeat Cortisol level after 30 minutes, if Cortisol level is <math>&lt;9</math>mcg/dL this will confirm adrenal insufficiency.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Volume depletion</li> <li>▶ Hypotension</li> <li>▶ Hypoglycemia</li> <li>▶ Hyponatremia</li> <li>▶ Hyperkalemia</li> </ul>	<ul style="list-style-type: none"> <li>▶ Hyperpigmentation</li> <li>▶ Abdominal pain</li> <li>▶ Fever</li> <li>▶ <math>\pm</math>Precocious puberty</li> </ul>	

Management				
Fluid Boluses: ▶ 20ml/kg Dextrose 5% Normal Saline up to 60ml/kg			<ul style="list-style-type: none"> <li>• Never delay the management if adrenal crisis is suspected waiting for the results</li> <li>• Consult pediatric endocrinologist.</li> <li>• If did not improve consider other differential diagnosis.</li> </ul>	
Treat Electrolyte imbalance if: ▶ Hyperkalemia: Refer to guidelines ▶ Hyponatremia: Refer to guidelines				
Steroid (Hydrocortisone) 50mg/m <sup>2</sup> as bolus, then 50mg/m <sup>2</sup> divided Q6hr for 24hr				
Approximate Hydrocortisone Doses				
Infant	10mg	Older Child	50mg	
Toddler	25mg	Adolescence	100mg	

## CLABSI - Central Line Associated Blood Stream Infection

Definition\*: A laboratory-confirmed bloodstream infection (LCBI) where central line (CL) was in place for >2 calendar days on the date of event, with day of device placement being Day 1, AND the line was also in place on the date of event or the day before.

PREVENTION	Insertion Bundle	Daily Care Bundle
	<ul style="list-style-type: none"> <li>▶ Hand hygiene immediately before donning gloves.</li> <li>▶ Using pre-filled central line cart.</li> <li>▶ Full protective equipment:                             <ul style="list-style-type: none"> <li>• Patient covered by long/full body drape.</li> <li>• Processor and assistant: sterile gown, sterile gloves, Mask and head cover</li> </ul> </li> <li>▶ Using Chlorhexidine* 2% with and alcohol 70% prior to prick.</li> <li>▶ Appropriate catheter site selection.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Daily inspection of the catheter.</li> <li>▶ Hand hygiene before palpating the insertion site.</li> <li>▶ Port entry: maintained closed all the time:                             <ul style="list-style-type: none"> <li>• Change cover cap whenever the port is accessed.</li> <li>• Swab the diaphragm of the port with alcohol before using for injection.</li> </ul> </li> <li>▶ CVC revised daily for possibility of removal.</li> <li>▶ Access the CVC by sterile technique.</li> </ul>

\*Use a chlorhexidine based antiseptic for skin preparation in > 2 months & Povidine-iodine for children < 2 months.

Adhere to infection prevention practices at the time of CL insertion and document the compliance with aseptic technique.

Signs of local infections are redness, discharge & pain at the site of insertion

## VAP - Ventilator Associated Pneumonia

Definition\*: A pneumonia which develops while the patient is on mechanical ventilation for >2 calendar days on the date of event (with day of ventilator placement being Day 1), AND the ventilator was in place on the date of event or the day before.

VAP Prevention Strategies	Ventilation Related Strategies
<ul style="list-style-type: none"> <li>▶ Adhere to hand-hygiene guidelines</li> <li>▶ Perform regular oral care with an antiseptic solution (chlorhexidine)</li> <li>▶ Maintain patients in a semi-recumbent position (30-45 degree)</li> <li>▶ Avoid gastric over distention (NG tube)</li> <li>▶ Avoid routine H2 blockers (Ranitidine) and proton pump inhibitors (omeprazole)</li> <li>▶ Maintain sterile technique during suctioning</li> <li>▶ Preferable to use only pre filled saline syringe during suctioning if available</li> </ul>	<ul style="list-style-type: none"> <li>▶ Use non-invasive ventilation whenever possible</li> <li>▶ Minimize the duration of ventilation (daily weaning readiness assessment)</li> <li>▶ Avoid unplanned extubation and re intubation</li> <li>▶ Use a cuffed endotracheal tube with in-line suction</li> <li>▶ Remove condensate from ventilatory circuit regularly (and keep the ventilator circuit closed)</li> <li>▶ Change the ventilatory circuit only when visibly soiled or malfunctioning</li> <li>▶ When open suctioning or disconnecting, ensure that tube will be closed (e.g., directly connected to test lung and avoid touching anywhere in the bed)</li> </ul>

## CAUTI - Catheter-Associated Urinary Tract Infection

Definition\*: A UTI where an indwelling urinary catheter was in place for >2 calendar days on the date of event, with day of device placement being Day 1, AND an indwelling urinary catheter was in place on the date of event or the day before.

	Insertion Bundle	Daily Care Bundle
PREVENTION	<ul style="list-style-type: none"><li>▶ Perform Hand Hygiene immediately before procedure.</li><li>▶ Maintain maximum Aseptic Technique.</li><li>▶ Use pre-prepared set.</li><li>▶ Use the smallest suitable catheter size.</li><li>▶ Competent personnel should do the procedure</li><li>▶ Secure the catheter properly.</li><li>▶ Maintain closed sterile drainage system.</li></ul>	<ul style="list-style-type: none"><li>▶ Daily review of the need for the urinary catheter.</li><li>▶ Keep catheter continuously connected to the drainage system.</li><li>▶ Daily Meatal Hygiene.</li><li>▶ Empty Urinary drainage bags regularly.</li><li>▶ Hand Hygiene before and after manipulating catheters.</li><li>▶ Collection bag kept below level of Bladder at all times.</li><li>▶ Collection bag is not on the floor at any time.</li><li>▶ Catheter secured by appropriate plaster.</li></ul>

Try to use the indwelling urinary catheters only when it is absolutely indicated.  
Remove catheters as soon as possible.

