Infants and Children with Potential or Possible Sepsis

Triage

Sepsis Stat Initiated or Epic Sepsis BPA
Attending and Bedside Nurse to determine if sepsis pathway is indicated

Sepsis Pathway Not Indicated:
Care/Reassessment continues as clinically indicated

Is Sepsis Pathway Indicated?

No

Provider Rapid Assessment:
- ABCDE’s
- Focused history and physical
- Monitors, VS
- Administer high flow O₂
- Immediate IV/IO access, Labs
- Administer 20ml/kg Normal Saline or balanced/buffered crystalloids, bolus-rapid infusion as indicated
- Order antibiotics - Assure 1st antibiotic given within 1st hour
- Antibiotic Recommendations
- Consider need for hydrocortisone for adrenally suppressed patients

Yes

Fluid Responsive Shock
- Consider Observation in ICU

Fluid Refractory Shock

Cold Shock
- Titrate Epinephrine

Warm Shock
- Titrate Norepinephrine

Admit to PICU

Infant 0-60 days of age with fever

Hematology/Oncology BMT patient with fever

Hematology/Oncology BMT patient with a fever

Within the first hour 40-60 ml/kg Normal Saline or balanced/buffered crystalloids unless clinical evidence of fluid overload

Consider ordering Epinephrine/Norepinephrine to the bedside if > 40-60 mL/kg with inadequate clinical response
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 leasing 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

<table>
<thead>
<tr>
<th>Infant ≤ 28 days</th>
<th>Healthy Patient No Central Line</th>
<th>Patient with any of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ampicillin</td>
<td>1. Ceftriaxone</td>
<td>Central Line</td>
</tr>
<tr>
<td>2. Gentamicin</td>
<td>2. Vancomycin</td>
<td>Chronic medical condition</td>
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<tr>
<td>recommendations</td>
<td></td>
<td>Immunocompromised</td>
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<tr>
<td>below</td>
<td></td>
<td>Oncologic process</td>
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<tr>
<td></td>
<td></td>
<td>Immunosuppressive medication</td>
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<tr>
<td></td>
<td></td>
<td>Recent hospitalization (&gt;4 days within 2 months)</td>
</tr>
</tbody>
</table>

Patient with Suspected Intra-abdominal Source including those with:
- Central Line
- Chronic medical condition
- Immunocompromised
- Oncologic process
- Immunosuppressive medication
- Recent hospitalization (>4 days within 2 months)

<table>
<thead>
<tr>
<th>Patient with Suspected CNS Source</th>
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</thead>
<tbody>
<tr>
<td>1. Ceftriaxone</td>
</tr>
<tr>
<td>2. Vancomycin</td>
</tr>
<tr>
<td>3. Metronidazole</td>
</tr>
</tbody>
</table>

Patient already on broad spectrum antibiotics or patient with history of drug resistance

| 1. Meropenem                     |
| 2. Vancomycin                    |
| 3. Tobramycin                    |

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
   - Azathioprine
   - Tacrolimus
   - Prednisone 2mg/kg/day or ≥ 20mg daily (>2 weeks)
   - Sirolimus
   - Rituximab
   - Cyclosporine
   - Mycophenolate mofetil
   - Anakinra
   - Cyclophosphamide
   - Infliximab
   - Adalimumab
   - Etanercept
3. Rapid Fluid Resuscitation

| Fluid Resuscitation | • First Hour  
|                     | - Rapid Normal Saline or balanced / buffered Crystalloids 20 mL/kg boluses every 5 minutes  
|                     | - Reassess, repeat boluses to improve perfusion |
| Rapid Fluid Infusion | • Push-Pull Technique (<15 kg)  
Techniques | - 30 mL syringe  
|                     | - Macrodrip set up with 3 way stopcock  
|                     | - T connector  
|                     | • Pressure Bag  
|                     | • Rapid infuser with compatible vascular access |
| Volume | • 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 | • 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 | • >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 | • 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 m Hg) |

| Warm Shock | • Vasodilatation, 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

