

## Neonatal Nursing Education Brief: The Effects of Maternal Chorioamnionitis on the Neonate

<https://www.seattlechildrens.org/healthcare-professionals/education/continuing-medical-nursing-education/neonatal-nursing-education-briefs/>

Maternal chorioamnionitis is a common condition that can have negative effects on the neonate. The use of broad spectrum antibiotics in labor can reduce the risks, but infants exposed to chorioamnionitis continue to require treatment. The neonatal sepsis risk calculator can guide treatment.

NICU, chorioamnionitis, early onset neonatal sepsis, sepsis risk calculator

# The Effects of Maternal Chorioamnionitis on the Neonate

## Purpose and Goal: CNEP # 2090

- Understand the effects of chorioamnionitis on the neonate.
- Learn about a new approach for treating infants at risk.

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## Requirements for successful completion:

- Successfully complete the post-test
- Complete the evaluation form

## **Date**

- December 2018 – December 2020

## **Learning Objectives**

- Describe the pathogenesis of maternal chorioamnionitis.
- Describe the outcomes for neonates exposed to chorioamnionitis.
- Identify 2 approaches for the treatment of early onset sepsis.

## **Introduction**

- Chorioamnionitis is a common complication
- It affects up to 10% of all pregnancies
- It is an infection of the amniotic fluid and placenta
- It is characterized by inflammation
  - Of the placenta
  - Of fetal membranes
    - The chorion
    - The amnion
- Chorioamnionitis places infants at risk
  - Of premature birth
  - Of neonatal sepsis

## **Definition of Chorioamnionitis**

- The definition of chorioamnionitis is inconsistent
- Generally it is associated with a bacterial or fungal infection
- Chorioamnionitis may or may not involve inflammation
- The most common definition involves inflammation

- Of chorionic layers of fetal membranes
- Of amniotic layers of fetal membranes
- The diagnosis is confirmed by placenta pathology
- There are 4 different categories of chorioamnionitis
  - Histologic chorioamnionitis
  - Clinical chorioamnionitis
  - Maternal inflammatory response
  - Fetal inflammatory response
- Histologic chorioamnionitis
  - Requires a pathologic diagnosis
  - Inflammatory cells present in fetal membranes
- Clinical chorioamnionitis
  - Requires a maternal fever  $>38^{\circ}$  C
    - Fever is always present
  - And at least 2 more clinical signs
    - Uterine tenderness
    - Elevated maternal WBCs  $>15$
    - Maternal tachycardia  $>100$
    - Fetal tachycardia  $>160$
    - Foul-smelling amniotic fluid
  - The exact criteria varies with each OB service
- Maternal inflammatory response
  - Inflammatory changes are present in
    - Subchorion
    - Chorion
    - Amnion
- Fetal inflammatory response
  - Inflammatory changes are present
    - Umbilical cord vasculitis
    - Umbilical cord funisitis
    - Umbilical cord blood
- Inflammatory changes are associated with adverse outcomes

## **Maternal Risk Factors for Chorioamnionitis**

- There are several risk factors for chorioamnionitis

- These factors include:
  - Nulliparity
  - Prolonged labor
  - Previous chorioamnionitis
  - Prolonged rupture of membranes
  - Multiple digital vaginal examinations
    - 3 or more examinations
  - Meconium stained amniotic fluid
  - Internal fetal or uterine monitoring
  - Genital tract infections
    - Bacterial vaginosis
    - Group B streptococcus
    - Sexually transmitted infection
  - Alcohol or tobacco use

## **Pathogenesis of Chorioamnionitis**

- The introduction of bacterial or fungal organisms
  - Into the placenta
  - Into the fetal membranes
  - Is thought to occur via 4 anatomic pathways
    - Ascending migration
    - Iatrogenic migration
    - Bloodstream migration
    - Peritoneal migration
- Ascending infection
  - Migration from the maternal genital tract
- Iatrogenic introduction
  - Migration secondary to invasive procedures
- Hematogenous spread
  - Migration from maternal bloodstream to placenta
- Peritoneal infection
  - Migration from kidney or liver via fallopian tubes
- Premature and prolonged rupture of membranes

- Are associated with increased risk of chorioamnionitis
- Conversely, membranes may rupture early due to infection
- Chorioamnionitis may be identified:
  - Before delivery
  - During delivery
  - Up to 24 hours after delivery

## **Common Organisms Seen in Chorioamnionitis**

- There are several organisms that are commonly seen
- These organisms include:
  - Ureaplasma urealyticum
  - Mycoplasma hominis
  - Group B streptococcus
  - Escherichia coli
  - Gardnerella vaginalis
  - Bacteroides species
  - Fusobacterium species
  - Prevotella species
  - Peptostreptococcus species

