**Clinical Pathway**  
**Pediatric Sepsis / Septic Shock**  
February 2012

2. Create a team-oriented approach to efficient and timely evaluation and work-up.  
3. Early and aggressive treatment to stabilize hemodynamic status and reverse shock. |
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<tbody>
<tr>
<td>NURSE Documentation</td>
<td>Chief complaint. Onset of symptoms. Vital signs. Assessment including hemodynamic status (core temp, presence of mottling, cap refill, urine output, ext. skin temp), neuro status. Cardiac monitoring</td>
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</table>
| INTERVENTIONS | Initiate on arrival: ESI Triage level II  
Initiate Pediatric Code White  
Full set of vitals including core temperature, cardiac monitor, continuous pulse oximetry  
Establish IV (2 if possible/largest size appropriate)  
Use of IO if cannot obtain IV in 3 attempts or 90 seconds  
Bedside CBG  
Oxygen  
Initiate warming devices if applicable |
| DIAGNOSTICS | Catheter specimen urine dip, UA/Mandatory Culture  
CBC with differential  
CMP, magnesium, phosphate, Ca (consider POC Chem 8)  
Blood culture (one peripheral, one from central line if present)  
DIC Panel, Type and Screen  
Lactic Acid (consider POC lactate)  
VBG (consider POC)  
Chest x-ray (portable) – Consider 2 view abdomen  
Consider LP if stable (gram stain, cell count, protein, glucose, culture, hold extra fluid)  
Consider Respiratory virus panel, Rapid influenza, RSV - if applicable |
| PHYSICIAN (LIP) | Fluids: Normal Saline bolus 20 ml/kg in the first 15 minutes; up to 60ml/kg/first hour  
Medication:  
**Vasopressors***: Dopamine 10mcg/kg/min titrate to SBP > 10% (70+2x Age in years)  
Norepinephrine 0.2mcg/kg/min titrate to SBP > 10% (70+2x Age in years)  
Epinephrine 0.05 mcg/kg/min titrate to SBP > 10% (70+2x Age in years)  
Hypoglycemia: D10 4-5ml/kg for CBG <60  
Antipyretics: Acetaminophen 12.5 mg/kg PO  
Acetaminophen 30 mg/kg PR  
Prostaglandin: Infants less than 12 days of life start prostaglandin infusion until ECHO shows no ductal-dependent lesion.  
Antibiotics: Administer within 60 minutes of arrival  
See antibiotic administration guidelines – page 3  
ADMISSION: Call PICU/DNCC attending early  
Call primary care physician or Kaiser Pediatrician  
Prepare family/infant for admission to DNCC or PICU as appropriate  
Distributive Shock: Common inclusion criteria:  
Altered level of consciousness  
Tachypnea without increased work of breathing  
Tachycardia  
Brisk or delayed cap refill  
Warm flushed skin  
Hypotension with wide pulse pressure (warm shock)  
Hypotension with narrow pulse pressure (cold shock)  
Fever or hypothermia  
Petechial or purpuric rash |

* See page 2 for indication of vasopressors use in the presence of warm shock and cold shock.
Clinical Pathway Decision Making Process
Pediatric Sepsis / Septic Shock
(Suspected infection, altered hemodynamic state, +/- altered level of consciousness)
February 2012

GOALS OF THERAPY:
- Normal Mental Status
- Warm extremities
- Cap refill <2 seconds
- Normal HR, BP for age
- UOP > 1 ml/kg/hr
- Maintain/support airway

Recognize & Treat (0-5 minutes)
1. Decreased perfusion
2. Decreased Mental Status
3. Cyanosis
4. Respiratory Distress
5. Initiate Pediatric Code White
6. Establish/Secure Airway

First 5 Minutes

Immediate Action (5 minutes):
- Oxygen
- Pulse Ox/Cardiac Monitor
- IV/IO Access/labs/Cx
- CBG
- Initiate aggressive fluid bolus 20ml/kg over 5-10 minutes

5-15 Minutes

Fluid Responsive?
- No
  - Establish central access
  - Initiate Vasopressive support (Dopamine) with consult to PICU
- Yes
  - Continue fluids up to 60 ml/kg bolus
  - Continue workup to identify source
  - Correct hypoglycemia
  - Administer First dose Antibiotics
  - Consult with PICU for admission

15-60 minutes

Dopamine resistant shock?
- No
  - Titrated dopamine to effect
  - Complete diagnostics as applicable
  - Admit PICU
- Yes
  - Titrated epinephrine for cold shock
  - Titrated norepinephrine for warm shock (consult with PICU)
Pediatric Sepsis / Septic Shock Rationale and Data

