Intrauterine Infection and Inflammation: Implications for Mom, Baby and You

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Disclosures

• Employed by MHealth who is a sponsor of the conference

Objectives

• Explain the change in terminology from chorioamnionitis to Intrauterine Infection and Inflammation (Triple I) and the pathophysiology leading to suspected diagnosis
• Describe treatment algorithms used to care for mom and baby
• Discuss impact of treatment approaches to nursing care and patient experience and satisfaction
Statistics

- Complicates 1-4% of term deliveries
  - 7% of pregnancies with premature rupture of membranes (PROM)
  - 40% of women with PROM > 24 hours
  - 12% of women who undergo Primary cesarean section after labor
  - 20% of women with > 8 digital vaginal deliveries
- Complicates 40-70% of preterm deliveries
  - Secondary to preterm labor or preterm premature rupture of membranes (PPROM)
  - 20-25% of pregnancies with PPROM not treated with antibiotics develop Triple I

Risk Factors

- Prolonged labor
- Prolonged ROM
- Cervical insufficiency
- Nulliparity
- Meconium stained amniotic fluid
- Internal fetal/uterine monitoring
- Genital Tract Pathogens (STI, GBS, BV)
- Alcohol/Tobacco use
- Previous Triple I
- Multiple digital exam post ROM (may actually be due to prolonged labor/rupture)

Pathophysiology
• Triple I and Maternal Complications
  – Sepsis, Prolonged labor, Wound infection, Need for Hysterectomy, Postpartum Endometritis, Postpartum Hemorrhage, Adult Respiratory Distress Syndrome, Intensive Care Admission, and Maternal Mortality

• Triple I and Fetal/Infant Complications
  – Neonatal pneumonia, meningitis, sepsis, death, bronchopulmonary dysplasia, cerebral palsy

• Chorioamnionitis
  – Inflammatory or infectious disorder of the chorion, amnion, or both
  – This is a histologic diagnosis that we “clinically suspect” and making this diagnosis can trigger unnecessary treatment for both mom and baby

• Triple I
  – Takes into consideration the more heterogeneous nature of conditions that can cause inflammation and infection with varying degrees of severity and duration
  • Extends to chorion, amnion, amniotic fluid, decidua
  • Inflammation: Edema, swelling and irritation of tissue
  • Infection: Inflammation with concurrent invasion of bacteria, virus, fungus or other infectious agent
Take Home Point

Triple I differentiates presence of fever FROM infection or inflammation or both

Pre-Triple I: Clinical Choriomamionitis

- Fever PLUS 1 or 2 of the following:
  - Maternal leukocytosis (>15,000)
  - Fetal tachycardia
  - Foul smelling amniotic fluid
  - Maternal tachycardia
  - Uterine tenderness

- Variance from provider to provider, became fever and a clinical suspicion>>>many moms and babies treated

<table>
<thead>
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Fever AND at least 1 below:
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- Fetal tachycardia
- Foul smelling fluid

Suspected Triple I AND at least 1 below:
- Amniocentesis, with positive gram stain
- Amniocentesis, with positive culture or low glucose
- Pathologic path showing histological infection

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<th>Table 1: Analysis of Induced Maternal Fever and Triple I Criteria (cont’d)</th>
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Sources of Isolated Fever

- Epidural anesthesia
- Room temperature
- Prostaglandin use
- Hyperthyroidism
- Dehydration

Clinical Chorioamnionitis vs. Suspected Triple I

- Fever PLUS ANY of the following:
  - Maternal leukocytosis (>15,000)
  - Fetal tachycardia (>160 BPM)
  - Purulent fluid from the cervical os
  - Maternal tachycardia
  - Uterine tenderness
- Temperature is assessed twice 30 min apart allowing for earlier recognition and treatment: these should be ORAL temperatures with no ice/water for 15 minutes before measurement.

What next with Suspected Triple I?
Labor Team Communication

- Labor RN: Communicate maternal fever to Obstetric Provider Team, Huddle prn
- Obstetric Provider Team: Discuss potential sources, communicate plans for evaluation, and plan for interventions per clinical pathway
- If patient meets criteria for Suspected Triple I and other sources of fever eliminated, initiate Antibiotic treatment
- Notify Newborn Care team of treatment initiated for suspected Triple I

Why is this important???

