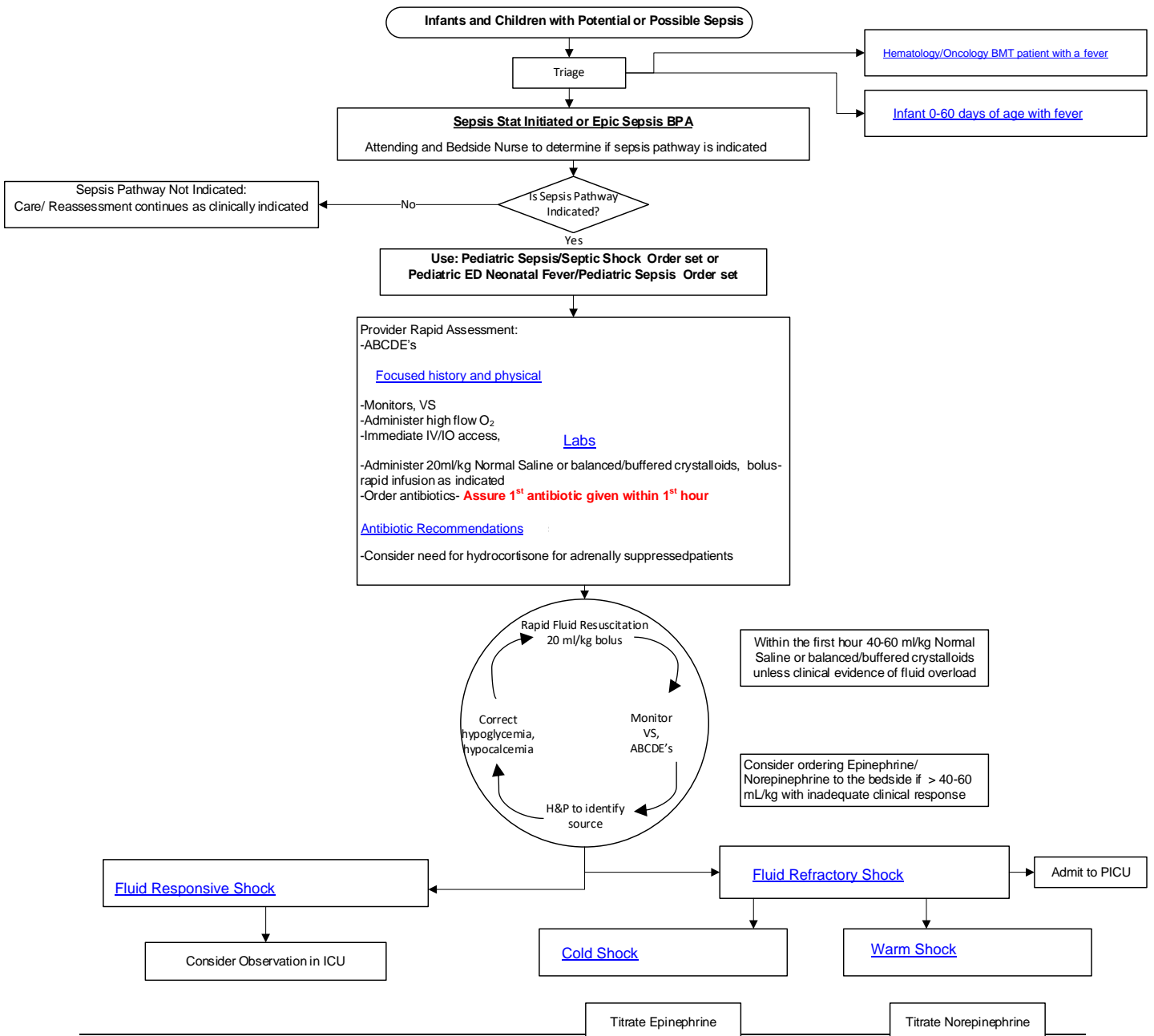


PEDIATRIC SEPSIS, EMERGENCY DEPARTMENT & INPATIENT, PATHWAY

Updated: May 5, 2023

Clinical algorithm: Evaluation/Treatment of Pediatric Patients with Suspected Sepsis



Clinical pathway summary

CLINICAL PATHWAY NAME: Pediatric Sepsis

PATIENT POPULATION AND DIAGNOSIS: Pediatric patients with signs or symptoms of sepsis, excluding patients in the NICU