\*Centers for Disease Control and prevention (CDC) def. January 2016.

Note: For proper diagnosis of CLABSI, VAP, and CAUTI, please refer to the diagnostic criteria published and updated in CDC web [site: www.cdc.gov](http://www.cdc.gov)

## Antibiotic Lock Therapy Guidelines

Antibiotic lock therapy has been used in patients with infected but badly needed central venous catheters and can't be replaced easily (e.g. Total Parenteral Nutrition, chemotherapy or dialysis cath).

### Caution:

- ▶ For Catheter Related Blood Stream Infection (CR-BSI), Antibiotic Lock Therapy (ALT) should not be used alone, but in conjunction with systemic antimicrobial therapy.
- ▶ Antibiotic Lock Therapy cannot be used when there are signs of exit site or tunnel infection as catheter salvage is the ultimate goal in this kind of therapy (consult ID service if in doubt).

## Causative organisms:

- ▶ Coagulase Negative Staph is the most common
- ▶ Some gram negatives like E. coli, Klebsiella.
- ▶ Some gram positives like S. Aureus, Enterococcus.

**Indication of Catheter Removal (antibiotic Lock is not recommended)**

- ▶ CRBSI with staph aureus.
- ▶ CRBSI with pseudomonas, fungi or microbacteria species.
- ▶ Severe sepsis or hemodynamic instability.
- ▶ Persistent bacteremia despite 72 hours of proper antibiotic therapy (organism is susceptible).
- ▶ Complicated catheter infection (endocarditis, thrombophlebitis, and osteomyelitis).
- ▶ Tunnel infections, port abscesses, or exit site infections.

**Standards Antibiotic Lock Solutions Concentration**

Antibiotic	Dwell Times	Final concentration (mg/mL) in Normal Saline	When Heparinized Antibiotic Lock Solution used: Concentration
Vancomycin	24 – 48 hours	5 mg/ml	1000 Heparin (Units/mL)
Cefazolin	24 – 72 hours	5 mg/ml	1000 Heparin (Units/mL)
Ceftazidime	8 – 12 hours	0.5 mg/ml	100 Heparin (Units/mL)
Gentamicin	12 – 24 hours	1 mg/ml	40 mg/mL citrate

**Standards Antibiotic Lock Solutions Volume:**

The final stock solution volume should be based on the length of the catheter but usually not more than 3mL

Duration of Therapy: Usually 7-14 days

**Precautions:**

- ▶ Hemodialysis Catheter: Lock solution to be renewed after every dialysis session.
- ▶ Heparin solution should be withdrawn and discarded at completion of dwell time and prior to initiating infusion or drawing blood.

## Guidelines for Empirical Antimicrobial Therapy in Children

Common problem with prescribing antimicrobial to children:

- Unnecessary administration of antimicrobials in viral illnesses
- Inappropriate choice of empiric antibiotics
- Lack of awareness of susceptibility patterns of common pathogens
- Continuation of empiric therapy despite negative cultures in stable patients

Over prescribing can lead to:

- Emergence of resistant bacteria
- Super infection with opportunistic fungi
- Increase the likelihood of adverse drug reaction.
- Increases in the cost of healthcare

The following point should be considered when you apply these guidelines:

- Change to specific therapy based on culture/sensitivity results and patient's clinical condition.
- In case of  $\beta$ -Lactam severe allergy, consult clinical pharmacist or consult ID service for alternative.
- Refer to formulary for Dosing of Antimicrobials and obtain cultures prior to starting antibiotics.
- These guidelines will serve sick patient who requires admission and treatment as inpatients.
- Special consideration will be given to unstable critically ill child (see below)

CENTRAL NERVOUS SYSTEM			
Indication	Suspected Pathogens	Antimicrobials of Choice	Alternatives/Comments
<b>Meningitis</b>			
Neonate (up to 4 wks)	Gr B Streptococcus, Gram negative Enteric Bacilli, Listeria	IV Ampicillin + IV Cefotaxime	
4 weeks – 3 months	Same as Neonates and Older Children	IV Ampicillin + IV Cefotaxime	Add Vancomycin in severely ill patients
Older Children	S. pneumoniae, N. meningitides, H. influenzae	IV Ceftriaxone + IV Vancomycin	De-escalate according to sensitivity

Encephalitis	Herpes Simplex Virus	IV Acyclovir	
If meningoencephalitis is suspected, refer to empiric antibiotics for Meningitis. Ensure sending HSV and other viruses PCR from CSF Samples			
V – P Shunt Related Infection	Coagulase-negative Staphylococci, Enteric gram negative bacilli	IV Vancomycin + IV Ceftazidime	Consider covering previous shunt infection pathogens (if known)

Blood Stream Infections (Excluding Meningitis)			
Indication	Suspected Pathogens	Antimicrobials of Choice	Alternatives/Comments
Septicemia or Bacteremia			
Neonates	Gr B Streptococcus, Gram negative Enteric Bacilli, Listeria, Enterococcus	IV Ampicillin + IV Gentamicin	
1 – 3 months	Same as Neonates and Older Children	IV Ampicillin + IV Cefotaxime	Add Vancomycin in very ill Patient
> 3 months	S. pneumoniae, Meningococcus H. influenza, E. coli ± S. aureus	IV Ceftriaxone	Add Vancomycin in very ill patient.
> 48 hours of Hospitalization	Consider hospital acquired like: P. aeruginosa, klebsiella pneumonia, staph aureus	IV Piperacillin-Tazobactam or Meropenem* + IV Vancomycin	Consider adding aminoglycoside in critically ill patient
Sickle Cell Disease with sepsis	S. pneumoniae, H. influenzae Salmonella	IV Ceftriaxone + IV Vancomycin	For β-Lactam Allergy: Clindamycin + Ciprofloxacin
Catheter-Related BSI	S. aureus, CONS, enteric gram-negative bacilli, Plus P. Aeruginosa and MDR Gram negative bacteria in immunocompromised patient.	Vancomycin + Ceftazidime	IV Vancomycin + IV Cefepime
		Add aminoglycosides in severely ill patients and/or immunocompromised patients.	

