Neonatal Sepsis - Emergency Department

**Indication Criteria**
- Any patient 0-28 days old with clinical concern for neonatal sepsis/septic shock OR
- Sepsis RED AND
- ED Attending/Fellow assessment with concern for neonatal sepsis/septic shock

**Exclusion Criteria:**
- Burn patients

**Primary team huddle to evaluate for sepsis**
- RN/Team Leader, LIP, Surgeon when appropriate
  - Notify Attending
  - Deviation from pathway requires detailed documentation

**Activate Neonatal Sepsis Pathway/Order Set**
- Provide supplemental oxygen as needed (oral/nasal ETCO2 for perfusion deficits)
- Reassess vital signs every 5 minutes
- Order appropriate antibiotics

**Diagnosis Evaluation**
- Blood/urine cultures
- iSTAT VBG
- POCT Glucose
- CBC + diff
- UA
- BMP
- CRP
- Procalcitonin
- Consider Type & Screen
- Lactate-order STAT
- Magnesium
- Phosphorus
- Lumbar puncture
- Consider PT/PTT/d-dimer
- STAT lytes
- Correct LFTs
- Consider PT
- Consider Broadening antibiotic coverage
- Consider hydrocortisone stress dosing in pt. with adrenal insufficiency or petechia
- Surgery consult for suspected infection requiring source control (e.g., skin/soft tissue, intra-abdominal)
- Correct glucose and electrolytes

**Administer Antimicrobials**
- Click here for appropriate antibiotics for specific populations:
  - Central line infections
  - Previously healthy patients with/without intra-abdominal source
  - Medically complex patients with/without intra-abdominal source
  - Consider NEC with abdominal symptoms
  - Acyl-CoA if clinical concern for HSV
  - Consider broadening antibiotic coverage
  - Surgery consult for suspected infection requiring source control (e.g., skin/soft tissue, intra-abdominal)

**Initial Resuscitation**
- Administer 1st bolus of 10-20mL/kg normal saline RAPIDLY via push-pull or pressure bag within 5-15 minutes
- Consider 5-10mL/kg boluses if concern for fluid intolerance (cardiac/renal dysfunction)
- Consider hydrocortisone stress dosing in pt. with adrenal insufficiency or petechia/purpura

**Ongoing Resuscitation**
- Administer 2nd and 3rd bolus of 20mL/kg normal saline RAPIDLY via push-pull or pressure bag, until perfusion improves or rates or hepatomegaly develop
- Order vasoactive/inotropic drips
- Consider blood products
- If suspect CHD, start prostaglandin
- Consider hydrocortisone for fluid refractory shock
- Treat seizure activity

**Bedside Huddle**
- with ED, ICU +/- Inpatient Admitting LIP
- LIP-Document outcome of huddle
- RN-Sepsis reassessment

**ICU Admit/Transfer to AC**
- Little Rock Criteria: Any of the following and/or other concerning clinical findings:
  - Ventilatory support
  - Vasoactive/inotropic support
  - Hypotension despite fluid resuscitation volume
  - Lactate ≥ 4 mmol/L
  - pH < 7.3
  - Base excess greater than -6 mmol
  - Ill appearing
  - Cold shock
  - Tachycardia not resolved after intervention
  - CR > 3 sec after ≥ 60mL/kg NS boluses
  - Need for critical care management
  - MAP < 40 mmHg

**Inpatient Admit Criteria**
- (ACNW – use clinical judgement for transfer to ACLR)
  - Normotensive after ≤ 40mL/kg NS boluses
  - Well appearing with reassuring labs
  - First dose of antibiotics administered
  - Improving tachycardia
  - Improving respiratory support
  - Intubate if hypo or apneic
  - Normotensive after 40-60mL/kg NS boluses
  - Increased assessment needs increased vital sign needs
  - Increased HFNC support

**Respiratory Support**
- Intubate if hypo or apneic, fluid refractory shock, or if starting PGE using shock safe medications

**Emergency Department**
- Consider alternate diagnostics:
  - Ductal dependent congenital heart disease
  - Congenital adrenal hypoplasia
  - Inborn errors in metabolism
  - Arrhythmias
  - CMS-P

**SHOCK TIME GOALS**
- Bolus in 20 minutes from time zero
- Antibiotics in 60 minutes from time zero

**Neonatal Sepsis**
- Hypotension (MAP < 40 mmHg)
- Tachycardia
- Poor perfusion
- Reduced urine output/poor feeding
- Tachypnea/new oxygen requirement/ grunting/cyanosis/apnea
- Mental status changes/tachycardia
- Fever ≥ 38°C or hypothermia ≤ 35°C