TO DECREASE RISK OF MATERNAL SEPSIS
AND
INITIATE APPROPRIATE CARE AND ASSESSMENTS FOR BABY
Sepsis

- Leading cause of death in the US and the #1 cause of death in the ICU
- Severe sepsis and septic shock are important contributors to maternal mortality
- Early detection and the application of time-sensitive and standard therapies can improve outcome and survivability

Maternal Sepsis

- **Septic shock** affects 0.002-0.01% of all deliveries. 0.3-0.6% of all septic patients are pregnant. Maternal Sepsis has increased over the last decade due to:
  - Older maternal age at delivery
    - Obesity, diabetes, chronic HTN, placental abruption and placenta accreta
    - Infertility and multi-fetal gestation
  - Obesity
    - HTN, DM, Cesarean, cardiopulmonary complications

Definitions

- **Systemic Inflammatory Response Syndrome (SIRS)**
  Inflammatory process that can be generated by infection or by non-infectious causes (burns, trauma)

- **Sepsis**
  The systemic inflammatory response syndrome that occurs during infection (Society Critical Care Medicine 2001 consensus statement)

- **Septic shock**
  - Vascular collapse secondary to an infectious process
  - Usually components of hypovolemic and cardiogenic shock
When the obstetric patient has 2 of the following signs, maternal evaluation of sepsis should begin.

1. Temperature >38.3°C (101 F) or less than 36°C
2. Respiratory rate > 24 breaths per minute
3. Blood glucose > 140 in a known non diabetic condition and has not received betamethasone
4. Extremely altered mental status (determined by nurse charting mental status as confused, obtunded, semicomatose, unresponsive, or somnolent)
5. Heart rate > 110 bpm
6. WBC >20 or <4

When there is concern for maternal sepsis, the OB provider should consider ordering the following labs (INR, Platelets, Creatinine, Bilirubin, Lactic Acid) to evaluate for organ dysfunction.

- Organ Dysfunction includes one or more of the following:
  1. INR>1.5
  2. Plt<100
  3. Cr>1.5, Cr incr of 0.5
  4. Bilirubin>2
  5. Lactic acid>2

Maternal Sepsis Diagnosis

- Rapid Response Team Management
- Rapid fluid infusion
- Antibiotics
- Monitoring vital signs
- Transfer to a higher level of care
Intrapartum Baby Stratification

Once Suspected Triple I diagnosed by OB Provider Team:

Preparation for delivery of newborn and required interventions begins!!!

• Is this baby well enough to stay with mom?
• What are the signs and symptoms of EOS (Early Onset Sepsis)?
• Now we need to learn newborn IV therapy?
• What are the assessments for newborns at risk for EOS?
What does nursing need to know-(cont)

- Do these newborns need closer monitoring?
- How do we staff for these babies?
- Epic modifications for documentation
- Escobar build

Care of the Newborn-education needs

- Newborn IV management
- Antibiotic administration
- Early Onset Sepsis signs and symptoms
- Central capillary refill and blood pressure assessments- mean cuff pressure
- Pulse oximetry- assessed with vital signs
Staff Roles and Responsibilities

