Septic shock is suspected when children with fever, tachycardia, and vasodilation have a change in mental status manifested as inconsolable irritability, lack of interaction with parents, or inability to be aroused. The clinical diagnosis of septic shock is made in children who have a suspected infection manifested by hypothermia or hyperthermia and have clinical signs of decreased perfusion, including decreased mental status, prolonged capillary refill of >2 seconds (cold shock) or flash capillary refill (warm shock), diminished pulses (cold shock) or bounding pulses (warm shock), mottled cool extremities (cold shock), or decreased urine output of <1 mL/kg/hr. Hypotension is not necessary for the clinical diagnosis of septic shock; however, its presence in a child with clinical suspicion of infection is confirmatory.

**STEP 1**

**First 5 minutes of Patient / Health Care Provider Interaction:**

Assess Mental Status: Normal or Depressed
Assess Perfusion: Heart Rate: Normal or Elevated or Low
Cap Refill: Normal or > 3 seconds
Systolic BP: Normal or Low

If Mental Status is depressed and ANY of the Perfusion Assessments are abnormal assume Shock and proceed to Step 2

**STEP 2**

Give Oxygen to all patients regardless of Oximeter Reading

Support Ventilation

Establish Vascular Access using PALS guidelines (Peripheral IV, If unsuccessful IO, and then Central Line)

Begin Resuscitation according to PALS guidelines

Lab: VBG or ABG, Egroup, BUN, Cr, Glu, Anion Gap, iCa, Cultures, CBC, Chemstip

Proceed to Step 3

**STEP 3 A**

Minutes 5 thru 30 of Patient Interaction (Now with Nurse and Physician at Bedside):

Give 20 ml/kg NS or LR over 5 minutes and Reassess - See Step 1
Give a minimum of 2 boluses in this time period as long as the patient does not deteriorate as the bolus is given.
A child may need 3 to 5 boluses within the first 30 – 60 minutes (60 to 200 ml/kg)

If shock stabilizes with boluses—Discuss Hospital Admission with PICU Attending

Continue Q 5 minute VS and Nursing Reassessments until transferred

If Vital Signs do not improve with boluses or deteriorate proceed to Step 4
**STEP 3 B**

Minutes 5 thru 30 of Patient Interaction (Now with Nurse and Physician at Bedside):

*Additional Interventions in this time period:*
- Correct Hypoglycemia
- Correct Hypocalcemia
- Administer the First Dose of Antibiotics
- Check Lab
- Consider having the Pharmacist or Nurse prepare a STAT Vasopressor Drip
- Consider Stress Dose Hydrocortisone

If Vital Signs do not improve with boluses or deteriorate proceed to Step 4

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**STEP 4**

Minutes 15 thru 60 of Patient Interaction (Nurse and Physician continue at Bedside):

At this point you assume that you have Fluid Refractory Shock – i.e. Cardiogenic Shock

*Continue Care And Consult PICU While You Proceed*

**Normotensive:**

Begin Dobutamine at 6-8 mcg/kg/min IV Drip and titrate in 6-8 mcg/kg/min increments to a max of 20 mcg/kg/min by reassessing VS (SEE STEP 1) and Scvo2

**Hypotensive vasodilated (warm, nl cap refill) shock:**

Begin Norepinephrine 10mg/100ml at 0.17 mcg/kg/min (This is a rate of 1/10th the Body Wt in Kg at this concentration) titrate by reassessing VS (SEE STEP 1) and Scvo2

**Hypotensive vasoconstricted (cold, prolonged cap refill) shock:**

Begin Epinephrine 10mg/100ml at 0.17 mcg/kg/min (This is a rate of 1/10th the Body Wt in Kg at this concentration) and titrate by reassessing VS (SEE STEP 1) and Scvo2

Scvo2 Goal Directed Therapy – SEE STEP 5
STEP 5
Scvo2 Goal Directed Therapy
(Nurse and Physician continue at Bedside)

**Scvo2 > 70%, low BP, “Warm Shock”**
1. Additional Fluid Boluses
2. Norepinephrine Drip titration
3. Consider Vasopressin

**Scvo2 < 70%, normal BP/poor perfusion (Cap refill >3)**
1. Transfuse to Hgb > 10g/dl
2. Optimize Arterial Oxygen Saturation
3. Additional fluid boluses
4. Dopamine Drip
5. Consider: Milrinone or Dobutamine if not improving

**Scvo2 < 70%, low BP/poor perfusion (Cap refill > 3), “Cold Shock”**
1. Transfuse to Hgb > 10g/dl
2. Optimize Arterial Oxygen Saturation
3. Additional fluid boluses
4. Epinephrine Drip or Norepinephrine + Dobutamine

STEP 6
NOW AT 60 MINUTES OUT
CONSIDER ADRENAL INSUFFICIENCY
Fluid Refractory and Dopamine or Norepinephrine dependent shock indicate the patient is at risk for adrenal insufficiency:
Draw baseline serum cortisol
Consider ACTH stimulation test if unsure of need for steroids

IF ADRENAL INSUFFICIENCY IS “SUSPECTED” (does not have to be proven):
Give: Hydrocortisone 2mg/kg IV (Max dose 100mg)

Addendum:

**First Dose Antibiotics in Children > 2 month of age:**
Ceftriaxone 50mg/kg IV and
Clindamycin 10mg/kg IV
Use a macrolide in children who cannot receive ceftriaxone