**Assessment**
- Consider umbilical line if cord stump still present
- If 2 unsuccessful IV attempts: consider IO

**Access**
- Place PIV
- Consider PIV in patients with central line
- Consider umbilical line if cord stump still present
- If 2 unsuccessful IV attempts: consider IO

**ICU Admit Criteria (ACNW – use clinical judgement for transfer to ACLR)**
- Normotensive after ≤ 40mL/kg NS boluses
- Well appearing with reassuring labs
- First dose of antibiotics administered
- Improving tachycardia

**IMU Admit Criteria**
- (ACNW – use clinical judgement for transfer to ACLR)
  - Need for monitored bed
  - Normotensive after 40-60mL/kg NS boluses
  - Increased assessment needs increased vital sign needs
  - Increased HFNC support

**Emergency Department**
- Consider umbilical line if cord stump still present
- If 2 unsuccessful IV attempts: consider IO

**Biopsies**
- Consider broadening antibiotic coverage

**Hospitalization**
- Surgery consult for suspected infection requiring source control (e.g., skin/soft tissue, intra-abdominal)
Neonatal Sepsis – General Care Inpatient Phase

**Inclusion Criteria:**
- Any patient 0-28 days old with clinical deterioration AND concern for
  - New or evolving neonatal sepsis/septic shock AND/OR that flags Sepsis RED

**Exclusion Criteria:**
- Burn and ICU patients

**Primary team huddle to evaluate for sepsis (RN/Team Leader, IP, Surgeon when appropriate)**
- Not Ry Attending
- Call MET
- Consider transfer to IMU/ICU

**Rapid Response/MET**

**Activate Critical Sepsis Pathway**
- Provide supplemental oxygen as needed (oral/nasal ETCO2 for perfusion deficits)
- Reassess vital signs every 5 minutes
- Order appropriate antibiotics

**Diagnostic Evaluation**
- POCT: Electrolytes, VBG, lactate, iCa, Glucose
- Procalcitonin
- Blood glucose/CSF cultures
- CBC + diff
- CMP
- LFTs
- Magnesium
- Phosphorus
- Consider Type & Screen
- Consider PT/PTT/d-dimer
- UA/urine microscopy
- Lumbar puncture

**Administer Antimicrobials**
- Click here for appropriate antibiotics for specific populations:
  - Central Line Infections
  - Previously healthy patients with/without intra-abdominal source
  - Medically complex patients with/without intra-abdominal source
  - Consider NEC with abdominal symptoms
  - Ayclovir if clinical concern for HSV
  - Consider broadening antibiotic coverage
  - Surgery consult for suspected infection requiring source control (e.g. skin/soft tissue, intra-abdominal)

**Access/Initial/Fluid Resuscitation**
- Consider IV in patients with central line if additional access is needed
- Administer 1st bolus of 10-20 ml/kg normal saline rapidly over 20 minutes OR LESS
- Consider 5-10ml/kg boluses if concern for fluid intolerance (cardiac/renal dysfunction)

**Ongoing Resuscitation**
- Consider administration of 2nd and 3rd boluses of 20ml/kg normal saline rapidly over 20 minutes OR LESS as clinically indicated
- Order vasoactive/inotropic drips as indicated
- Consider blood products as indicated
- BMT patients: consider vasoactive/inotropic drips after 2nd NS bolus
- Consider cardiogenic shock
- Consider PICU consult or calling a code

**Re-Evaluation**
- Well-appearing patients who do not meet IMU/ICU transfer criteria, may stay on Inpatient unit and are placed on WATCHER list for reassessment

**MET Debrief**
- Does patient meet IMU/ICU transfer criteria?

**ICU Transfer Criteria**
- Recurrent hypotension despite > 40ml/kg fluid resuscitation in the last 12 hours
  - Fluid resuscitation includes either crystalloid or colloid
  - MAP <40 mm/Hg
- Clinical situation not appropriate for ongoing fluid resuscitation
  - Defined as underlying cardiac disease, lung disease, existing fluid overload, impaired renal function
  - Lactate ≥ 4 or base excess < -4 mmol
  - Sustained change in mentation from baseline or perfusion (central CR > 2 seconds) for at least 15 minutes
  - Patient requires continuous ICU monitoring or ICU level respiratory support

**Transfer to ICU**
- (ACNW – use clinical judgement for transfer to ACLR)
  - Initiate vasoactive/inotropic drips for Fluid Refractory Shock
  - Epinephrine for cold shock
  - Norepinephrine for warm shock
  - Titrate drips to resuscitation goals