<table>
<thead>
<tr>
<th>Roles for Newborn Early Onset Sepsis</th>
<th>NICU/NURSE</th>
<th>MD</th>
<th>APP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NICU/APP</td>
<td>[ ] PIV start kit</td>
<td>[ ] Venipuncture/Arterial stick</td>
<td>[ ] Umbilical Cord Cart</td>
</tr>
<tr>
<td>NICU/L&amp;D</td>
<td>[ ] Microbore tubing-60</td>
<td>[ ] One Link IV connector (hub)</td>
<td>[ ] Space Lab Monitor BP cuff</td>
</tr>
<tr>
<td>L&amp;D/NFCC</td>
<td>[ ] Medfusion pump/pole</td>
<td>[ ] Space Lab Monitor</td>
<td>[ ] Extra tubing/supplies for PIV</td>
</tr>
<tr>
<td>Supplies</td>
<td>[ ] Microbore tubing-60</td>
<td>[ ] One Link IV connector (hub)</td>
<td>[ ] Space Lab Monitor BP cuff</td>
</tr>
<tr>
<td>Tasks</td>
<td>[ ] Exam</td>
<td>[ ] Assign Apgar’s</td>
<td>[ ] Disposition Decision</td>
</tr>
<tr>
<td></td>
<td>[ ] Space lab monitor</td>
<td>[ ] Update family w/ plan</td>
<td>[ ] Update family w/ plan</td>
</tr>
<tr>
<td></td>
<td>[ ] Place PIV</td>
<td>[ ] Blood Culture</td>
<td>[ ] Label and bring cultures to NICU lab</td>
</tr>
<tr>
<td></td>
<td>[ ] Blood Culture</td>
<td>[ ] Label and bring cultures to NICU lab</td>
<td>[ ] APP to enter Newborn Sepsis Prevention order-set</td>
</tr>
<tr>
<td></td>
<td>[ ] Label and bring cultures to NICU lab</td>
<td>[ ] APP enters .escobarnote and billing note</td>
<td>[ ] Chart interventions (including LDA for the PIV, enter vitals and weight)</td>
</tr>
<tr>
<td></td>
<td>[ ] Release Blood Culture Lab order</td>
<td>[ ] Calculate initial EOS score</td>
<td>[ ] Start Amp (1st) &amp; Gent (2nd) when arrives from main pharmacy</td>
</tr>
<tr>
<td></td>
<td>[ ] Baby Bands</td>
<td>[ ] Start Amp (1st) &amp; Gent (2nd) when arrives from main pharmacy</td>
<td>[ ] Continue Vital Signs POC glucose</td>
</tr>
<tr>
<td></td>
<td>[ ] Discuss PIV removal with provider</td>
<td>[ ] Pediatric provider to interpret CBC results</td>
<td>[ ] Provider to check on culture results daily</td>
</tr>
<tr>
<td></td>
<td>[ ] Lock PIV</td>
<td>[ ] Provider to check on culture results daily</td>
<td>[ ] Order, PA</td>
</tr>
<tr>
<td></td>
<td>[ ] Complete Antibiotic course</td>
<td>[ ] Provider to check on culture results daily</td>
<td>[ ] Obtain lab draw requisition</td>
</tr>
<tr>
<td></td>
<td>[ ] Replace any infiltrated PIVs</td>
<td>[ ] Pediatric provider to interpret CBC results</td>
<td>[ ] Order, PA</td>
</tr>
<tr>
<td></td>
<td>[ ] Discuss PIV removal with provider</td>
<td>[ ] Pediatric provider to interpret CBC results</td>
<td>[ ] Order, PA</td>
</tr>
<tr>
<td></td>
<td>[ ] Hearing screen after antibiotics are infused</td>
<td>[ ] Pediatric provider to interpret CBC results</td>
<td>[ ] Order, PA</td>
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Newborn Management Highlights

- CBC drawn at 24h
- Blood culture at birth (placenta or peripheral)
- Antibiotics for 48 hrs

Role of the Delivering RN

- Initial EOS scoring with diagnosis
- Preparation of pump and IV tubing
- If at time of delivery the newborn is vigorous, may go skin-to-skin
- Delayed cord clamping
- APP will examine the newborn
- NICU staff will obtain blood cultures from the placenta
Role of the Delivering RN (cont)

• Weigh the newborn asap for antibiotic order
• NICU staff to start IV
• Pharmacy provides RTA antibiotic versus needing to reconstitute
• Labor and Delivery nurse to start IV antibiotic within 1 hour of delivery- preferably Amp
• The labor nurses will determine who will coordinate VS, glucose check, release of Suspected Sepsis order set

Role of the Postpartum RN

• Hand off from Labor and Delivery staff
• Assessment of mother and baby on arrival
• Pediatric notification of newborn on the unit
• PIV restarts- Should the PIV infiltrate, consider if last dose of Ampicillin can be given IM. NICU IV restart versus Vascular Access team
• Timing of hearing screen

Role of the Postpartum RN (cont)

• Discharge timing- the newborn should not be discharged sooner than 48 hours after birth due to antibiotic therapy
• The mother is able to be discharged if meets discharge milestones, baby remains a patient until appropriate
• No change to the newborn bath timing- bath does not need to be delayed or expedited
The clinical signs of early onset sepsis are nonspecific and are associated with the causative organism. Therefore, it is prudent to provide treatment for suspected neonatal sepsis while excluding the presence of infection.