\*Consider the choice based on your own hospital organisms susceptibility patterns and antibiogram

\*\*Add clindamycin for suspected cases of toxic shock syndrome

RESPIRATORY SYSTEM			
Indication	Suspected Pathogens	Antimicrobial of Choice	Alternatives/ Comments
<b>Pneumonia</b>			
Neonates	Group B Streptococcus, Gram negative Enteric Bacilli, Listeria	IV Ampicillin + IV Gentamicin	
<b>Community – Acquired Pneumonia</b>			
1 – 3 months	S. pneumoniae, C. trachomatis, B. pertussis, S. aureus, H. influenzae	IV Cefotaxime ± Macrolides (e.g. clarithromycin)	Obtain a viral NPA and consider Adding Oseltimavir.
3 months – 14 years			
Immunized	S. Pneumoniae, mycoplasma, staph aureus	IV Ampicillin ± Macrolides	IV Augmentin
Non-immunized	S. Pneumoniae, H. influenzae, Mycoplasma. P, S. Aureus,	IV Cefuroxime ± Macrolides	
Aspiration pneumonia	Anaerobes ± enteric gram negative	IV Augmentin	IV Clindamycin
<b>Complicated Pneumonia</b>			
Necrotizing pneumonia Para pneumonic effusion Empyema Pneumatocele Lung abscess.	S. pneumoniae, S. aureus, H. influenzae, S. pyogenes, C. pneumoniae, M.pneumoniae	IV Ceftriaxone + IV Clindamycin ± Macrolides	Consider IV Vancomycin + Piperacillin-Tazobactam ± Macrolides for sick PICU patient
<b>Healthcare Associated Pneumonia</b>			
Ventilated patient	Gram negative bacilli including P. aeruginosa, anaerobes, staph aureus	IV Piperacillin/ Tazobactam* ±IV Vancomycin ± IV Aminoglycosides	Cefepime + Clindamycin. (Add aminoglycoside if patient colonized with MDR organisms).
Not ventilated	Gram neg. bacilli Staph aureus	IV Piperacillin/ Tazobactam ±IV Vancomycin	

\*Consider the choice based on your own hospital organisms susceptibility patterns and antibiogram

SKIN & SOFT TISSUE INFECTIONS			
Indication	Suspected Pathogens	Antimicrobial of Choice	Alternatives/Comments
Cellulitis	S. aureus, Gr A Streptococcus	IV Cloxacillin or Cefazolin	IV Clindamycin
Necrotizing Fasciitis	Gr A streptococcus, S. aureus, Polymicrobial, Clostridium spp.	IV Clindamycin + IV Cloxacillin	Consult ID on all cases consult Pediatric Surgery

GASTROINTESTINAL SYSTEM			
Indication	Suspected Pathogens	Antimicrobial of Choice	Alternatives/Comments
<b>Enterocolitis</b>			
Neonates (NEC)	Enteric gram negative bacilli, Enterococcus spp., anaerobes	IV Ampicillin + IV Gentamicin ± Metronidazole	
C. Difficile – Associated	Clostridium. Difficile	Stop offending antibiotic + PO Metronidazole	PO Vancomycin NPO: IV Metronidazole
<b>Peritonitis</b>			
Primary (spontaneous)	Strep. Pneumoniae, Gram negative bacilli	IV Ceftriaxone	
Secondary (i.e. post perforation)	Gram negative bacilli, anaerobes	IV Ampicillin + Gentamycin + Metronidazole	Consult ID

URINARY SYSTEM			
Indication	Suspected Pathogens	Antimicrobial of Choice	Alternatives/Comments
UTI	E. coli, Proteus spp.	IV Ceftriaxone	Amikacin if ESBL suspected
Hospital Acquired (CA-UTI)	Gram negatives & gram Positives	Vancomycin & Piperacillin/Tazobactam	As per antimicrobial sensitivity testing

Febrile neutropenic child need special consideration. Refer to specific guidelines or consult ID service.  
De – escalate to narrower spectrum antimicrobial as soon as susceptibility profile is available



## Nutrition IN picu

### Energy and protein requirements for critically ill infants and children

Age (in years)	Energy Kcal/kg/d	Energy Kcals/kg/d	Protein g/kg/d	Protein g/kg/d
	Acute Phase (BMR**/paralysis/sedation)	DRI* (BMR/activity/new tissue)	DRI*	injury
<1	55-45	107-79	1.5	3.0-2.0
1-3	55-40	89-79	1.05	2.0-1.5
4-6	50-40	81-62	0.95	2.0-1.5
7-10	40-35	60-45	0.95	2.0-1.5
11-18	35-25	47-30	0.85	2.0-1.5

\* DRI: Dietary Reference Intakes

\*\* BMR: Basal Metabolic Rate

- Acute phase energy requirements reflect BMR, but maybe increased x 1.3-1.6 stress factor.
- Energy needs vary greatly especially during an acute phase of illness.

### Total Energy Expenditure (TEE)

- The next step in determining a patient's energy/caloric needs is to calculate the total energy expenditure.
- Surgery, infection, trauma or other stresses to the body add to energy requirements, as does physical activity:
- TEE (kcal/day) = BEE x stress/activity factor. (BEE: Basal Energy Expenditure)

Stress or activity level	Stress Factor	Stress or activity level	Stress Factor	Stress or activity level	Stress Factor
Bed rest	1.1	Infection	1.3	Major trauma	1.7
Minor surgery	1.1 - 1.3	Fracture	1.3	Sepsis	1.7 - 1.9
Ambulatory	1.3	Major surgery	1.5	Burns	1.9 - 2.1

### Suggested guidelines for initiation rate and advancement of enteral nutrition

Weight	Initiation rate	Advancement rate
<10 kg	Start at 1ml/kg/hr	Increase by 0.5 ml/kg every 4 hrs
>10 kg	Start at 0.5 ml/kg/hr	Increase by 0.5 ml/kg every 4 hrs

