

Differentiating Undifferentiated Shock in Kids

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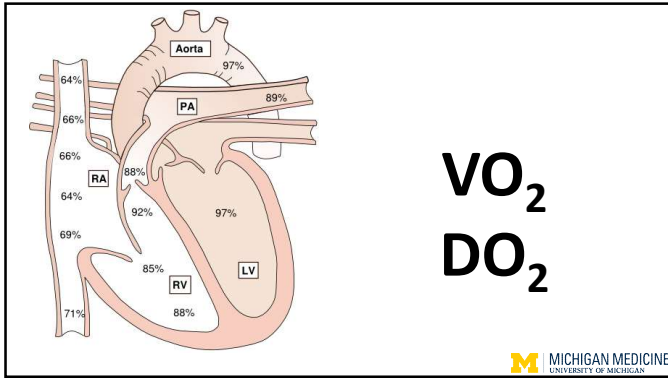
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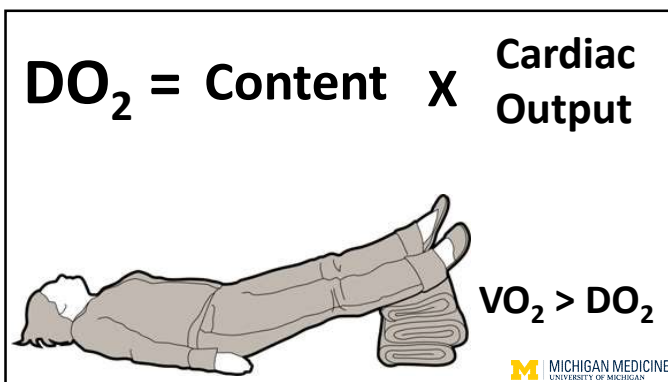


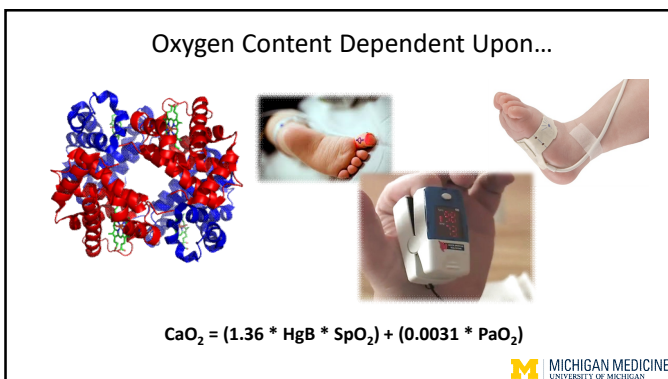
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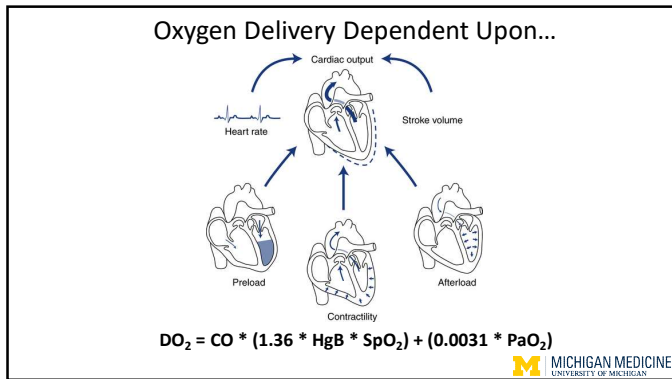
- Understand and differentiate between shock states in children
- Manage a hypo perfused pediatric patient in a systematic manner
- Determine effectiveness of resuscitation utilizing clinical, invasive and less invasive assessment parameters