## **Maternal Outcomes with Chorioamnionitis**

- There are several potential maternal effects
- These effects include:
  - Preterm birth
  - Increased operative delivery
  - Maternal bacteremia
  - Maternal sepsis
  - Post-Cesarean wound infection
  - Postpartum hemorrhage

## Neonatal Outcomes with Chorioamnionitis

- There are several neonatal effects of chorioamnionitis
- These effects include:
  - Preterm birth
  - Neonatal sepsis
  - Brain disease
  - Lung disease
- Preterm birth
  - Preterm birth is the most common outcome
  - Chorioamnionitis is present in 25% of preterm births
- Neonatal sepsis
  - Infants exposed to chorioamnionitis are at risk for sepsis
  - It is associated with 30-40% of neonatal sepsis
    - Most frequent organisms
      - Group B streptococcus
      - Escherichia coli
- Brain injury
  - There is increased incidence of early neurologic insults
    - Intraventricular hemorrhage
    - Periventricular leukomalacia
    - Cerebral palsy
- Lung disease
  - Respiratory distress syndrome
    - There is documented increased risk
    - However, studies show variable percentages
  - Chronic lung disease
    - There is variable risk for CLD
    - Inflammation → abnormal lung development
- Untreated maternal chorioamnionitis can lead to:
  - Perinatal death
  - Perinatal depression
  - Neonatal septic shock
  - Neonatal pneumonia
  - Neonatal meningitis

## Management of Maternal Chorioamnionitis

- Antibiotics should be given to all women:
  - With persistent fever
  - With premature onset of labor
  - With premature rupture of membranes
- Prenatal antibiotics can reduce the risk of preterm birth
  - Especially between 24 and 32 weeks gestation
  - Delivery has been shown to be delayed 7-14 days
- Broad spectrum antibiotics should be used:
  - Ampicillin
  - Gentamicin
  - Ampicillin-sulbactam
  - Ticarcillin-clavulanate
  - Cefoxitin
- Group B strep pretreatment is not effective
  - Penicillin alone is not recommended
  - It has not been shown to decrease chorioamnionitis
- The risks of chorioamnionitis can be further reduced
  - With use of antipyretics
  - With environmental cooling
    - Fans
    - Ice chips
    - Cooling blankets
    - Cooler room temperature
- Chorioamnionitis cannot be cured without delivery
  - Removal of the placenta
  - Removal of the fetal membranes
- Delivery should be expedited
  - Vaginal delivery is preferred
    - Via prompt induction
    - Via prompt augmentation
  - Cesarean section delivery is not indicated

## Management of Infants Exposed to Chorioamnionitis

- There is an increased risk for early onset sepsis
- The American Academy of Pediatrics recommends:
  - A sepsis evaluation
    - Blood culture
    - CBC with differential
  - Treatment with broad spectrum antibiotics
    - Ampicillin
    - Gentamicin
- The evidence behind this recommendation was initiated prior to the widespread use of maternal antibiotic treatment
- Given this, some clinicians question the practice
- If an infant is clinically well, do they need treatment?
  - The likelihood of sepsis in a well appearing is low
  - The accuracy of physical exam is a better predictor
- Are the recommendations to treat all infants
  - Leading to overtreatment?
- Overtreatment been associated with:
  - Separation of mother and infant
  - Painful procedures
  - Significant expenditure
  - Exposure to toxic drug effects
  - Potential for antibiotic resistance
  - Increased length of stay
- A more recent approach is based on clinical signs
- Initial clinical exam:
  - Tone
  - Alertness
  - Work of breathing
  - Vital signs
- For well appearing infants
  - Assess for maternal risk factors
  - Use Neonatal Sepsis Risk Indicator
    - Follow instructions on Indicator
    - Anticipate 24-36 hour length of stay
    - Provide parents with signs of infection handout
- For symptomatic infants

- Assess maternal risk factors
- Consider sepsis evaluation
- Use Neonatal Sepsis Risk Indicator
  - Follow instructions on indicator
  - Anticipate 36-48 hour length of stay
  - Provide parents with signs of infection handout
- The Indicator removes OB emphasis on chorioamnionitis
- It bases infant care on risk factors
  - Helps guide infant management
  - Avoids overtreatment of all infants