Common Formulas Available

**INFANT FORMULA: From 0 to 1y.o**

CATEGORY	FORMULA ( Examples not limited to)	ENERGY kcal/mL	Standard preparation for powder formula Scope/ml water
Cow's Milk Based : Premature	Prenan	0.8	1scope/30ml
Cow's Milk based	Similac Advance, s-26	0.68	1scope/60ml
	Nan,ronalac		1scope/30ml
Soy Based	Isomil	0.68	1scope/60ml
Lactose free	Plemil plus LF, Al110	0.67	1scope/30ml
High calorie Milk above 5kg	infantrini	1	liquid
Protein & Fat Malabsorption Semielemntal formula	Neocate (free amino acid)	0.68	1scope/30ml
Fat Malabsorption high in MCT Oil	Monogen	0.74	1scope/30ml

**PEDIATRIC FORMULAS 1-10 years (or above 7Kg)**

CATEGORY	FORMULA (Examples not limited to)	ENERGY kcal/mL	Standard preparation for powder formula
Cow's Milk Based : Standard (oral or tube)	Pediasure Resurse junior	1	liquid
Malabsorption semielemntal	Peptamin Jr.	1	1scope/30ml
Malabsorption	Peptamin	1	1scope/30ml
Age > 4 y.o	Cow's Milk Based Fortisip	1	liquid
Above 10 yr.	Cow's Milk Based Ensure	1	liquid

**Modules to be added to the formula as needed**

CATEGORY	FORMULA ( Examples not limited to)	ENERGY kcal/mL	Standard preparation for powder formula Scope/ml water
Protein	Beneprotein	3.6 kcal/g 0.9 protein/g	As Pt. needs
Fat	Corn Oil MCT Oil	8.13 kcal/mL 7.7 kcal/mL	Min.1ml/100ml Max.4ml/100ml
Carbohydrate	Polycose Fantomalt	3.8 kcal/g 0.94 g CHO/g	As Pt. needs
Fat & carbohydrate	Doucal	4.9 kcal/g 0.73 g CHO/g 0.22 g Fat/g	As Pt. needs

## Renal formula

CATEGORY		FORMULA (Examples not limited to)	ENERGY kcal/mL	Standard preparation for powder formula
Renal: Low electrolyte (from birth)		Renastart	1.0	1scope/30ml
Age > 4 y.o	Renal high protein (on dialysis)	Nepro HP Renal novasource HDmax	1.8 1.8 1.5	Liquid
	Renal: Lower Protein & low electrolyte (pre dialysis)	Nepro LP	2	Liquid

### Cautions:

- ▶ If patient is admitted on any special formula designed for special cases other than standard formulas please refer to dietician for further assistance.
- ▶ NB: Infantrini should be used with caution in those < 5 kg.

### Metabolic Formula Composition Table: Values given are per 1 gm unless otherwise indicated.

Formula	Age	Indication	Kcal	Protein (g/100)	Fat (g/100)	Na (mg)	K (mg)	Phos (mg)	Calo	Notes
<b>Phenex-1</b> Powder (Abbott)	Infants & Toddlers	PKU	4.80	0.13	0.33	0.217	1.90	6.75	4.00	PHF free
<b>Phenex-2</b> Powder (Abbott)	Children & Adults	PKU	4.10	0.30	0.31	0.14	8.00	13.70	7.60	PHF free
<b>Ketona-1</b> Powder (Abbott)	Infants & Toddlers	MCTD	4.80	0.13	0.33	0.217	1.90	6.75	4.00	K.E., LEU, NVL free
<b>Cyclina-1</b> Powder (Abbott)	Infants & Toddlers	Ornithine transcarbamoylase deficiency (OTCD)	4.40	0.075	0.17	0.286	2.14	7.60	4.31	Non-Essential A.A. free
<b>Glutara-2</b> Powder (Abbott)	Children & Adults	For GA Type 1	4.10	0.30	0.31	0.11	8.00	13.70	7.60	LYS & TRY free
<b>Tyros-1</b> Powder (Abbott)	Infants & Toddlers	For Tyrosinemia Type I, R, III	4.80	0.13	0.33	0.217	1.90	6.75	4.00	PHF & TYR free
<b>L-Vites-2</b> Powder (Abbott)	Children & Adults	For Lactose intolerance	4.10	0.30	0.31	0.11	8.00	13.70	7.60	LEU free
<b>ProZare</b> (and Liquid/Vialts)	From 6 months of age	A milk replacement	0.47	0	0.001	0.038	0.41	0.02	0	Protein free Contains lactose 200mg/100g
<b>Humana-2</b> Powder (Abbott)	Children & Adults	Hemocromatosis	4.10	0.30	0.31	0.14	8.0	13.7	7.60	CYS MET free
<b>Protonex-1</b> Powder (Abbott)	Children & Adults	MMA/PA	4.10	0.30	0.31	0.11	8.0	13.70	7.60	E.E., MET, VAL, THR and OCA free
<b>Med 97</b> (milk)	From 1 year	MCTD	3.38	0.417	0.429	0.0005	3.79	8.36	8.23	1,600kcal = 100g CV free

## Pediatric NON-INVASIVE POSITIVE-PRESSURE VENTILATION

**NPPV can augment oxygenation and ventilation without insertion of an artificial airway**

### Continuous Positive Airway Pressure

- CPAP increases the baseline system pressure (higher than atmospheric pressure) during spontaneous breathing, thus preventing collapse of distal small airways and alveoli.
- Can be delivered invasively or non-invasively via nasal cannula, mask, tracheostomy, or endotracheal tubes.
- The respiratory rate and tidal volume (VT) are dependent on the patient's inspiratory effort

### BiPAP

- One form of NPPV, bilevel positive airway pressure, augments ventilation by delivering pressurized air through a facial or nasal mask, nasal pillows, total face mask and nasopharyngeal ET tube.
- Both the nasal mask and the face mask must be tight fitting to avoid leakage.