**Intermediate Care (IMU) Transfer Criteria**
- Resolved hypotension requiring intervention (≤5th percentile for age)
  - MAP <40 mm/Hg
- Need for continuous cardiorespiratory monitoring
- Need for 3rd normal saline fluid bolus
- IMU Admission, Transfer, and Discharge Criteria

**Shock Time Goals**
- Bolus in 20 minutes from time zero
- Antibiotics in 60 minutes from time zero
- **Bolus in 20 minutes from time zero**
- **Antibiotics in 60 minutes from time zero**

**Correct glucose and calcium**
Medication Dosing for Neonatal Sepsis

Dosing is for normal renal function

<table>
<thead>
<tr>
<th>Antipyretics – Choose one</th>
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<tbody>
<tr>
<td>□ Acetaminophen 15 mg/kg, PO, q6 PRN fever</td>
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<tr>
<td>□ Acetaminophen 20 mg/kg, Rectal, q6 PRN fever</td>
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<tr>
<td>□ Acetaminophen 15 mg/kg, IV, q6 PRN fever</td>
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<thead>
<tr>
<th>Antibiotics: Previously healthy patients</th>
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<tr>
<td>□ Ampicillin 100 mg/kg q8h ≤ 7 days old</td>
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<tr>
<td>□ Ampicillin 75 mg/kg q6h &gt; 7 days old</td>
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<tr>
<td>□ Cefepime 50 mg/kg, IV, q12h</td>
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<tr>
<td>□ Acyclovir only if suspect HSV 20 mg/kg q8h</td>
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<tr>
<th>Antibiotics: Medically Complex Patients</th>
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<tbody>
<tr>
<td>□ Cefepime 50 mg/kg, IV, q12h</td>
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<tr>
<td>□ Vancomycin only if suspect MRSA 15 mg/kg IV, q12h ≤ 7 days old</td>
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<tr>
<td>□ Vancomycin only if suspect MRSA 15 mg/kg IV, q8h &gt; 7 days old</td>
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<tr>
<th>Hypocalcemia</th>
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<tbody>
<tr>
<td>□ Calcium gluconate in dextrose 5%-IV</td>
<td>50 mg/kg, IV, once</td>
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<tr>
<th>Adrenal insufficiency</th>
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<tbody>
<tr>
<td>□ Hydrocortisone 2 mg/kg, IV, once</td>
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<tr>
<th>Hypoglycemia – serum glucose &lt; 60 mg/dL</th>
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<tbody>
<tr>
<td>□ D10 Bolus 5 mL/kg, IV, once</td>
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<td>□ D25 Bolus 2 mL/kg, IV, once</td>
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<tr>
<td>□ D50 Bolus 1 mL/kg, IV, once</td>
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<th>Intubation</th>
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<tr>
<td>□ Atropine 0.02 mg/kg (max 0.5 mg)</td>
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<tr>
<td>□ Ketamine 2 mg/kg (max 100 mg)</td>
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<td>□ Rocuronium 1.2 mg/kg (max 100 mg)</td>
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<tr>
<td>□ Sugammadex (for NMB reversal) 16 mg/kg</td>
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<tr>
<th>Vasoactive</th>
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<tr>
<td>Dopamine – titrate by 2.5 mcg/kg/min based on MAP 2.5 mcg/kg/min – 20 mcg/kg/min</td>
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<tr>
<td>Epinephrine – titrate in small increments based on perfusion (drug of choice for inotropy in pediatric shock) 0.05 - 2 mcg/kg/min</td>
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<tr>
<td>Norepinephrine – titrate in small increments to achieve normal MAP 0.05 - 2 mcg/kg/min</td>
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<tr>
<td>Milrinone – no bolus; no titration 0.3 - 0.5 mcg/kg/min</td>
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<tr>
<th>Anticonvulsants</th>
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<tr>
<td>Keppra (loading dose) 20 - 40 mg/kg</td>
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<tr>
<td>Ativan 0.1 mg/kg</td>
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Metrics

1. Time to first normal saline bolus from positive sepsis red screen
2. Time to first antibiotics from positive sepsis red screen
3. Blood culture collection time and result
4. Huddle completed for patients that screen sepsis red
5. Neonatal sepsis order set usage in ED and Inpatient areas
6. Number of neonatal sepsis/septic shock diagnoses added to problem list
Contributing Members

Jennifer Perry, MD – Emergency Medicine
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References


