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Name of CPM: **Newborns At Risk for Sepsis**

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**WHAT IS A CARE PROCESS MODEL?**

Care Process Models strive to ensure that all care delivered by the health system, regardless of a patient’s location in the continuum, is medically necessary, the leading edge in medical science, and the appropriate treatment intensity. Put into effect, these models will systematize treatment processes across all hospitals and practices, improving consistency as well as effectiveness. This CPM summarizes Mission Health’s multidisciplinary care of newborns at risk for sepsis.

**WHAT IS MULTIDISCIPLINARY CARE?**

Multidisciplinary care is agreed-upon, interdisciplinary, patient-centered, disease-focused, care delivery systems that are informed by a series of evidence-based Care Process Models. Multidisciplinary care supports the achievement of the BIG(GER) Aim systematically across the continuum of care.

**WHAT ARE THE BENEFITS OF A CPM?**

- Reduces variation
- Utilizes the best practice from literature and expert opinion
- Improves care delivery repetition
- More readily exposes errors
- Variation study informs revisions to CPMs
**Risk factors for Neonatal Early Onset Sepsis**
- Chorioamnionitis (regardless GBS status)
- GBS colonized (positive) mother
- Maternal fever > 100.4 intrapartum
- ROM > 18 h
- Preterm gestation < 37 weeks
- Previous child with GBS disease
- Maternal GBS bacteriuria during pregnancy

**Focus on Reducing Early On-set Neonatal Sepsis**
Early onset sepsis is a significant cause of morbidity and mortality in neonates. Risk factors for early onset sepsis have been identified and interventions to mitigate those risk factors have been well-studied. This CPM incorporates the best evidence around reducing neonatal sepsis with the goal of helping our region:
- Prevent Early Onset Neonatal Sepsis
- Follow safe, established guidelines that reduce risk and minimize over treatment
- Keep mother-baby couplet together

### I. PRENATAL CARE - Assess for GBS colonization during pregnancy

<table>
<thead>
<tr>
<th>Women are considered colonized with GBS if they have:</th>
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<tr>
<td>- Bacteriuria with GBS (at any CFU level) anytime during this pregnancy</td>
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<tr>
<td>- Previous infant with GBS disease</td>
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<tr>
<td>- Positive GBS swab anytime during this pregnancy</td>
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| - Perform rectovaginal GBS swab routinely at 35-37 weeks EGA and in cases of threatened preterm labor (unless patient was already found to be GBS colonized due to bacteriuria or previous infant with GBS disease) |
| - Swab should be of lower vagina and rectum (pass swab through anal sphincter) |

**TIP** If patient is allergic to penicillin, request susceptibilities with GBS swab and with any urine culture in pregnancy

| - If a GBS swab is done prior to 35 weeks and returns negative, it should be repeated in 5 weeks, since earlier GBS swabs are less predictive of colonization at term. |
| - If a GBS swab is done at ≥ 35 weeks and returns negative, it does NOT need to be repeated, even if delivery does not occur within 5 weeks |

**TIP** Once a patient is found to be GBS colonized (by history, urine or swab), they are considered to be colonized for the duration of the pregnancy; if a GBS swab is erroneously ordered and returns negative, it should be disregarded and the patient still treated as GBS colonized.
- All pregnant patients, including those with scheduled Cesarean Delivery, require a GBS swab, except those already identified as GBS colonized by bacteriuria this pregnancy or history of previous infant with GBS disease.

II. L&D ADMISSION- Assess need for intrapartum antibiotic prophylaxis (IAP)

- **GBS Bacteriuria this pregnancy?**
  - Yes: Initiate GBS IAP in labor
  - No: **GBS result available?**
    - Yes: (TIP) Start IAP if ROM ≥ 18 hours for GBS-unknown patients who are ≥ 37 wks
    - No: Obtain GBS culture, Initiate GBS IAP, Continue IAP until delivery, May stop IAP if swab returns negative

  - No: **EGA**
    - <37 wks: Obtain GBS culture, Initiate GBS IAP, Continue IAP until delivery, May stop IAP if swab returns negative
    - ≥37 wks: No IAP needed unless ROM >18 hrs

  - **No**

(TIP) Start IAP if ROM ≥ 18 hours for GBS-unknown patients who are ≥ 37 wks
III. PATIENT IN LABOR- Initiate intrapartum antibiotic prophylaxis if indicated

Antibiotic prophylaxis indicated if
- GBS colonized
- GBS unknown ≤ 37 weeks 0 days
- GBS unknown ≥ 37 weeks 0 days if ROM ≥ 18 hours.

Cesarean delivery does not require GBS prophylaxis, even if patient is GBS colonized, as long as not in labor and has intact membranes.