Clinical Considerations for Inclusion Criteria

1. **Mental status**: Restless, agitated, anxious, progressive lethargy
2. **Skin**: Temperature, color, turgor, petechial rash may be present in meningococcemia or disseminated intravascular coagulation.
3. **Cardiovascular**: By far, the most significant physical findings in septic shock results from autonomic responses to stress. In children tachycardia occurs early. The younger the child, cardiac output is more dependent on heart rate rather than on increase in stroke volume. Alteration in blood pressure is a late manifestation of hypovolemia in children, occurring faster in children. Diastolic blood pressure begins to fall early as vascular tone begins to decrease. Systolic blood pressure is well maintained initially and only begins to fall once hemodynamic compromise is severe. Decreasing blood pressure signifies decompensated stage of shock. In warm phase of septic shock capillary refill time may be normal; however signs of hyperdynamic circulation, widened pulse pressure, a hyperdynamic apex beat are important signs. Capillary refill time of more than 3 seconds is always abnormal.
4. **Respiratory**: Respiratory rate is increased to compensate for metabolic acidosis, progressive worsening of respiratory distress may occur
5. **Urine output**: Oliguria is common leading to anuria.

It is important to remember that physical findings will vary according to the stage of shock.

Goals of Clinical Pathway

2. Create a team-oriented approach to efficient and timely evaluation and work-up.
3. Early and aggressive treatment resulting in stabilization of hemodynamic status and reversal of shock.

Pediatric Sepsis

Reversal of shock within 75 minutes has been shown to result in >9-fold increase in survival. Each additional hour of persistent shock is associated with >2-fold increased odds of mortality (Han et al., Pediatrics. Oct 2003)

Septic shock can be defined by the inflammatory triad of hypotension, perfusion abnormalities, and an acute alteration in mental status.

- **Warm shock** (early, or hyperdynamic phase) is characterized by peripheral vasodilation due to endotoxins that prevent catecholamine-induced vasoconstriction. Assessment findings include warm, dry, flushed skin, bounding peripheral pulses, tachycardia, and tachypnea. Dopamine and norepinephrine are recommended for vasopressor support of warm shock.
- **Cold shock** (late, or hypodynamic/decompensated) phase is characterized by cool extremities, vasoconstriction and resembles hypovolemic shock (Comprehensive Pediatric Emergency Care, 2007). Assessment findings include mottled, cool extremities, diminished or absent peripheral pulses, altered mental status, tachycardia, delayed cap refill and decreased urine output. Epinephrine is recommended for vasopressor support of cold shock (PALS 2006).

Bacterial Pathogen Consideration

Bacteremia is not necessary for the development of septic shock. Only 30-50% of patients with sepsis have positive blood culture results. (Chamberlain, 2008) Sepsis accounts for 4.2 deaths/100,000, with around 750,000 cases diagnosed per year. Mortality rate is 31%, shock develops in 40% of septic patients.

### Suspected Source of Sepsis

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<th>Lungs</th>
<th>Abdomen</th>
<th>Skin/Soft Tissue</th>
<th>Urinary Tract</th>
<th>CNS</th>
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<tbody>
<tr>
<td><strong>Major Community Acquired Pathogens</strong></td>
<td>Streptococcus pneumoniae</td>
<td>Haemophilus influenzae</td>
<td>Escherichia coli</td>
<td>Streptococcus pneumoniae</td>
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<td>Legionella sp.</td>
<td>Bacteroides fragilis</td>
<td>Staphylococcus pyogenes</td>
<td>Enterococcus sp.</td>
<td>Listeria monocytogenes</td>
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<tr>
<td><strong>Major Nosocomial Pathogens</strong></td>
<td>Aerobic gram negative bacilli</td>
<td>Anaerobes Candida sp.</td>
<td>Staphylococcus aureus</td>
<td>Aerobic gram negative bacilli</td>
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**Antibiotic Selection**

**Empiric IV therapy**

**Pneumonia**

UTI

- **0-28 days of life**
  - Amoxicillin 50 mg/kg/dose IV and Gentamicin 2.5 mg/kg/dose IV
  - Acyclovir 20 mg/kg/dose IV
- **>28 days of life**
  - Cefotaxime 50 mg/kg/dose
  - *if suspected meningitis or unclear CSF results increase dose to 100mg/kg/dose*
- *see neonatal fever/sepsis pathway for additional information <90 days of life*

**MRSA (suspected or known)**

**Presence of Central Line**

**Suspected Meningitis**

Vancomycin 15 mg/kg/dose IV. Consult DNCC attending if <90 days of life

**Herpes Encephalitis**

Acyclovir 20 mg/kg/dose IV

**Cellulitis**

Clindamycin 10 mg/kg/dose IV

**Abdominal**

Cefoxitin 25 mg/kg/dose IV

*if peritonitis/perforated viscus suspected: Use Amoxicillin/Gentamicin/Flagyl combination or Meropenem*

Content review: David Spiro, Denise Langley, Melinda Hartenstein, Pediatric Section Meeting January 2012