**First Dose Antibiotics in Children < 2 month of age:**
Cefotaxime 50mg/kg IV & Ampicillin 100mg/kg IV or
Ampicillin 100mg/kg IV & Gentamicin 2.5 mg/kg IV
**Clindamycin dosing:**

Neonates: I.M., I.V.:  
Postnatal age < 7 days:  
- < 2000 g: 10 mg/kg/day divided every 12 hours  
- > 2000 g: 15 mg/kg/day divided every 8 hours  
Postnatal age > 7 days:  
- < 1200 g: 10 mg/kg/day divided every 12 hours  
- 1200-2000 g: 15 mg/kg/day divided every 8 hours  
- > 2000 g: 20-30 mg/kg/day divided every 6-8 hours

Infants and Children:  
Oral: 10-30 mg/kg/day divided every 6-8 hours; maximum dose: 1.8 g/day

**Ceftriaxone dosing:**

Neonates:  
Postnatal age < 7 days: 50 mg/kg/day given every 24 hours  
Postnatal age > 7 days:  
- < 2000 g: 50 mg/kg/day given every 24 hours  
- > 2000 g: 50-75 mg/kg/day given every 24 hours

Note: Use cefotaxime in place of ceftriaxone in hyperbilirubinemic neonates

Infants and Children: 50-75 mg/kg/day divided every 12-24 hours  
Meningitis: 80-100 mg/kg/day divided every 12-24 hours; loading dose of 75 mg/kg may be administered at the start of therapy; maximum dose: 4 g/day

**Ampicillin:**

Neonates: I.M., I.V.:  
Postnatal age < 7 days:  
- < 2000 g: 50 mg/kg/day divided every 12 hours; meningitis: 100 mg/kg/day divided every 12 hours  
- > 2000 g: 75 mg/kg/day divided every 8 hours; meningitis: 150 mg/kg/day divided every 8 hours  
Group B streptococcal meningitis: 200 mg/kg/day divided every 8 hours  
Postnatal age > 7 days:  
- < 1200 g: 50 mg/kg/day divided every 12 hours; meningitis: 100 mg/kg/day divided every 12 hours  
- 1200-2000 g: 75 mg/kg/day divided every 8 hours; meningitis: 150 mg/kg/day divided every 8 hours  
- > 2000 g: 100 mg/kg/day divided every 6 hours; meningitis: 200 mg/kg/day divided every 6 hours  
Group B streptococcal meningitis: 300 mg/kg/day divided every 6 hours

Infants and Children: I.M., I.V.: 100-200 mg/kg/day divided every 6 hours; meningitis: 200-400 mg/kg/day divided every 6 hours; maximum dose: 12 g/day
Gentamicin:

Neonates: I.M., I.V.:  
Premature neonate, <1000 g: 3.5 mg/kg/dose every 24 hours  
0-4 weeks, <1200 g: 2.5 mg/kg/dose every 18-24 hours  
Postnatal age ≤7 days: 2.5 mg/kg/dose every 12 hours  
Postnatal age >7 days:  
  1200-2000 g: 2.5 mg/kg/dose every 8-12 hours  
  >2000 g: 2.5 mg/kg/dose every 8 hours  

Initial dose for term neonates receiving ECMO: I.V.: 2.5 mg/kg/dose every 18 hours; subsequent doses should be individualized by monitoring serum drug concentrations; when ECMO is discontinued, dosage may require readjustment due to large shifts in body water

Once daily dosing:  
Premature neonates with normal renal function: 3.5-4 mg/kg/dose every 24 hours  
Term neonates with normal renal function: 3.5-5 mg/kg/dose every 24 hours  

Infants and Children <5 years: I.M., I.V.: 2.5 mg/kg/dose every 8 hours*  
Once daily dosing in patients with normal renal function: 5-7.5 mg/kg/dose every 24 hours  
Endocarditis prophylaxis (high-risk patients): 1.5 mg/kg (maximum: 120 mg) within 30 minutes of starting the procedure plus ampicillin or vancomycin (in patients allergic to ampicillin)  
Pulmonary infection in cystic fibrosis: 2.5-3.3 mg/kg/dose every 6-8 hours  
Patients on hemodialysis: 1.25-1.75 mg/kg/dose postdialysis  

Children ≥5 years: I.M., I.V.: 2-2.5 mg/kg/dose every 8 hours*  
Once daily dosing in children with normal renal function: 5-7.5 mg/kg/dose every 24 hours  
Endocarditis prophylaxis (high-risk patients): 1.5 mg/kg (maximum: 120 mg) within 30 minutes of starting the procedure plus ampicillin or vancomycin (in patients allergic to ampicillin)  
Pulmonary infection in cystic fibrosis: 2.5-3.3 mg/kg/dose every 6-8 hours  
Patients on hemodialysis: 1.25-1.75 mg/kg/dose postdialysis
PEDIATRIC SEPTIC SHOCK FLOW SHEET

PEDIATRIC MEASUREMENTS:

1. BOLUS THERAPY: AT LEAST TWO 20ML/KG NS OR LR BOLUSES IN THE FIRST HOUR
2. ANTIBIOTIC GIVEN IN THE FIRST HOUR
3. GLUCOSE AND IONIZED CALCIUM CHECKED IN THE FIRST HOUR
4. IF A VASOACTIVE DRIP WAS STARTED ON THE DAY OF ADMISSION IT WAS INITIATED WITHIN THE FIRST HOUR OF THERAPY FOR SHOCK

DAVID HARDY, MD