### Indications:

- NPPV found helpful in patients with:
  - Asthma
  - Chronic obstructive lung disease
  - Neuromuscular disorders
  - Obstructive sleep apnea
  - Cystic fibrosis
  - Upper airway obstruction
  - Thoracic dysplasia.
- A means to avoid intubation in patient with mild to moderate acute respiratory insufficiency
- In post extubations cases that is difficult to wean

### Clinical Signs of Improvement

- NPPV can significantly improve:
    - Respiratory rate
    - Heart rate
    - Work of breathing
- Decrease O<sub>2</sub> requirement

Signs of improvement or response which usually are seen within 2 hrs of trial

NPPV has been especially useful in previously health children with respiratory embarrassment due to muscle deconditioning following prolonged intubation.

### Contra-indications:

- NPPV is contraindicated in patients with:
  - Rapidly progressive respiratory failure
  - Hemodynamic instability
  - Significant risk of aspiration
  - Loss of protective airway reflexes or inability to clear copious oro-pharyngeal secretions
  - Inability to properly fit the mask (e.g. facial trauma)

### Special Considerations (sedation use):

- NPPV respiratory support requires the patient's cooperation, including a willingness to tolerate little or no sedation.
- Sedation may be used in some patients to enhance cooperation (e.g., midazolam, ketamine).

Initial setting	
Age	Initial Setting
Infants <12 months	Nasal CPAP should be attempted first. If CPAP does not provide adequate support, tracheal intubation is usually indicated.
Toddlers 1-2 years	Ppeak: 8cm H2O; PEEP: 4cm H2O; FIO2: 1.0; ± backup rate appropriate for age and disease
Children >2 years	Ppeak: 10cm H2O; PEEP: 5cm H2O; FIO2: 1.0; ± backup rate appropriate for age and disease

*Ppeak: peak inspiratory pressure; PEEP: positive end-expiratory pressure; FIO2: Fraction of Inspired O2.*

#### Maximum settings & signs of failure of NIV

- Effective delivery relies at least in part on the adequacy of the seal rather than the settings.
- Signs of failure of NIV: If a Ppeak >18-20cm H2O and PEEP >12-15cm H2O can be tolerated but does not decrease work of breathing or improve oxygenation sufficiency within 2-4 hrs, or if respiratory insufficiency is not improved, tracheal intubation is usually indicated.

#### Modes of NPPV:

Spontaneous	The patient triggers the inspiratory and expiratory pressure cycles and the rate and depth of breathing.
Spontaneous/timed positive pressure:	Similar to the spontaneous mode, but machine breaths are delivered at a set frequency for patients who may be intermittently apneic.
Timed positive pressure:	Breaths are delivered at a set frequency, but the patient can still breathe spontaneously.
CPAP	A baseline system pressure is provided (usually 4 to 8cm H2O for children), but respiratory drive and effort must be maintained by the patient.

*Note: Appropriate setting are based on the nature and severity of the patient's respiratory insufficiency.*

*A word of caution: machines are often insufficiently sensitive to the respiratory efforts of small patients.*

Advantages	disadvantages
<ul style="list-style-type: none"> <li>• Decreased laryngeal trauma</li> <li>• Decreased risk of ventilator-associated pneumonia or tracheitis</li> <li>• Decreased the need for sedation and analgesia.</li> <li>• The patient can talk, cough, cooperate with pulmonary toilet, and sip clear liquids (if a nasal mask is utilized)</li> </ul>	<ul style="list-style-type: none"> <li>• The risk of skin breakdown over the nasal bridge</li> <li>• An increased risk of aspiration due to gastric distention.</li> <li>• Restriction of activity is often needed to maintain optimal mask placement. (Masks may not fit tightly and may not provide effective ventilation, particularly in small patients).</li> <li>• Tracheal suctioning requires mask removal, which can lead to respiratory decompression.</li> </ul>

## PEDIATRIC Invasive MECHANICAL VENTILATION

### Mechanical Ventilation Goals:

- ▶ Support Oxygenations (O<sub>2</sub>)
- ▶ Support Ventilation (CO<sub>2</sub>)
- ▶ Decrease Work of Breathing (WOB)
- ▶ Patient comfort and synchrony

### Avoid:

- ▶ Barotrauma (plateau pressure > 30)
- ▶ Volutrauma (tidal volume > 10-12 ml/kg)
- ▶ O<sub>2</sub> toxicity (FI<sub>O2</sub> > 0.5 -0.6)
- ▶ Atelec-trauma (stretching lung adjacent to atelectasis)
- ▶ Auto PEEP (air-trapping)

Please, ventilate gently and safely  
Normal values are not the ultimate goals in most PICU patients

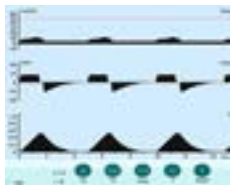
## Modes of Conventional Ventilation

### Assist Control (AC):

It is a mode in which the ventilator provides a breath at:

- ▶ pre-set tidal volume- V<sub>t</sub> (in volume control mode) or
- ▶ pre-set pressure-PIP (in pressure control mode)
- ▶ pre-set inspiratory time (T<sub>i</sub>) in response to patient-initiated effort (patient trigger).
- ▶ pre-set volume/pressure at a pre-set frequency if patient does not trigger (time trigger).

It is good starting mode in general but not for weaning.

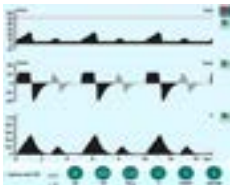


### Synchronized Intermittent Mandatory Ventilation (SIMV):

It is a mode of ventilation in which the patient can spontaneously breathe and in addition, receives a number of mandatory mechanical breaths with a pre-set V<sub>t</sub> (or PIP), T<sub>i</sub> and rate.

- ▶ Synchronization (SIMV) helps in keeping the mandatory breath in harmony with patient efforts.
- ▶ The ventilator delivers a pre-set volume/pressure at a pre-set frequency (IMV rate) with pre-set inspiratory time if patient does not trigger (time trigger).

