PEDIATRIC SEPTIC SHOCK

Identify Septic Shock
- Use a screening tool, such as the Phoenix Sepsis Score
- Follow facility protocols and facility trigger tools

- Ensure adequate airway, oxygenation and ventilation; ensure vascular access (IV/IO) if not already obtained; if advanced airway is needed, do not use etomidate for induction
- Rapidly administer 10-20 mL/kg **crystalloid fluid bolus**; balanced/buffered crystalloids are preferred over 0.9% NS; repeat bolus as needed to max of 60mL/kg; reassess after each bolus
  - In the absence of intensive care availability, consider a decreased fluid bolus of up to 40 mL/kg (in 10 to 20 mL/kg aliquots) over the first hour
- Administer broad-spectrum **antibiotics** as soon as possible (do not delay fluid therapy or antibiotic administration)
- Obtain blood for cultures (do not delay antibiotics to obtain cultures) and laboratory studies (e.g., glucose, calcium, lactate)
- Implement measures to control the source of infection as needed
- Identify and treat hypoglycemia and hypocalcemia
- Evaluate for untreated/unrecognized morbidities as resources allow

Patient has met therapeutic end points?

YES → Consider critical care consult

NO

Fluid refractory shock

- Obtain expert/critical care consult
- Place central venous catheter (CVC) if trained (do not delay therapy for placement)

- Initiate **epinephrine** or **norepinephrine** infusion
  - Titrate as needed to manage perfusion
  - May alternatively initiate dopamine infusion as initial catecholamine if epinephrine/norepinephrine are not available
  - Preferable to administer through CVC, but do not delay initiation for CVC placement

Catecholamine resistant shock?

YES → **See reverse side**

NO

- Continue monitoring and supporting hemodynamic status
- Titrate medications and continue interventions as appropriate
- Consider hydrocortisone if at risk for absolute adrenal insufficiency and not responsive to adequate fluid therapy and vasopressor administration
- Ensure continued adequate airway, oxygenation and ventilation
- Place CVC and invasive blood pressure monitoring if not already done
- Continue assessment for etiology of septic shock and direct therapy accordingly
- Obtain further diagnostic laboratory studies

Within First Hour

- IV/IO within 5 min
- Appropriate fluid resuscitation within 15 to 30 min
- Antibiotics within 60 min; vasopressors within 60 min if needed

Goals of First Hour

- Maintain or restore airway, oxygenation and ventilation
- Maintain or restore circulation, defined as normal perfusion for age, normal blood pressure for age, normal HR for age, capillary refill ≤ 2 sec and normal mental status. Additional parameters can include normal urine output for age, normal lactate levels and normal invasive pressures

Medications

Epinephrine
- 0.1 to 1 mcg/kg/min IV/IO infusion, titrated to clinical effect

Norepinephrine
- 0.05 to 2 mcg/kg/min IV/IO infusion, titrated to clinical effect

Care Notes

- Do not use colloids in the initial resuscitation of children and infants with septic shock or another sepsis-associated organ dysfunction.
- Consider smaller (5 to 10 mL/kg) fluid bolus volumes in children with cardiac dysfunction/heart failure.
- Consider a trial of noninvasive mechanical ventilation (over invasive mechanical ventilation) in children and infants with sepsis induced pediatric acute respiratory distress syndrome (PARDS) without a clear indication for intubation and who are responding to initial resuscitation; consider a trial of prone positioning in children with sepsis and severe PARDS.

American Red Cross
Training Services

PEDIATRIC SEPTIC SHOCK

Catecholamine Resistant Shock

Further care should be guided by pediatric critical care/emergency specialist

- Place CVC and invasive blood pressure monitoring if not already done
- Continue vasopressors already initiated and titrate to optimize perfusion
- Ensure adequate intravascular volume
- Goals of management are appropriate perfusion and blood pressure for age, normalized HR for age, adequate cardiac output, normalized end-organ perfusion, normalized lactic acid and $ScvO_2 \geq 70\%$
- Consider **hydrocortisone** if at risk for absolute adrenal insufficiency and not responsive to adequate fluid therapy and vasopressor administration, if not already given
- Evaluate for untreated/ unrecognized morbidities
- Obtain laboratory and diagnostic imaging studies

Persistent shock?

NO

YES

- Consider adding **vasopressin**
- Consider adding an **milrinone** for persistent poor perfusion and cardiac dysfunction despite other vasoactive agents
- Consider **PRBC** transfusion as clinically indicated

Persistent shock?

NO

YES

- Evaluate for untreated/ unrecognized morbidities
- Consider **ECLS** for continued refractory shock

- Continue to ensure continued adequate airway, oxygenation and ventilation
- Continue monitoring and supporting hemodynamic status
- Place CVC and invasive blood pressure monitoring (as indicated) if not already done
- Titrate medications and continue interventions as appropriate
- Continue assessment for etiology of septic shock and direct therapy accordingly
- Continue to assess for morbidities and complications
- Repeat appropriate laboratory and diagnostic imaging studies

Untreated/Unrecognized Morbidities

- Unrecognized/uncontrolled source infection
- Pericardial effusion
- Pneumothorax
- Adrenal insufficiency
- Hypothyroid
- Hemorrhage or ongoing blood loss
- Increased intra-abdominal pressure
- Excessive immunosuppression and/or immunocompromise

Therapeutic End Points in Shock

- Normal peripheral pulses and capillary refill (< 2 sec)
- Normal HR for age
- Normal blood pressure for age
- Normal urine output
  - Infants and young children: 1.5 to 2 mL/kg/hr
  - Adolescents: 1 mL/kg/hr
- Normal mental status
- Correction of acidosis
- Normal lactate levels
- Normal perfusion pressure (MAP – CVP) for age, $ScvO_2 \geq 70\%$ (except congenital heart patients with mixing lesions), and cardiac index > 3.5 < 5.5 L/min/m^2 in PICU

Medications	Dosage
Epinephrine	0.1 to 1 mcg/kg/min IV/IO infusion, titrated to desired clinical effect
Dopamine	2 to 20 mcg/kg/min IV/IO infusion, titrated to desired clinical effect
Hydrocortisone	2 mg/kg IV/IO, max, 100 mg
Milrinone	▪ Loading dose: 50 mcg/kg IV/IO over 10 to 60 min (may choose not to administer bolus in setting of hypotension) ▪ Infusion: 0.25 to 0.75 mcg/kg/min
Norepinephrine	0.05 to 2 mcg/kg/min IV/IO infusion, titrated to desired clinical effect
Vasopressin	0.0002 to 0.002 units/kg/min (0.2 to 2 milliunits/kg/min) IV/IO infusion, titrated to desired clinical effect

Care Notes

- Children with purpura fulminans, recent or chronic steroid use, or pituitary or adrenal abnormalities are at risk for absolute adrenal insufficiency.
- Consider a trial of noninvasive mechanical ventilation (over invasive mechanical ventilation) in children and infants with sepsis induced pediatric acute respiratory distress syndrome (PARDS) without a clear indication for intubation and who are responding to initial resuscitation; consider a trial of prone positioning in children with sepsis and severe PARDS.