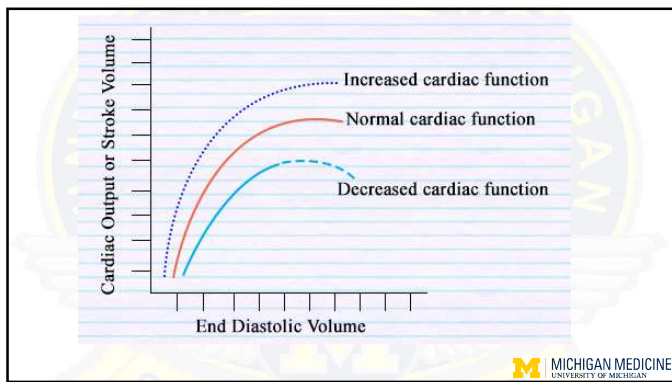


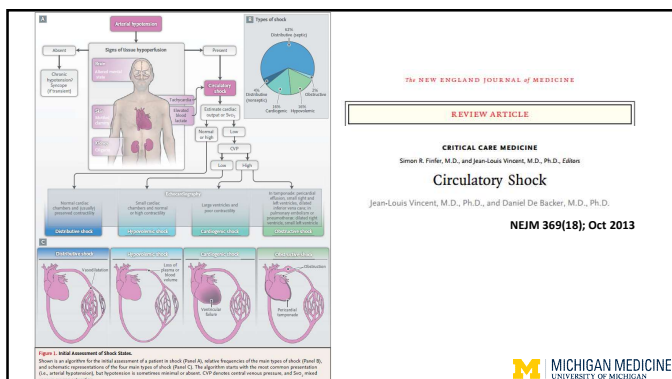


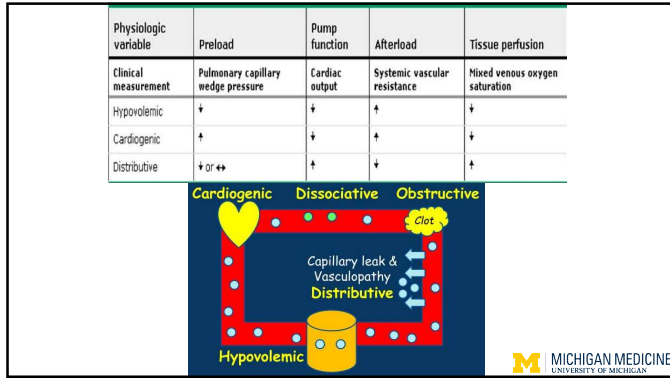


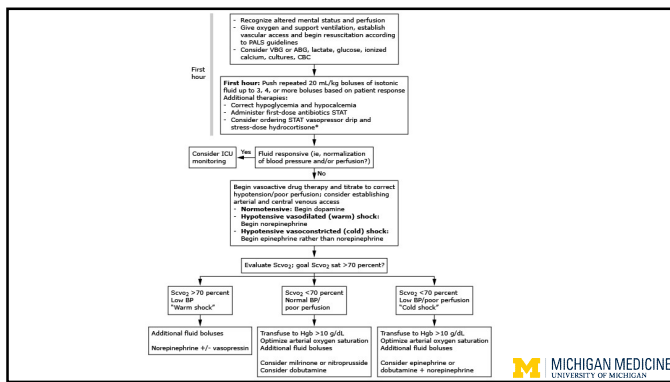


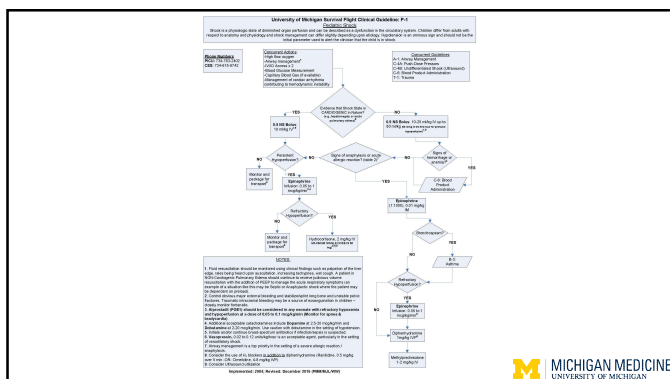


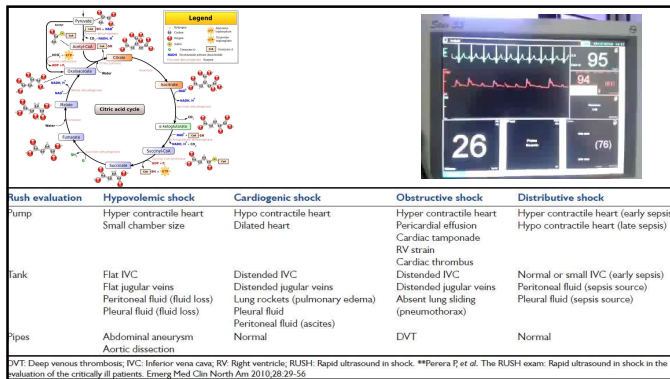












Summary Points...