OWNER(S): Dr. Erica Michiels, Dr. Ben Braun, Dr. Adam Nicholson

CONTRIBUTOR(S): Dr. Sharon Smith, Dr. Allison Long, Dr. Julie Gunderson, Dr. Robert Nolan, Dr. Desire Andersen, Nicole Kalinowski CNS, Kellie Joyce CNS, Ashleigh Nurski CNS, Caryn Steenland CNS

EXPERT IMPROVEMENT TEAM (EIT): Children’s Sepsis EIT

CLINICAL PRACTICE COUNCIL (CPC): Children’s Health

CPC APPROVAL DATE: 5/1/23

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

References


# Appendix A

## Considerations on H&P to Identify Source of Infection

<table>
<thead>
<tr>
<th>HPI</th>
<th>Details</th>
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<tbody>
<tr>
<td>Height and duration of fever</td>
<td></td>
</tr>
<tr>
<td>Oral intake/urine output in past 24 hours</td>
<td></td>
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<tr>
<td>Presence of headache, neck pain</td>
<td></td>
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<tr>
<td>Change in behavioral/mental status</td>
<td></td>
</tr>
<tr>
<td>Cough, rhinorrhea, shortness of breath, sore throat</td>
<td></td>
</tr>
<tr>
<td>Abdominal pain/vomiting, diarrhea, fluid loss in past 24 hours</td>
<td></td>
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<tr>
<td>Dysuria frequency, urgency, back pain</td>
<td></td>
</tr>
<tr>
<td>Vaginal discharge, recent sexual activity, LMP if adolescent female</td>
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<tr>
<td>Joint or muscle pain, swelling or redness</td>
<td></td>
</tr>
<tr>
<td>Rash</td>
<td></td>
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<tr>
<td>Any recent wounds/breaks in skin integrity</td>
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<tr>
<td>Ill contact, recent immunizations</td>
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<tr>
<td>Current or recent antibiotic use</td>
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<table>
<thead>
<tr>
<th>PMH</th>
<th>Details</th>
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<tbody>
<tr>
<td>Any underlying illness</td>
<td></td>
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<tr>
<td>Any immunosuppressive condition</td>
<td></td>
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<tr>
<td>Central line</td>
<td></td>
</tr>
<tr>
<td>Past surgical history</td>
<td></td>
</tr>
<tr>
<td>Allergies to medications, contrasts, blood products</td>
<td></td>
</tr>
<tr>
<td>Medication history (steroid treatment &gt;2 weeks)</td>
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<tr>
<td>Birth history</td>
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<tr>
<td>Immunization history</td>
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<table>
<thead>
<tr>
<th>Physical Assessment</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS, weight</td>
<td></td>
</tr>
<tr>
<td>General appearance</td>
<td></td>
</tr>
<tr>
<td>Detailed exam including:</td>
<td></td>
</tr>
<tr>
<td>Rash, signs of meningitis/pneumonia/abdominal infection</td>
<td></td>
</tr>
<tr>
<td>Consider pelvic exam in an adolescent female if concern for PID or retained tampons as the source for sepsis</td>
<td></td>
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</tbody>
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Appendix B

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

<table>
<thead>
<tr>
<th>Blood Culture</th>
<th>Peripheral Blood Culture</th>
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<tbody>
<tr>
<td></td>
<td>Central Line Blood Culture (all lumens, if applicable)</td>
</tr>
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<table>
<thead>
<tr>
<th>Laboratory Studies</th>
<th>All Patients</th>
<th>Septic Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>POC Glucose</td>
<td></td>
<td>Type and Screen</td>
</tr>
<tr>
<td>iStat/VBG</td>
<td></td>
<td>CRP</td>
</tr>
<tr>
<td>Lactate</td>
<td></td>
<td>PT/INR</td>
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<tr>
<td>CBC with differential</td>
<td></td>
<td>PTT</td>
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<tr>
<td>Comprehensive Metabolic Panel</td>
<td></td>
<td>Fibrinogen</td>
</tr>
<tr>
<td>Procalcitonin</td>
<td></td>
<td><em>Cortisol if clinically indicated</em></td>
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<tr>
<td></td>
<td></td>
<td>Amylase/Lipase</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Urine</th>
<th>Urinalysis and Urine Culture</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Urine HCG (all females &gt;12 years or younger if menses begun)</td>
</tr>
</tbody>
</table>

| 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*