<table>
<thead>
<tr>
<th>General</th>
<th>Central nervous system</th>
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<tbody>
<tr>
<td>Poor feeding</td>
<td>Hypotonia, stupor, poor</td>
</tr>
<tr>
<td>Irritability</td>
<td>spontaneous movement, coma</td>
</tr>
<tr>
<td>Lethargy</td>
<td>Irritability</td>
</tr>
<tr>
<td>Temperature instability</td>
<td>Seizures, rigidity</td>
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<tr>
<td></td>
<td>Bulging anterior fontanelle</td>
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<tr>
<td>Respiratory</td>
<td></td>
</tr>
<tr>
<td>Grunting</td>
<td></td>
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<tr>
<td>Nasal flaring</td>
<td></td>
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<tr>
<td>Intercostal retractions</td>
<td></td>
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<tr>
<td>Tachypnea, apnea, irregular respiration</td>
<td></td>
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<tr>
<td>Abnormal breath sounds, decreased breath sounds, rales</td>
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<tr>
<td>Cirrulatory</td>
<td></td>
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<tr>
<td>Bradycardia, tachycardia</td>
<td></td>
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<tr>
<td>Hypotension</td>
<td></td>
</tr>
<tr>
<td>Cyanosis</td>
<td></td>
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<tr>
<td>Decreased perfusion (pallor, gray, mottled, ashen, delayed capillary refill)</td>
<td></td>
</tr>
<tr>
<td>Metabolic</td>
<td></td>
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<tr>
<td>Hypoglycemia/Hyperglycemia</td>
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<tr>
<td>Other</td>
<td></td>
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<tr>
<td>Jaundice</td>
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A frequent indication of serious infection is an inability to maintain the body temperature in the neutral thermal zone (usually 97.7°F and 99°F axillary).

### Frequency of Vital Signs (HR, RR, Temperature, Oxygen Saturation and Central Capillary Refill)

- At Birth
- Every 15 minutes X4
- Every 30 minutes X4
- Every 2 hours X4
- Every 3-4 hours with feeding cues and cares

### Blood pressure (including mean pressure)

- Once in the delivery room within 2 hours after birth
- Every 3-4 hours with feeding cues and cares
The newborn will receive more frequent monitoring of clinical presentation and vital signs for the first 12 hours. Notify the APP if the newborn has, at least 2 instances of 1 of the following, with "instance" meaning that there were 2 measurements 2 hours apart.

- Report abnormal findings to the APP:
  - Heart rate greater than 160
  - Temperature greater than 100.4°F or less than 97.5°F
  - Respiratory distress (grunting, flaring, or retraction)

**IMPORTANCE OF MEAN CUFF PRESSURE**

- It is important to obtain, monitor and document mean cuff pressure (arterial pressure [MAP]) in the newborn born with risk of early onset sepsis.
- The mean pressure is an important indicator of blood pressure change, and represents the newborn’s average tissue perfusion pressure.
- Mean cuff pressure values are easier to trend than changes in systolic or diastolic pressures.

**ASSESSING CENTRAL CAPILLARY REFILL**

- Hypotension with decreased perfusion and diminished pulses are signs of early onset sepsis. In addition to vital signs like blood pressure, signs of decreased perfusion must be evaluated in the newborn at risk for EOS.
- Central capillary refill will be evaluated with each vital sign.

1. Blanch the skin on the newborn’s chest.
2. Watch for blood return.
3. If capillary refill takes greater than 3 seconds, report capillary refill time, blood pressure, and mean cuff pressure to the NNP.
The newborn at risk for early onset sepsis is at risk for metabolic symptoms including hypoglycemia. Blood glucose will be checked in the delivery room 30 minutes after the first feeding attempt but no later than 2 hours of age. If the baby has other risk factors for hypoglycemia, initiate the hypoglycemia order set and algorithm.

How should I staff for these babies?

- Labor: Staff a nurse for mom and a nurse for baby with the delivery.
- Postpartum: Consider staffing up the first several hours of life.
- Utilize the Resource Nurse to assist with vitals, etc.

Patient Experience

- “I felt so comfortable having my baby in my room with me and knowing that we both had the same nurse, put me at ease.”
- “I am so thankful to have my baby with me. I can hold her and breastfeed anytime I want.”
- “Thank you for letting my baby stay with me.”
**Maternal discharge instructions**

- Call with fever > 100.4°F, abdominal pain not assisted with pain medications, pus-like discharge from wound, shortness of breath, racing heart rate, low urine output
- Discharge RN communication:
  - Reiterate patient treated for uterine infection and potential for recurrence/worsening of infection despite receiving appropriate treatment
  - Encourage communication with any concerning symptoms to OB Provider Team

**Baby discharge instructions**

- Call with fever > 100.4°F or low temperature < 98°F (rectal measurement), poor feeding, lethargy
- Postpartum RN:
  - Reiterate maternal and newborn treatment for concerns for uterine infection during labor
  - Encourage communication with Pediatric Provider with any concerning symptoms

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**References**

- Committee on Obstetric Practice. Committee Opinion No. 35: intrapartum management of intraamniotic infection. Obstet Gynecol 2017;130:50.