APPLICABLE TO: Helen Devos Children's Hospital and Regionals

BRIEF DESCRIPTION: A guideline to assist in the identification, treatment, and management of pediatric sepsis. This guideline also includes: Recommended [Laboratory studies](#), [Rapid Fluid Resuscitation](#), [Antibiotic Recommendations](#), [Fluid Refractory Shock](#), [Fluid Responsive Shock](#), and [H&P](#) Questions for Source

OPTIMIZED EPIC ELEMENTS (if applicable): Order Sets: Pediatric ED Neonatal Fever/Pediatric Sepsis, Pediatric Sepsis/Septic Shock. Smart phrase: .SepsisStat, .phosepsishuddle, ED Sepsis BPA

IMPLEMENTATION DATE: May 1, 2023

LAST REVISED: May 2023

Clinical pathways clinical approach

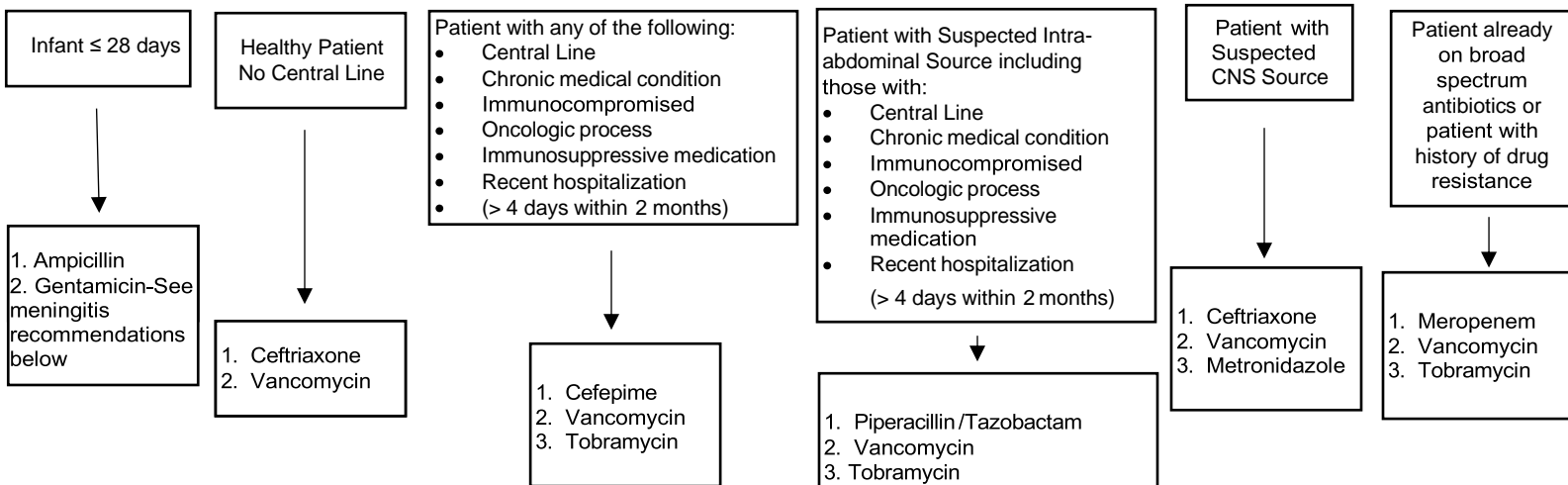
TREATMENT AND MANAGEMENT:

1. Identification of Children at Risk for Sepsis/Unstable Sepsis

Use clinical suspicion and/or Sepsis screening tool (BPA) to identify patients at risk for sepsis/ unstable sepsis. Huddle with appropriate team members to determine if patient meets criteria for sepsis pathway. Patients with sepsis/unstable sepsis have an infection which triggers an exaggerated immune response that causes inadequate tissue perfusion leading to organ failure. **Hypotension is a late finding.** Early recognition and goal directed therapy improves patient outcomes.

The provider reviews vitals appropriate for the age of the child. Hypotension is a late finding in children and should not be expected.

