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SHOCK IN PEDIATRICS

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Shock is a clinical syndrome of circulatory dysfunction resulting in inadequate oxygen and nutrient delivery, with inability to meet the metabolic demands of the tissues (cells). This results in a cascade of events resulting in altered cellular metabolism, function, structure, and ultimately death. Shock is NOT necessarily hypotension. It begins with a normal blood pressure and progresses over time.

Normal circulatory function depends on 3 components: 1) adequate cardiac function (the pump), 2) appropriate vascular tone (the pipes) and 3) adequate blood volume (the fuel). When one or more of these circulatory components fail, shock results. Shock is a dynamic process that if untreated, progresses through three phases: 1) compensated, then 2) uncompensated, and finally 3) irreversible.

The main point to reemphasize is: the early recognition and treatment of compensated shock (better prognosis) is essential to prevent decompensated and irreversible shock (poor prognosis, high risk of death). Important historical information and physical exam findings must be included when considering the clinical manifestations and differential diagnosis of shock

Treatment can be classified broadly into:

1. Fluid therapy
 - Crystalloid therapy (normal saline, lactated Ringers)
 - Colloid therapy (dextran, gelatin, 5% albumin)
2. Intravascular catheters and monitoring of central venous pressure and arterial pressure
3. Monitoring of heart rate, blood pressure, temperature, urine output, glucose and ionized calcium, oxygen saturation, and cardiac index
4. Packed red cell infusion
5. Vasopressor therapy: dopamine, norepinephrine, epinephrine, phenylephrine, angiotensin/arginine vasopressin, nitric oxide inhibitors (considered as investigational therapy only) or methylene blue (considered as investigational therapy only)
6. Inotrope therapy: dobutamine, epinephrine/norepinephrine, milrinone or amrinone
7. Vasodilator therapy

- Nitroprusside
- Nitroglycerin
- Milrinone
- Amrinone
- Prostacyclin
- Phentolamine
- Pentoxifylline
- Dopexamine

S. Glucose, calcium, thyroid, and hydrocortisone replacement 9. Therapy for persistent pulmonary hypertension of the newborn (PPHN)

- Inhaled nitric oxide therapy
- Metabolic alkalization with sodium bicarbonate or tromethamine
- Extracorporeal membrane oxygenation (ECMO)

Immunotherapies include the use of anti-endotoxin (HA-1A or E5), anti-tumor necrosis factor (TNF α) and interleukin-1 (IL-1) receptor antagonist. These are beyond the scope of this chapter, but will be important adjuncts to antibiotics and intensive care treatment in the future.