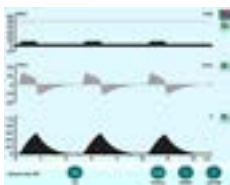
A reasonable starting mode and It is good for weaning (interactive) and can be combined with Pressure Support mode.



### Pressure Support Mode:

This is a spontaneous mode of positive pressure ventilation in which the ventilator delivers a pre-set pressure using a decelerating flow pattern and the patient determines his own inspiratory time and frequency.

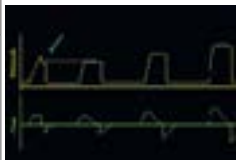
- ▶ No back-up rate (apnea risk).
- ▶ PS is provided to counteract the ETT resistance and to assist patient efforts
- ▶ Spontaneous Breathing Trial (SBT) used before extubation is usually done using this mode.



### Pressure Regulated Volume Control

The most widely used mode in many PICUs as starting mode.

- ▶ It delivers the set tidal volume with decelerating flow pattern that decrease the pressure required to achieve the target  $V_t$ .
- ▶ During PRVC, the pressure and volume are regulated. Thus, all breaths are volume targeted, with pressure adjusted to reach that volume target.
- ▶ The ventilator gives several initial breaths at varying  $V_T$ s that increase incrementally up to the set value.
- ▶ From this information, the ventilator computes the pressure target required to deliver the desired  $V_T$ . Depending on the respiratory system compliance and resistance, the pressure associated with the tidal breath can vary over time.
- ▶ This mode can be used as standalone Assist Control or as SIMV-PRVC mode (with PS).



*This mode can be named differently by different companies (e.g., +autoflow)*

### How to Initiate MV in PICU

There is no one optimal mode of ventilation for any particular disease state or one single optimal method of weaning from MV but these guidelines would work if properly followed in most cases.

Understand pathophysiology to make smart choices and decide 1st what you want to achieve

- ▶ Choose the mode (AC or SIMV) based on patient condition and desired goals (need full control vs interactive setting)
- ▶ Choose volume control, pressure control, or PRVC.

### Recommended Initial Settings:

Tidal volume ( $V_t$ )	6 – 8cc/kg (per ideal body weight, IBW*)
Frequency	30 – 40/min for infants, 20 – 30 for toddlers, 12 – 20 for older
$FIO_2$	1.0 (100%) and fast weaning to keep saturation >93%
Inspiratory time ( $T_I$ ) (keep I:E ratio of 1:2 to 1:3)	0.3 – 0.6 sec in infants 0.6 – 1 sec in children 1 – 1.5 sec in adolescent
PS (with SIMV)	6 – 12 cm H <sub>2</sub> O (smaller ET tube à larger PS, for example use 12 cm H <sub>2</sub> O PS for 3 mm ETT, use 6 for 6 mm ETT)

### Modify the settings according to disease process & subsequent blood gases

\*IBW: Estimated using growth chart (based on patient height)

Special Consideration:	
ARDS (and similar lung parenchyma diseases)	Asthma (And Similar Obstructive Diseases)
<ul style="list-style-type: none"> <li>▶ Improve oxygenation by lung recruitment and protective lung strategy (high PEEP with low Vt)</li> <li>▶ Tidal volume 4 – 6 ml/kg (keep plateau pressure &lt; 30)</li> <li>▶ PEEP increment up to 10 – 15 (maybe higher with caution) with high FIO2 requirement (&gt; 50%)</li> <li>▶ Use high Mean Airway Pressure (MAP) using longer TI</li> <li>▶ Could use inverse I:E ratio 1:1 or 2:1 (+deep sedation)</li> <li>▶ Permissive hypercapnia (keep pH ≥ 7.2)</li> <li>▶ High respiratory rate without air trapping (with low Vt)</li> </ul>	<ul style="list-style-type: none"> <li>▶ Slow rate (below physiologic)</li> <li>▶ Long expiratory time (1:4 – 1:5 I:E ratio)</li> <li>▶ Watch for air-trapping (sedate deeply/paralyze in refractory cases with air trapping caused by triggering patient)</li> <li>▶ Accept higher CO2 (Permissive hypercapnia).</li> <li>▶ High PIP is temporarily acceptable (35 – 40) as long as the plateau pressure is &lt; 30CmH2O</li> </ul>

Useful Respiratory Equations	
Minute Ventilation:	$VE = \text{Respiratory rate} \times \text{Tidal volume}$
Alveolar-arterial gradient:	$A-a \text{ gradient} = PAO_2 - PaO_2$
Partial Alveolar O2 pressure:	$PAO_2 = FiO_2 (PB^* - 47) - 1.2 (PaCO_2)$ *PB = Barometric Pressure
Oxygen Content	$CaO_2: CaO_2 = SaO_2 \times 1.34 \times Hb$
O2 extraction	$= (CaO_2 - CvO_2 / CaO_2) \times 100$
Oxygen Index:	$OI = FiO_2 \times MAP \times 100 / PaO_2$
Common hypoxemia Index	$PaO_2 / FiO_2 (< 300 \text{ in ARDS})$



# Pediatric High Frequency Oscillatory Ventilation

## HFOV General Principles

- A continuous positive pressure system with piston displacement of gas & active exhalation
- Tidal volume delivered is less than anatomic dead space (1-3 ml/kg)
- Rates of 180 – 900 breaths per minute (3-15 Hertz)
- Lower inspiratory pressures as compared to Conventional ventilation (prevents barotrauma and volutrauma)

### Main Indication:

Inadequate oxygenation that cannot be safely treated without potentially toxic ventilator settings with high risk of Ventilator Associated Lung Injury that can be defined by:

- Peak inspiratory pressure (PIP) > 30-35 cm H<sub>2</sub>O
- FiO<sub>2</sub> > 0.60 with inability to wean it
- Mean airway pressure (Paw) > 15-20 cm H<sub>2</sub>O
- Peak End Expiratory Pressure (PEEP) > 10-15 cm H<sub>2</sub>O
- Oxygenation index > 13-15