2. Helen Devos Children's Hospital Antimicrobial Stewardship Program Guidelines: Antibiotic Recommendations for Specific Populations in Order of Administration



A. Antibiotics that Can Be Given IM

- I. Ampicillin, Cefepime, Ceftriaxone, Clindamycin, Gentamicin

B. Consider Additional Antimicrobials with the following clinical scenarios

- I. Toxin-Mediated Syndrome

- a) Prescribe Clindamycin

- II. Suspicion of Influenza

- a) Prescribe Oseltamivir

C. Type I mediated penicillin allergy or Cephalosporin allergy

- I. A cephalosporin plus metronidazole replaces piperacillin/ tazobactam in a type 1 mediated penicillin allergy

- II. Ciprofloxacin replaces cephalosporin for cephalosporin allergy

- a) If suspected **intra-abdominal** source: Add metronidazole to ciprofloxacin for anaerobic coverage in place of piperacillin/tazobactam

*Type I mediated hypersensitivity includes hives, angioedema and/or anaphylaxis

D. For infants ≤ 28 days with clinical concerns for meningitis or CSF pleocytosis:

- I. Consider ampicillin + ceftriaxone or ampicillin + ceftazidime.

- II. Neonates who should not receive ceftriaxone include those requiring calcium containing products, hyperbilirubinemia, and premature neonates.

E. Risk for fungemia:

- I. Consider micafungin for patients with CVL and ≥ 2 of the following:

- a) >3 days of broad-spectrum antibiotics in the prior 2 weeks

- b) TPN

- c) Malignancy

F. Immunosuppressive Medications (select list)

Oral or SQ methotrexate ≥ 5 mg

Tacrolimus

Sirrolimus

Cyclosporine

Anakinra

Infliximab

Etanercept

Azathioprine

Prednisone 2mg/kg/day or ≥ 20mg daily (>2 weeks)

Rituximab

Mycophenolate mofetil

Cyclophosphamide

Adalimumab

3. Rapid Fluid Resuscitation

Fluid Resuscitation	<ul style="list-style-type: none"> • First Hour <ul style="list-style-type: none"> -Rapid Normal Saline or balanced / buffered Crystalloids 20 mL/kg boluses every 5 minutes -Reassess, repeat boluses to improve perfusion
Rapid Fluid Infusion Techniques	<ul style="list-style-type: none"> • Push-Pull Technique (<15 kg) <ul style="list-style-type: none"> -30 mL syringe -Macro drip set up with 3 way stopcock -T connector • Pressure Bag • Rapid infuser with compatible vascular access
Volume	<ul style="list-style-type: none"> • 20 mL/kg Normal Saline or balanced / buffered Crystalloids boluses up to ≥ 60 mL/kg • Continue rapid volume infusion as needed following clinical parameters • Use NS when possible
Other Considerations	<ul style="list-style-type: none"> • Order D₅NS fluids to run at maintenance to provide adequate glucose • Order FFP if INR, PT/PTT abnormal • Order PRBC if Hgb < 10 mg/dL (if patient hypotensive or actively bleeding) • Order platelets for platelet count < 50 k

A. Monitor Response to therapy:

I. Mental Status, VS, Airway, Breathing, Perfusion

a) Clinical Parameters to monitor response to therapy:

- 1) Mental Status
- 2) HR, BP, pulse pressure
- 3) RR, work of breathing, pulse oximetry
- 4) Capillary refill, skin temperature, quality of pulses
- 5) Urine Output (goal > 1 mL/kg/hr)
- 6) Nursing assessment standards: [Emergency Services Nursing Standards](#) and [Pediatric Inpatient Nursing Standards](#)
- 7) Serum lactate concentration
- 8) If able, consider monitoring advanced hemodynamic parameters such as cardiac output/cardiac index, systemic vascular resistance, or central venous oxygen saturation (ScvO₂).

B. Fluid Responsive Shock

I. Patients who show improvement with the initial resuscitation may not require ICU care. Consider parameters as listed below with an observation period

- a) Mental status normal
- b) Vital signs in target range
- c) Perfusion Improving
- d) Urine output adequate
- e) Initial laboratory studies without evidence of MSOF and consider repeat labs as indicated

II. Ongoing Care

- a) Ensure continued IV fluids
- b) Assure antibiotics completed
- c) Recheck POC glucose, other laboratory studies as indicated

