

## Clinical Pathway Pediatric Sepsis / Septic Shock

February 2012

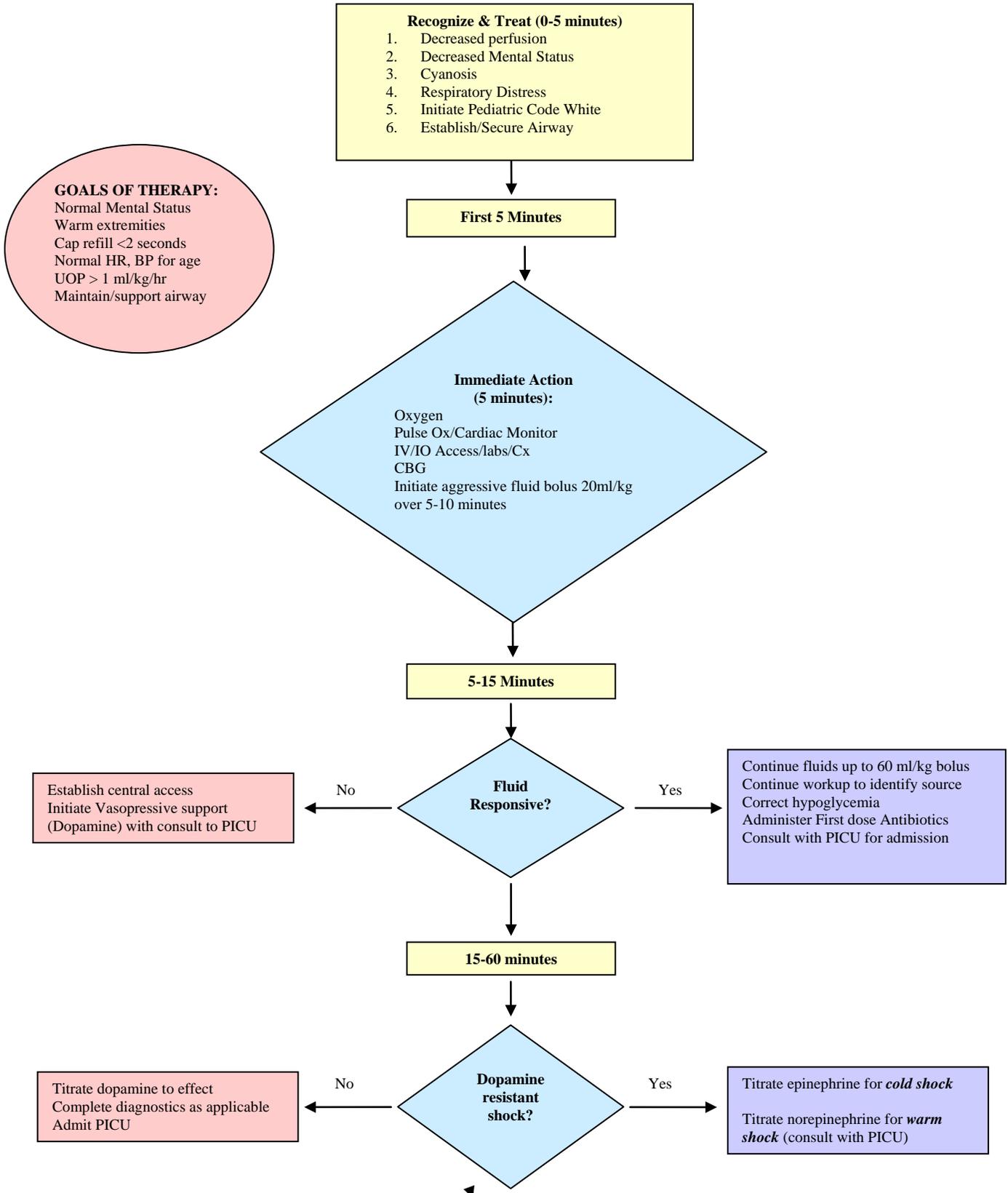
<b>Outcomes/Goals</b>	<ol style="list-style-type: none"> <li>1. Rapid identification and treatment of pediatric patients presenting in septic shock.</li> <li>2. Create a team-oriented approach to efficient and timely evaluation and work-up.</li> <li>3. Early and aggressive treatment to stabilize hemodynamic status and reverse shock.</li> </ol>
<b>NURSE</b> Documentation	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
<b>INTERVENTIONS</b> 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
<b>DIAGNOSTICS</b>	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
<b>PHYSICIAN (LIP)</b>	
Fluids	Normal Saline bolus 20 ml/kg in the first 15 minutes; up to 60ml/kg/first hour
Medication <b>Vasopressors*</b>	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	<b>Administer within 60 minutes of arrival</b> <b>See antibiotic administration guidelines – page 3</b>
<b>ADMISSION</b>	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	<b>Common inclusion criteria:</b> 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 pupuric 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



# Pediatric Sepsis / Septic Shock Rationale and Data

## Clinical Considerations for Inclusion Criteria

- Mental status:** Restless, agitated, anxious, progressive lethargy
  - Skin:** Temperature, color, turgor, petechial rash may be present in meningococemia or disseminated intravascular coagulation.
  - 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.
  - Respiratory:** Respiratory rate is increased to compensate for metabolic acidosis, progressive worsening of respiratory distress may occur
  - 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

- Rapid identification and treatment of pediatric patients presenting in sepsis/septic shock.
- Create a team-oriented approach to efficient and timely evaluation and work-up.
- 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 vasopressive 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 vasopressive 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

	Lungs	Abdomen	Skin/Soft Tissue	Urinary Tract	CNS
<b>Major Community Acquired Pathogens</b>	Streptococcus pneumoniae Haemophilus influenzae Legionella sp.	Escherichia coli Bacteroides fragilis	Streptococcus pyogenes Staphylococcus aureus Clostridium sp. Pseudomonas aeruginosa	Escherichia coli Klebsiella sp. Enterobacter sp. Proteus sp.	Streptococcus pneumoniae Neisseria meningitidis Listeria monocytogenes Escherichia coli Haemophilus influenzae
<b>Major Nosocomial Pathogens</b>	Aerobic gram negative bacilli	Aerobic gram negative bacilli Anaerobes Candida sp.	Staphylococcus aureus Aerobic gram negative bacilli	Aerobic gram negative bacilli Enterococcus sp.	Pseudomonas aeruginosa Escherichia coli Klebsiella sp. Staphylococcus sp.

## Antibiotic Selection

Empiric IV therapy Pneumonia UTI	<b>0-28 days of life</b> – Ampicillin 50 mg/kg/dose IV <u>and</u> Gentamicin 2.5 mg/kg/dose IV +/- *Acyclovir 20 mg/kg/dose IV <b>&gt;28 days of life</b> Cefotaxime 50 mg/kg/dose (if suspected meningitis or unclear CSF results increase dose to 100mg/kg/dose) <i>* see neonatal fever/sepsis pathway for additional information &lt;90 days of life</i>
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  <i>* if peritonitis/perforated viscus suspected: Use Ampicillin/Gentamicin/Flagyl combination or Meropenem</i>