- Oxygen Delivery / Cellular Respiration
- HPI, Physical Assessment and Diagnostic Studies are ALL Important
- Follow the Guidelines
- Where is your Patient on the Starling Curve?
- Meaningful Reassessment
- Use your Tools



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References Cited

1. Acker, S. N., Ross, J. T., Partrick, D. A., Tong, S., & Bensard, D. D. (2015). Pediatric specific shock index accurately identifies severely injured children. *Journal of pediatric surgery*, 50(2), 331-334.
2. Alqahtani, M. F., Marsillio, L. E., & Rozenfeld, R. A. (2014). A review of biomarkers and physiometers in pediatric sepsis. *Clinical Pediatric Emergency Medicine*, 15(2), 177-184.
3. Cruz, A. T., Perry, A. M., Williams, E. A., Graf, J. M., Wuestner, E. R., & Patel, B. (2011). Implementation of goal-directed therapy for children with suspected sepsis in the emergency department. *Pediatrics*, 127(3), e758-e766.
4. Gallagher, R. A., & Levy, J. A. (2014). Advances in point-of-care ultrasound in pediatric emergency medicine. *Current opinion in pediatrics*, 26(3), 265-271.
5. Goodwin, M., Ito, K., Gupta, A. H., & Rivers, E. P. (2016). Protocolized care for early shock resuscitation. *Current opinion in critical care*, 22(5), 416-423.
6. Fitzgerald, J. C., Weiss, S. L., & Kissoon, N. (2016). 2016 Update for the Rogers' Textbook of Pediatric Intensive Care: Recognition and Initial Management of Shock. *Pediatric Critical Care Medicine*, 17(11), 1073-1079.
7. Maitland, K., Kiguli, S., Opoka, R. O., Engoru, C., Olupot-Olupot, P., Akech, S. O., ... & Brent, B. (2011). Mortality after fluid bolus in African children with severe infection. *New England Journal of Medicine*, 364(26), 2483-2495.
8. Park, D. B., Presley, B. C., Cook, T., & Hayden, G. E. (2015). Point-of-Care Ultrasound for Pediatric Shock. *Pediatric emergency care*, 31(8), 591-598.
9. *Pediatric Advanced Life Support*. Dallas, TX: American Heart Association, ©2016.
10. Rozenfeld, R. A. (2014). Sepsis Guidelines: The Work of the Society of Critical Care Medicine. *Clinical Pediatric Emergency Medicine*, 15(2), 120-122.
11. Shaffner, D. H., & Nichols, D. G. (2015). *Rogers' textbook of pediatric intensive care*. Chapter 28: Shock. Lippincott Williams & Wilkins.
12. Vincent, J. L., & De Backer, D. (2013). Circulatory shock. *New England Journal of Medicine*, 369(18), 1726-1734.
13. Waltzman, M. L. (2015). Pediatric shock. *Journal of Emergency Nursing*, 41(2), 113.



University of Michigan Survival Flight Clinical Guideline: P-1

Pediatric Shock

Shock is a physiologic state of diminished organ perfusion and can be described as a dysfunction in the circulatory system. Children differ from adults with respect to anatomy and physiology and shock management can differ slightly depending upon etiology. Hypotension is an ominous sign and should not be the initial parameter used to alert the clinician that the child is in shock.