## Neonatal Sepsis Risk Calculator

- The Neonatal Sepsis Risk Calculator
  - Is a method for predicting early onset sepsis
  - Uses maternal risk factors and infant exam
  - <https://www.dor.kaiser.org/external/DORExternal/research/InfectionProbabilityCalculator.aspx>
  - <https://neonatalesepsiscalculator.kaiserpermanente.org/>
- The calculator was developed by Kaiser Permanente
  - An HMO in Oregon and California
  - Using data from 750,000 infants
  - Using data from 14 hospitals
- The baseline risk for sepsis is 0.5/1000 births
- The calculator uses 5 maternal risk factors
  - Accurate gestational age
  - Maternal GBS status
  - Highest maternal temperature in labor
  - Duration of rupture or membranes
  - Type and duration of maternal antibiotics
- The calculator uses the infant clinical exam
  - Clinical signs are defined as:
    - Clinical illness
    - Equivocal presentation
    - Well appearing
  - Clinical illness

- CPAP beyond initial delivery period
- Ventilation beyond initial delivery period
- Hemodynamic instability needing pressor support
- Neonatal encephalopathy
  - 5 minutes Apgar score <5
  - Clinical seizure activity
- Significant respiratory distress
  - Signs of respiratory distress
  - Oxygen for longer than 2 hours
- Equivocal presentation
  - At least 2 instances of the following
  - An instance is 2 or more 2 or more hours apart
    - Less than 4 hours old
      - Heart rate >180
      - Respiratory rate >80
    - More than 4 hours old
      - Heart rate >160
      - Respiratory rate >60
  - Temperature >38° C or <36.3° C
  - Signs of respiratory distress
- Well appearing
  - None of the above signs in the first 12 hours

## **Management of Infants Based on Clinical Signs**

- Low risk infants
  - No blood culture
  - No CBC with diff
  - No antibiotics
  - Parent handout
  - Routine VS
  - No discharge <24 hours
- Moderate risk infants
  - Blood culture
  - No CBC with diff

- No antibiotics
- Birth Center (not NICU) observation
- Q4 hours VS x 24 hours
- Two provider exams in first 24 hours
- Parent handout
- No discharge <36 hours
- High risk infants – well appearing
  - Sepsis risk >1.54/1000
  - Follow instructions on calculator
  - Parent handout
  - No discharge <36 hours
- High risk infants – equivocal presentation
  - Sepsis risk >0.65/1000
  - Blood culture
  - CBC with diff
  - Antibiotics x36 hours
    - 4 doses Ampicillin
    - 2 doses Gentamicin
  - NICU admission until symptoms resolve
    - At least 12 hours
  - Parent handout
  - No discharge <36 hours
- High risk infants - clinical illness
  - Blood culture
  - CBC with diff
  - Antibiotics x36 hours
    - 4 doses Ampicillin
    - 2 doses Gentamicin
  - NICU admission until symptoms resolve
    - At least 12 hours
  - Parent handout
  - No discharge <36 hours

## Infection in Newborns Parent Handout

- A parent handout is important
- All parents should be taught the signs of infection
  - What to watch for
  - When to call the doctor
- Below is the Seattle Children's Handout
  - This handout is used as an example only
  - It may not be copied and used verbatim

### Why is my baby at risk for infection?

When your baby was born, you had symptoms (risk factors) that increase the chances of your baby having an infection in the first week of their life. These symptoms may include:

A high fever during labor

A high heart rate during labor

An increase in your blood cells that fight infection

Physical signs that your uterus may have had an infection

### Why do I need to watch for signs of infection at home?

We have assessed your baby and do not see any signs that your baby needs to stay in the hospital longer. However, some babies do not show signs of infection in their first 1 to 3 days but may show signs of infection after leaving the hospital. This is why we want you to watch your baby for signs of infection.

### When should I call the doctor?

There are many different ways a baby may show that they do not feel well.

**Call your baby's doctor if they have any of these signs:**

Difficult to arouse for feeds for more than 4 hours or will not feed for more than 5 minutes twice in 8 hours

More cranky and hard to calm

Breathing too fast or too hard (watch your baby's ribs to see if they "stand out" when breathing)

Breathing has slowed down (watch for pauses in your baby's breathing of more than 10 seconds)

Has a fever (temperature above 100.3 °F) or has difficulty staying warm (temperature less than 97.5 °F). Ask your baby's nurse to show you how to take your baby's temperature.

Too floppy when you handle them or too stiff when handled

Pale, cool, clammy, or mildly blue skin

If you think there are signs that your baby is getting sick, call your baby's primary care doctor and tell them about your concerns. Your baby's doctor will let you know if your baby needs to be seen or if more tests are needed.

## Summary

- Chorioamnionitis is a common problem
  - Especially in preterm deliveries
- Neonates exposed to chorioamnionitis are at risk
  - For neonatal sepsis
  - For poor neonatal outcomes
- Not all exposed infants need to be treated
- The Neonatal Sepsis Risk Calculator
  - Can help guide treatment
  - Can help protect against overtreatment
- Parent education is critical
  - A parent handout should be created
  - A handout should be given to all parents
  - Parents should be taught the signs of sepsis

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