Antibiotic regimen:

Ampicillin 2 g IV then 1 g IV q 4 hrs until delivery
OR
Penicillin G 5 million units IV, then 2.5 million units IV q 4 hrs until delivery

*If penicillin allergic and low risk for anaphylaxis (rash, GI side effects) give:* Cefazolin 2 g IV then 1 g IV q 8 hrs until delivery

*If penicillin allergic and high risk for anaphylaxis (hives, throat swelling, respiratory symptoms), review susceptibilities (if available) and give:* Clindamycin 900 mg IV q 8 hrs (ONLY if isolate proven susceptible to clindamycin AND erythromycin)
OR
Vancomycin 1 g IV q 12 hrs (if resistant to either clindamycin OR erythromycin or if susceptibility unknown)

[TIP]: Adequate IAP means delivery occurs at least 4 hours after maternal antibiotics were initiated (1 dose is considered adequate prophylaxis as long as 4 hours have elapsed).

IV. THROUGHOUT LABOR- Assess for development of chorioamnionitis

- Diagnosis:
  - A single maternal fever ≥ 100.4°F alone is adequate for a presumptive diagnosis of chorioamnionitis (in the absence of a clear alternative etiology for the fever, such as flu or other non-obstetrical infection), and empiric antibiotic treatment for chorioamnionitis in this setting is recommended since maternal treatment of chorioamnionitis decreases the risk of neonatal sepsis.
  - Findings that lend additional support to a chorioamnionitis diagnosis include maternal tachycardia > 100 bpm, maternal leukocytosis >15,000 cells/mm³, uterine tenderness, foul-smelling amniotic fluid and fetal tachycardia > 160 bpm.
**{TIP}**: Minimize the administration of antipyretics to patients with only mildly elevated temperatures (<100.4) as this can mask a true fever (≥100.4) that would lead to a diagnosis of chorioamnionitis.

**{TIP}**: A maternal fever **up to 1 hour after delivery** is considered diagnostic of presumed chorioamnionitis and infants should be managed according to the chorioamnionitis algorithm. Decisions about maternal antibiotics in the setting of a post-partum fever are deferred to the maternal provider’s clinical judgement.

Note that a maternal fever up to 12 hours after delivery could signal increased risk for early onset neonatal sepsis. The pediatric provider should be informed of the maternal fever and the maternal provider’s clinical assessment, then determine if neonatal interventions are warranted.

- Treatment should be initiated immediately since early initiation of antibiotic treatment reduces risk of fetal infection. Treatment requires gram positive and gram negative coverage, typically:
  
  Gentamicin 1.5 mg/kg IV q 8 hr or 5mg/kg IV q 24 hr
  
  AND
  
  Ampicillin 2 g IV q 6 hr *

* If penicillin-allergic, then give one of the following in place of ampicillin:

  - cefazolin 2 g IV q 6 hr (if LOW risk for anaphylaxis)
  - clindamycin 900 mg IV q 8 hr (if HIGH risk for anaphylaxis AND GBS culture susceptible to clindamycin)
  - Vancomycin 1g IV q 12 hrs (if HIGH risk for anaphylaxis AND GBS resistant to clindamycin OR susceptibilities unknown)

**{TIP}** If chorioamnionitis is diagnosed, use the “OB Chorioamnionitis Antibiotics Subplan” to find the above antibiotic regimens, to indicate the clinical criteria used to make the diagnosis, and to facilitate the flow of crucial information to the infant provider.
V. Assess Newborn Risk

VI. Recommendation for Care of Symptomatic Newborn

Any newborn infant with clinical signs of sepsis (respiratory distress, apnea, pallor with poor peripheral perfusion, temperature instability, and/or metabolic acidosis) should have:

- admission to NICU
- a full diagnostic evaluation (CBC/diff and a single blood culture; NICU provider to consider CXR and LP)
- broad spectrum antibiotics (ampicillin and gentamicin)

{TIP} 1 mL of blood is ideal volume for blood culture in newborns.
VI. Care of Well-Appearing Newborns

Well-appearing infants born to mothers with GBS colonization or unknown status are treated based on risk level.

Care of the Well-Appearing Newborn at Risk for Sepsis (GBS)

Maternal factors:
- GBS colonization: GBS in urine this pregnancy, GBS disease in infant in prior pregnancy, GBS swab positive this pregnancy
- IAP required for: GBS colonized; GBS unknown and < 37 weeks 0 days; GBS unknown (at any EGA) with ROM ≥ 18 hours
  - Adequate IAP = Mother received 1st dose Ampicillin or Cefazolin > 4 hrs prior to delivery
  - Inadequate IAP = Mother received 1st Ampicillin or Cefazolin < 4hrs prior to delivery (or not at all) or received Clindamycin or Vancomycin

Treatment Protocol for Newborns born to GBS positive or GBS unknown moms

These recommendations are for newborns ≥ 35 weeks who are asymptomatic. Infants < 35 weeks are admitted to the NICU.