Phone Numbers

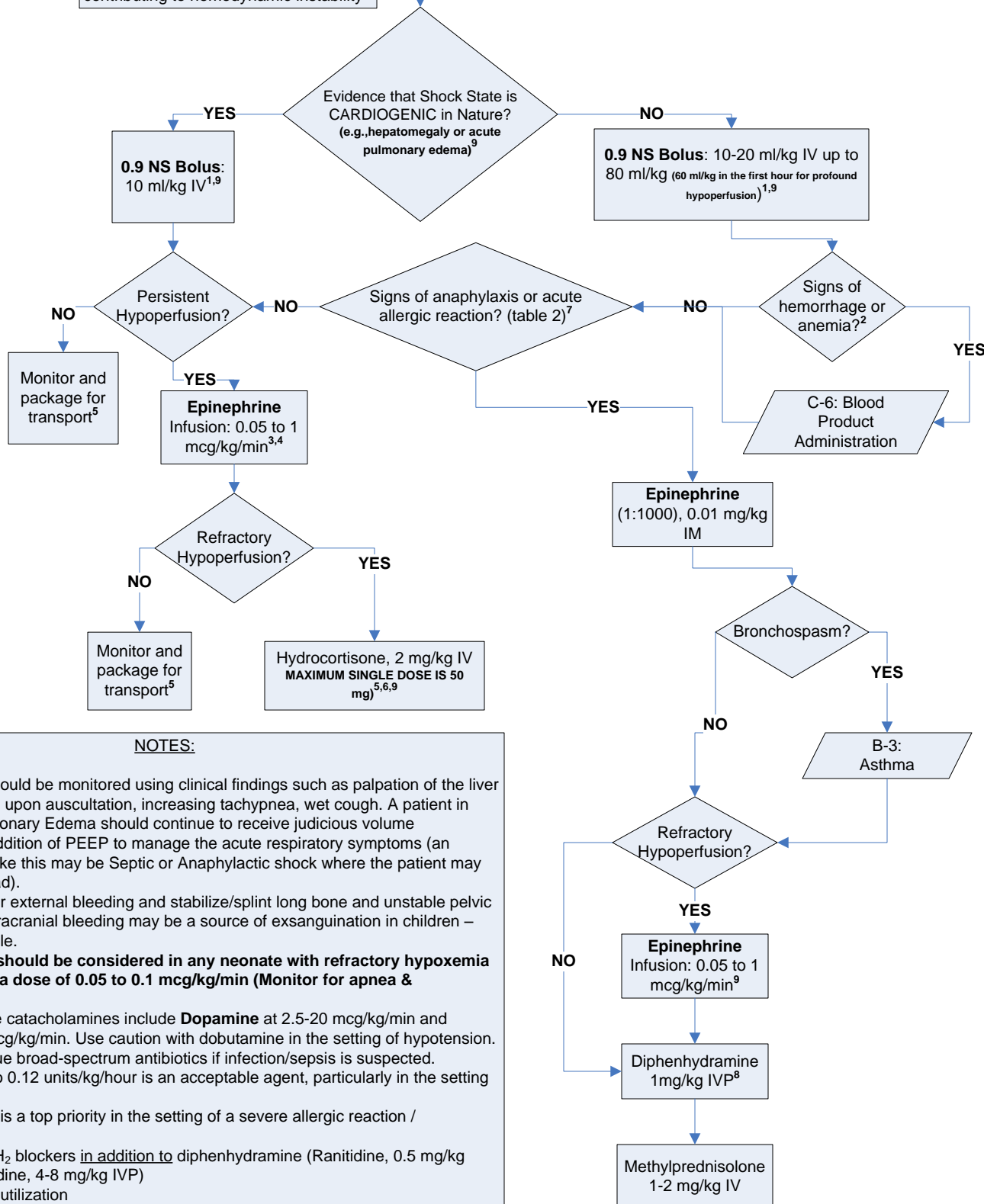
PICU: 734-763-2402
CES: 734-615-9742

Concurrent Actions:

- High flow oxygen
- Airway management⁷
- IV/IO Access x 2
- Blood Glucose Measurement
- Capillary Blood Gas (if available)
- Management of cardiac arrhythmia contributing to hemodynamic instability

Concurrent Guidelines:

- A-1: Airway Management
- C-4A: Push-Dose Pressors
- C-4B: Undifferentiated Shock (Ultrasound)
- C-6: Blood Product Administration
- T-1: Trauma



NOTES:

- Fluid resuscitation should be monitored using clinical findings such as palpation of the liver edge, rales being heard upon auscultation, increasing tachypnea, wet cough. A patient in NON-Cardiogenic Pulmonary Edema should continue to receive judicious volume resuscitation with the addition of PEEP to manage the acute respiratory symptoms (an example of a situation like this may be Septic or Anaphylactic shock where the patient may be dependent on preload).
- Control obvious major external bleeding and stabilize/splint long bone and unstable pelvic fractures. Traumatic intracranial bleeding may be a source of exsanguination in children – closely monitor fontanelle.
- Alprostadil (PGE1) should be considered in any neonate with refractory hypoxemia and hypoperfusion at a dose of 0.05 to 0.1 mcg/kg/min (Monitor for apnea & bradycardia)**
- Additional acceptable catecholamines include **Dopamine** at 2.5-20 mcg/kg/min and **Dobutamine** at 2-20 mcg/kg/min. Use caution with dobutamine in the setting of hypotension.
- Initiate and/or continue broad-spectrum antibiotics if infection/sepsis is suspected.
- Vasopressin**, 0.02 to 0.12 units/kg/hour is an acceptable agent, particularly in the setting of vasodilatory shock.
- Airway management is a top priority in the setting of a severe allergic reaction / anaphylaxis.
- Consider the use of H₂ blockers in addition to diphenhydramine (Ranitidine, 0.5 mg/kg over 5 min -OR- Cimetidine, 4-8 mg/kg IVP)
- Consider Ultrasound utilization

Tables and Additional Information

Table 1: Signs of Shock / Hypoperfusion

- Pallor or central cyanosis
- Tachycardia
- Tachypnea
- Refractory Hypoxemia
- Pulmonary Edema
- Increased Shock Index (HR/SBP)
- Capillary Refill >2 sec (inconsistent in vasodilatory shock)
- Altered Mentation
- Hypotension (Late)
 - MAP <40 mmHg (neonates)
 - SBP < 70 mmHg (infants)
 - SBP < 70 + 2x age (years) (age 2-10 yrs)
 - SBP < 90 mmHg (Adolescent)
- Hyper / hypo-glycemia
- SVC₂ (Vena Caval Oxygen Saturation) < 70% (MAY BE ABNORMALLY HIGH IN DISTRIBUTIVE SHOCK)
- Lactate > 4 mmol/L
- Anion Gap > 16 mEq/L
- Abnormally high (or low) RV Preload (CVP)

Table 2: Anaphylaxis Defined

General Allergic Reaction

- Flushing
- Urticaria
- Rhinitis
- Gastroenteritis
- Conjunctivitis

Airway Compromise Resulting from Anaphylaxis

- Dysphagia / changes in voice
- Wheezing
- Swollen tongue / uvula
- Dyspnea / Acute respiratory failure

Poor Perfusion / Hemodynamic Instability

- Hypotension
- Restlessness, Anxiety, Combativeness
- Decreased LOC
- Cool, pale extremities
- Delayed Capillary Refill
- Tachycardia

Table 3: Target Resuscitation Goals/Endpoints

- Capillary Refill < 2 sec
- Urine Output > 1 ml/kg/hour
- Decreased Shock Index (HR/SBP)
- Normal BP for age
- Serum Lactate < 2 mmol/L
- Anion Gap < 16 mEq/L

Table 4: Medication Quick Reference

<u>Medication</u>	<u>Dosage</u>
• Cimetidine (Tagamet)	4-8 mg/kg IVP
• Diphenhydramine (Benadryl)	1 mg/kg (Max Dose 50 mg) IV
• Dobutamine	2-20 mcg/kg/min
• Dopamine	2.5-20 mcg/kg/min
• Epinephrine	IM (1:1000): 0.01 mg/kg IM Infusion: 0.05-1.0 mcg/kg/min
• Hydrocortisone	2 mg/kg (Max Single Dose 50mg) IV
• Methylprednisone (Solu-Medrol)	1-2 mg/kg IV
• PGE1	0.05 – 0.1 mcg/kg/min
• Ranitidine (Zantac)	0.5 mg/kg (> 5 min) IVP
• Vasopressin	0.02 – 0.12 units/kg/hr