### Common Uses:

- ARDS/ALI (most common use)
- Air leaks (pneumothorax, PIE)
- Persistent pulmonary hypertension (PPHN)
- Pulmonary hemorrhage
- Congenital diaphragmatic hernia
- Acute chest syndrome (SCD)
- Inadequate alveolar ventilation with respiratory acidosis

## HFOV suggested Settings

MAP/Paw (cmH <sub>2</sub> O)	<ul style="list-style-type: none"> <li>▶ level of pressure held in the lung</li> <li>▶ Supports oxygenation</li> <li>▶ Used to optimize lung volume and, thus, alveolar surface area for gas exchange.</li> <li>▶ Recruit atelectatic alveoli</li> <li>▶ Prevent alveoli from collapsing (de-recruitment)</li> <li>▶ Typically obtain a chest radiograph 1 hour after initiating HFOV then Q12-24 hours.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Initial MAP 2-5 cm higher than on CMV in neonates &amp; 5-8 cm higher in children</li> <li>▶ Monitor degree of lung expansion by CXR</li> <li>▶ diaphragm is at ~T9 on chest radiograph</li> <li>▶ guard against overdistension.</li> <li>▶ Alveolar atelectasis or overdistension can result in high pulmonary vascular resistance</li> <li>▶ For V/Q matching, ensure adequate intravascular volume &amp; cardiac output.</li> </ul>
Power/Amplitude/ $\Delta$ P (cmH <sub>2</sub> O)	<ul style="list-style-type: none"> <li>▶ Volume of gas generated by each wave</li> <li>▶ Inversely proportional to PaCO<sub>2</sub></li> <li>▶ Start amplitude in the 30's and adjust until the "wiggle" extends to the groin.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Adjust in increments of 3 to 5 cm H<sub>2</sub>O</li> <li>▶ Subjectively follow the wiggle</li> <li>▶ Objectively follow PaCO<sub>2</sub></li> </ul>

Frequency (Hertz)	<ul style="list-style-type: none"> <li>▶ number of breaths per second</li> <li>▶ 10 Hz equal to 600 breath/minutes</li> <li>▶ lower Hz = increased tidal volume</li> <li>▶ Start as per table and adjust by 1 at a time if needed</li> </ul>	Suggested starting frequency	
	Inspiratory Time (%):	Set at 33%, 1:2 ratio	Preterm Neonates
Term Neonates			8 to 10 Hz
Children			6 to 8 Hz
		Adult	5 to 6 Hz

Trouble shooting with HFOV	Pitfalls with HFOV
<b>Hypoxemia</b>	<b>Suctioning should be done to ensure the ETT remains patent</b>
<ul style="list-style-type: none"> <li>▶ Adjust FIO2</li> <li>▶ Increase MAP (diaphragm T9 on CXR)</li> <li>▶ Avoid overdistension (check CXRay)</li> <li>▶ Avoid hypovolemia/hypotension</li> </ul>	<p>Frequency: every 12 to 24 hours and PRN. When?</p> <ul style="list-style-type: none"> <li>▶ Decreased/absent wiggle</li> <li>▶ Decrease in SpO2</li> <li>▶ Increase in CO2 level</li> </ul> <p>Avoid/minimize disconnect to suction (de-recruitment occurs quickly).</p> <p>De-recruitment may be minimized with closed suction system.</p> <p>Consider a sustained inflation recruitment maneuver post suctioning.</p>
<b>Hypercarbia</b>	<b>Sedation:</b>
<ul style="list-style-type: none"> <li>▶ Suction Pt using inline suction</li> <li>▶ Increase POWER to increase ventilation</li> <li>▶ Decrease Frequency to increase tidal volume</li> <li>▶ Deflate cuff in ETT</li> <li>▶ Monitor for a loss in Paw with the airleak created by deflating the cuff</li> <li>▶ Increase Bias Flow to 30-40 L/min</li> </ul>	<p>Deeper sedation may be required.</p> <p>Neuromuscular blockade can be used in difficult/sensitive cases.</p>
	<b>Complications of HFOV</b>
	<p>Hypotension secondary to decreased venous return</p> <p>Pneumothorax</p> <p>ETT Obstruction from suboptimal mucus clearance</p>

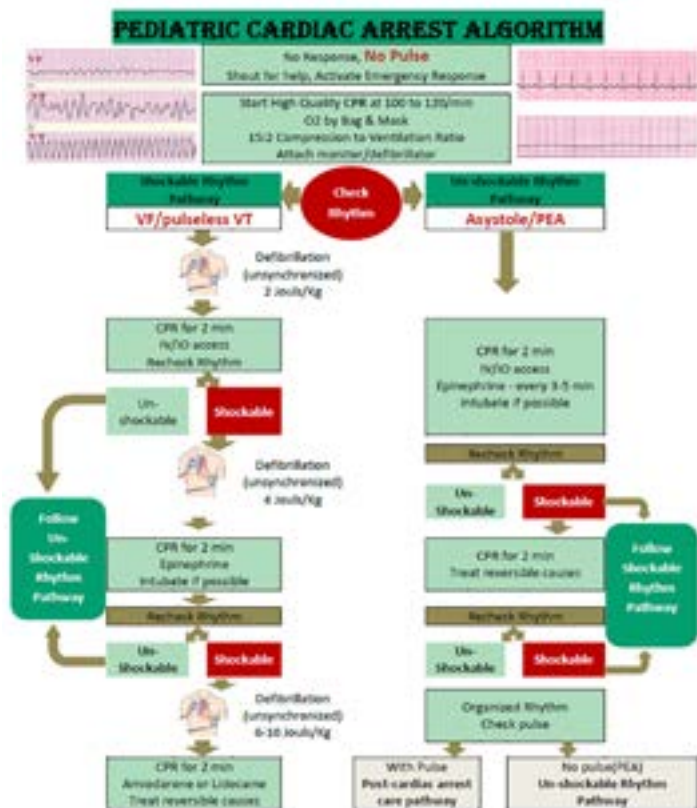
Remember, the goal is not to achieve 'normal' PaCO2 and pH, but to minimize VALI.