C. Fluid Refractory Shock

Fluid Refractory Shock	<ul style="list-style-type: none"> • >40-60 ml/kg fluid resuscitation administered without adequate clinical response • Order appropriate *vasopressor (see cold vs warm shock below) • Consider central venous line • Continue fluid boluses until perfusion improves or signs of fluid overload develop
Cold Shock <ul style="list-style-type: none"> • Titrate epinephrine infusion with starting dose 0.05mcg/kg/min 	<ul style="list-style-type: none"> • High systemic vascular resistance, low cardiac output • Cold extremities, prolonged capillary refill (>3 seconds) • Faint pulses • Normal or increased diastolic blood pressure • Narrow pulse pressure (<30 mm Hg)
Warm Shock <ul style="list-style-type: none"> • Titrate norepinephrine infusion with starting dose 0.05mcg/kg/min -If norepinephrine is not immediately available, use epinephrine 	<ul style="list-style-type: none"> • Vasodilation, low systemic vascular resistance, high cardiac output • Warm extremities, flash capillary refill <1 second, bounding pulses • Decreased diastolic pressure, wide pulse pressure (>40 mm Hg)

***If patient needs vasopressors consult with peds ICU attending**

D. Assess for Fluid Overload

- I. Increased WOB, rales
- II. Gallop
- III. Hepatomegaly

4. ICU Level of Monitoring is Required

A. Airway/Sedation

- I. Favor sedation agents less likely to contribute to hypotension such as Ketamine and fentanyl
- II. Recommend vecuronium or rocuronium for procedural muscle relaxation
- III. Avoid etomidate

B. Monitoring

- I. CR monitor, blood pressure q 15 minutes
- II. Continuous pulse oximetry, EtCO₂ if indicated
- III. If appropriate central access, consider CVP, ScvO₂, cardiac output/cardiac index, systemic vascular resistance
- IV. Foley catheter to monitor urine output

C. Coagulopathy/Anemia

- I. Recommend against prophylactic replacement of plasma in nonbleeding children
- II. Recommend against transfusion of PRBC's if Hgb > 7 g/dL
- III. Recommend against prophylactic transfusion of platelets in nonbleeding children, but consider transfusion for invasive procedures or bleeding

D. Consider Stress dose Hydrocortisone if at risk of Adrenal Insufficiency

- I. Purpura fulminans
- II. Congenital adrenal hyperplasia
- III. Prolonged or frequent steroid use
- IV. Catecholamine-resistant shock

*Send blood for baseline cortisol level when possible, prior to treatment

Pathway Information

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CLINICAL PRACTICE COUNCIL (CPC): Children's Health

CPC APPROVAL DATE: 5/1/23

OTHER TEAM(S) IMPACTED: nursing, pharmacy, phlebotomy, lab

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Appendix A

Considerations on H&P to Identify Source of Infection

HPI	<ul style="list-style-type: none">• Height and duration of fever• Oral intake/urine output in past 24 hours• Presence of headache, neck pain• Change in behavioral/mental status• Cough, rhinorrhea, shortness of breath, sore throat• Abdominal pain/vomiting, diarrhea, fluid loss in past 24 hours• Dysuria frequency, urgency, back pain• Vaginal discharge, recent sexual activity, LMP if adolescent female• Joint or muscle pain, swelling or redness• Rash• Any recent wounds/breaks in skin integrity• Ill contact, recent immunizations• Current or recent antibiotic use
PMH	<ul style="list-style-type: none">• Any underlying illness• Any immunosuppressive condition• Central line• Past surgical history• Allergies to medications, contrasts, blood products• Medication history (steroid treatment >2 weeks)• Birth history• Immunization history
Physical Assessment	<ul style="list-style-type: none">• VS, weight• General appearance• Detailed exam including:<ul style="list-style-type: none">-Rash, signs of meningitis/pneumonia/abdominal infection• Consider pelvic exam in an adolescent female if concern for PID or retained tampons as the source for sepsis

Appendix B

*Recommended Initial Laboratory Testing for Patients with Suspected Stable or Unstable Sepsis

Blood Culture	Peripheral Blood Culture Central Line Blood Culture (all lumens, if applicable)	
Laboratory Studies	All Patients	Septic Shock
	POC Glucose iStat/VBG Lactate CBC with differential Comprehensive Metabolic Panel Procalcitonin	Type and Screen CRP PT/INR PTT Fibrinogen *Cortisol if clinically indicated Amylase/Lipase
Urine	Urinalysis and Urine Culture Urine HCG (all females ≥ 12 years or younger if menses begun)	
Respiratory Studies (as clinically indicated)	Quad Screen (COVID, Influenza A/B, RSV) Respiratory Film Array Respiratory Gram Stain and Culture	
CSF Studies (as clinically indicated)	Routine studies: CSF culture/gram stain, cell count with differential, protein, glucose If clinically indicated: HSV PCR, Enterovirus PCR, Meningoencephalitis panel	

*Use Sepsis order set