Abnormal Lab Results
- Newborn provider to consider antibiotics.
- If antibiotics initiated, close observation / monitoring for 12 – 24 hours.
- NB hospital stay ≥ 48 hrs

Well appearing infants born to mothers with Chorioamnionitis are treated based on risk level.

Care of the Well-Appearing Newborn at Risk for Sepsis (Maternal Chorioamnionitis)

Chorioamnionitis: Maternal fever ≥ 100.4°F without clear alternative explanation is adequate for a presumptive diagnosis of chorioamnionitis, even in the absence of other features: tachycardia > 100, leukocytosis, uterine tenderness, foul-smelling amniotic fluid or fetal tachycardia > 160.

Dedicated NRP team attends delivery if maternal Chorioamnionitis is diagnosed.
• Note
  o CBC with differential is considered abnormal* when one of the following is present:
    ▪ Leukopenia (WBC <5000)
    ▪ ANC <2000
    ▪ Thrombocytopenia (Platelets <100,000)
    ▪ I/T ratio > 0.2
      • I/T ratio is calculated by dividing the immature neutrophils (bands, myelocytes, metamyelocytes) by the total neutrophils (immature plus segmented neutrophils)
  *Other etiologies may account for abnormalities, such as pre-eclampsia
  o A 2012 study of over 166,000 neonates found that using a cut-off of I:T > 0.2:
    ▪ 54.6% sensitivity
    ▪ 73.7% specificity
    ▪ 99.2% negative predictive value
    ▪ 2.5% positive predictive value for early onset neonatal sepsis.
  • The strength of the I:T ratio is therefore in its negative predictive capacity: an infant with an I:T < 0.2 is 99.2% likely to not have sepsis.
  o Infants who are started on empiric antibiotics due to risk level or laboratory abnormalities should be monitored for 12-24 hours for apnea or other symptoms of sepsis.

Well-Appearing Newborns Receiving Empiric Antibiotics

Determine duration of empiric antibiotics
  o Repeat CBC w/diff 24 hrs after initial CBC w/diff
  o Draw two CRPs 24 hours apart (first drawn no earlier than 12 hrs of life)
  • If positive blood culture, discuss with NICU provider need for NICU transfer for treatment of sepsis.
  • The combination of a negative blood culture, two normal CBCs w/diff and two normal CRP values is reassuring that the infant does not have sepsis, with a negative predictive value of >99.5%. Empiric antibiotics could be discontinued after 48 hours.
  • Negative blood culture but abnormal CBC w/diff and/or CRP may warrant 5-7 days of antibiotics.

V. Administration of Newborn Antibiotics

For symptomatic newborns: continuous IV fluids (Dextrose concentration based on serum glucose monitoring and fluid requirements)
For asymptomatic newborns: 24 gauge IV catheter insertion for intermittent medication administration and maintenance with at least Q 4 hr flushing (0.9% Sterile Saline).

Ampicillin
Recommended dosage: 100mg/kg IV Q 12 hours IV (slow IV push or syringe pump over 5-10 minutes)
IV is preferred route, though IM is possible if IV access is unattainable.

Gentamicin
Recommended dosage *
  35 weeks 0 days through 37 weeks 6 days: 3.5mg/kg IV q 24 hours
  38 weeks 0 days and above: 3.5mg/kg IV q 18 hours
Administer medication and flush via syringe pump over total of 30-40 minutes IV is preferred route, though IM is possible if IV access is unattainable.
*Note: this dosing regimen differs from Neofax and is based on data from a study done at Mission Hospital NICU (see reference below).

VII. Metrics
- Neonatal Mortality
- PRC Experience: Overall Quality of Care
- Length of Stay: Average of Days (for each encounter) and Observed/Expected (CMS) Ratio by DRG
- # babies who should have been treated per CPM recommendations and did not receive SOC treatment
- Readmissions within 28 Days: all readmissions within 28 days with a diagnosis of sepsis

VIII. Resources
During the newborn hospital stay, health care personnel should provide educational activities that include information explaining the rapid changes in physiology that occur in the newborn. Parents should be familiar with normal and abnormal changes in wake/sleep patterns, temperature, respiration, voiding, stooling, and the appearance of the skin, temperature, and become familiar with the behavior, temperament, and neurologic capabilities of the newborn.

Additional resources for families with infants who appear healthy but have risk factors which could make them become ill during the first 24 hours of life:
- Your new baby is at risk of becoming sick

IX. REFERENCES


This guideline is not intended to be construed or to serve as medical advice, for diagnosis or treatment, or to indicate a standard of care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care. The ultimate judgment must be made by the appropriate health care professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. This judgment should only be arrived at following discussion of the options with the patient, covering the diagnostic and treatment choices available.