## Blood Products Transfusion

Blood Product	Receiver	Donor
Packed RBC and Whole Blood	A	A, O
	B	B, O
	O	O
	AB	AB, A, B, O
	Rh-	Rh-
	Rh+	Rh+ or Rh-
Plasma or Platelet	A	A, AB
	B	B, AB
	AB	AB
Platelet	Rh+	Rh+ or Rh-
	Rh-	Rh- or Rh +*
*Give as an anti - D vaccine if the receiver is Rh-and the platelet concentration is Rh+		

Blood Component	Dose
pRBCs	10 – 20ml/kg over 3 – 4 hours
Platelet	10ml/kg over 30 min
FFP	10 – 20ml/kg over 1 hour
Cryoprecipitate	5ml/kg over 30 min

## Pediatric Cardiac Arrest Algorithm



Rotate compressor every 2 minutes	Reversible Causes
<ul style="list-style-type: none"> <li>▶ With bag &amp; mask give 15:2 Compression to Ventilation Ratio</li> <li>▶ With advanced airway give 8-10 breath per minutes (continuous chest compression)</li> <li>▶ Give epinephrine every 3-5 min</li> <li>▶ Dose: 0.01 mg/kg/dose (0.1 ml/kg/dose for 1:10,000 dilution) 0.1 mg/kg/dose via ETT if no IV/IO access (0.1 ml/kg for 1:1000 dilution)</li> <li>▶ Shock energy dose after 2ed shock 4 J/kg or more (max 10 J/kg till adult dose 200 J)</li> <li>▶ Amiodarone dose: 5 mg/kg IV/IO bolus. (may repeat only once for refractory cases)</li> <li>▶ Lidocaine dose: 1 mg/kg IV/IO bolus</li> </ul>	<ul style="list-style-type: none"> <li>Hypovolemia</li> <li>Hypoxia</li> <li>Hydrogen ion (acidosis)</li> <li>Hypoglycemia</li> <li>Hypo/Hyperkalemia</li> <li>Hypothermia</li> <li>Tension pneumothorax</li> <li>Tamponade, cardiac</li> <li>Toxins</li> <li>Thrombosis, pulmonary</li> <li>Thrombosis, coronary</li> </ul>

## PEDIATRIC TACHYCARDIA WITH A PULSE AND POOR PERFUSION ALGORITHM

### Identify and treat underlying cause

- Maintain patent airway; assist breathing as necessary
- Oxygen
- Cardiac monitor to identify rhythm; monitor BP and extremity
- IO/IV access
- 12-Lead ECG if available; don't delay therapy

### Evaluate QRS duration

**Narrow (<0.09 sec)**

Evaluate rhythm with 12 lead  
ECG or monitor



#### Probable sinus tachycardia

- Compatible history consistent with known cause
- P wave present/normal
- Variable R-R; constant PR
- Infants: rate usually <220/min
- Children: rate usually <180/min

Search for  
and treat cause

#### Probable supraventricular tachycardia

- Compatible history (vague, nonspecific); history of abrupt rate changes
- P wave absent/abnormal
- HR not variable
- Infants: rate usually <220/min
- Children: rate usually <180/min

- Consider vagal maneuvers (No delays)
- if IO/IV access present, give adenosine or
- if IO/IV access not available, or if adenosine ineffective, synchronized cardioversion

**Wide (>0.09 sec)**



#### Possible ventricular tachycardia

#### Cardiorespiratory compromise?

- Hypotension
- Acutely altered mental status
- Signs of shock

**Yes**

Synchronized  
cardioversion

**No**

Consider adenosine  
if rhythm regular  
and QRS  
monomorphic

Expert consultation  
advised:

- Amiodarone or  
Procainamide

### Management Dose/Details

#### Synchronized Cardioversion

- Begin with 0.5-1 J/kg; if not effective, increase to 2 J/kg.
- Sedate if needed, but don't delay cardioversion.

#### Drug Therapy

Adenosine IO/IV: First dose 0.1 mg/kg rapid bolus (maximum 6 mg)  
 Second dose: 0.2 mg/kg rapid bolus (maximum 12 mg)  
 Amiodarone IO/IV dose: 5 mg/kg over 20-60 minutes or  
 Procainamide IO/IV dose: 15 mg/kg over 30-60 minutes  
 Do not routinely administer amiodarone and procainamide together

## PEDIATRIC BRADYCARDIA WITH A PULSE AND POOR PERFUSION ALGORITHM

### Identify and treat underlying cause

- ▶ Maintain patent airway; assist breathing as necessary
- ▶ Cardiac monitor to identify rhythm; monitor BP and axmetry
- ▶ 12-Lead ECG if available, don't delay therapy
- ▶ Oxygen
- ▶ ICU/IV access

### Cardiopulmonary compromise?

- Hypotension
- Acutely altered mental status
- Signs of shock

Yes

CPR if HR < 60/min  
(with poor perfusion despite  
oxygenation and ventilation)

Yes

### Bradycardia persists?

- Epinephrine
- Atropine for increased vagal tone or primary AV block
- Consider transvenous pacing
- Treat underlying cause

No

No

- Support ABCs
- O<sub>2</sub>
- Observe
- Consider expert consultation

**If pulseless arrest develops,  
go to  
Cardiac Arrest Algorithm**

### Drug Doses

**Epinephrine Dose:** 0.01 mg/kg/dose (0.1 mg/kg/dose for 1:100,000 solution) Give every 3-5 min.  
Give 0.1 mg/kg/dose via ETT if no IV/IO access (0.1 mg/kg for 1:1000 solution)

**Atropine Dose:** IV/IO: 0.02 mg/kg

May repeat once. Maximum single dose 0.5 mg

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