Chorioamnionitis, Other Risk Factors and Bugs

Susan Greenleaf, BSN, RNC~NIC
MultiCare Regional Neonatal Outreach Coordinator
Spring AWHONN 2015
Objectives

• Discuss fetal and neonatal complications associated with maternal infections
• Recognize S/S of perinatal infections
• Describe perinatal and postnatal risk factors for infection
• Discuss treatment of maternal infections and neonatal infections
Definitions

• Chorioamnionitis: inflammation of the chorion and amnion occur

• Premature rupture of membranes (PROM): Membrane rupture before the onset of uterine contractions

• Preterm premature rupture of membranes (PPROM): PROM before 37 0/7 weeks of gestation
Definitions

- Neonatal SEPSIS is a disease of infants less than 28 days of age with a positive blood culture and clinical illness.
- BACTEREMIA is a positive blood culture in a healthy infant.
- EARLY ONSET disease can be defined as infection in the first 72 hrs. or first week of life.
- LATE ONSET disease occurs after early onset disease.
Why do we have to know?

• Infections are a common complication of pregnancy
• Some infections only affect the mother
• Other infections do little to the mother but cause significant fetal injury
• There are infections that cause serious problems for both the mother and the fetus
Transmission of Infection

- Infections can be acquired by in one of 3 ways:
  - Transplacental (vertically)
  - May ascend in the birth canal (ascending)
  - Acquired during the passage through the vagina at the time of birth

- For the infant: nosocomial
Infective Disease Review

• TORCH – 5 infectious diseases (transoegenic)
  – T = Toxoplasmosis
  – O = Other (Hep B)
  – R = Rubella (German Measles)
  – C = Cytomegalovirus (CMV)
  – H = Herpes Simples Virus (HSV)
HIV/AIDS and STD’s

1. AIDS and HIV infection
2. HPV
3. Chlamydia
4. Gonorrhea
5. Syphilis
6. Trichomonas
7. Candida (bacterial vaginosis)

STD is any disease spread by sexual contact between partners
Other contributors to infection

- Urinary Track Infections
- Pyelonephritis

We know that UTI’s can contribute to preterm labor and if left untreated can progress into Pyelonephritis.

Pyelonephritis contributes significantly to an increased rate of prematurity.
Communicable Diseases

1. Varicella (chickenpox or shingles)
2. Mumps
3. Influenza
4. Measles (rubeola)
5. Tuberculosis (TB)
6. Group B Streptococcus (GBS)
7. Parvovirus B19 (fifth disease)
8. Listeriosis
9. Lyme disease
Chorioamnionitis

• What is it?
• Frequency?

• It is associated with what conditions?
• What are the signs and symptoms?
Chorioamnionitis

- How is it diagnosed?
- What are the contributing pathogens?
- What are the maternal risk factors contributing to Chorioamnionitis?
Clinical criteria for intrauterine infection:

- Fever >37.8°C
- Plus ≥2 of the following:
  - Maternal Tachycardia (>100 bpm)
  - Fetal Tachycardia (>160 bpm)
  - Maternal WBC counts (15,000 cells/mm³)
  - Uterine Tenderness
  - Malodorous/cloudy amniotic fluid
Chorioamnionitis

- Mortality:
  - Maternal
  - Infant
- Prompt treatment:
  - Should we treat fast or slow?
- Maternal antibiotics:
  - What do we treat with?
Case Presentation 1

• 16 yr old single primigravida
• Admitted at 36 weeks gestation
• Temperature = 39.4 C (103 F)
• Uterine tenderness, chills : BP 102/72mmHg
• Fetal HR 180 bpm
• Fetal monitoring: absent short-term variability, no decelerations.
Case Presentation 1

- Urinalysis is unremarkable
- CBC: hemoglobin 10.5/ hematocrit 36%
- WBC: 22,000/ mm3
- Differential:
  - Neutrophils 85%
  - Bands 10%
  - Lymphocytes 5%
Questions

• All of the following are possible pathogens associated with chorioamnionitis except:
  A. Escherichia coli
  B. Group A and B Streptococci
  C. Toxoplasma gondii

• All of the following are diagnostic for chorioamnionitis except:
  A. Culture of cervix
  B. Amniotic fluid smear
  C. Vaginal smear
Questions

• Chorioamnionitis is associated with premature rupture of membranes and what other factor?
  A. Cerclage use
  B. Prolonged rupture of membranes
  C. Inadequate hydration
Questions

• Determine whether the following statements are true or false?

  A. Mononuclear leukocytes and PMNs (neutrophils) infiltrate the chorion.
  B. Teenage unwed pregnancy and poor nutrition are factors that predispose to chorioamnionitis.
  C. A cesarean section is the preferred method of delivery in a client with chorioamnionitis.
PROM & PPROM

• What is the definition? Review
• Gestational Age usually determines the plan of care
• Augmentation of labor may be necessary
• Strong clinical evidence links PROM to intrauterine infection
PROM

- Diagnosis
- Laboratory confirmation

- What should we as nurses be concerned with if there is PROM?
• What are the nursing interventions that we need to be practicing?
• How soon should we expect delivery of the infant?
• What are the risk factors that we need to be watching for to report to the physician?
• Prophylaxis with antibiotics
• What are we trying to treat or prevent?
• When did these guideline come out?
• Have you read them or are you familiar with them?
GBS Management

• Several maternal flow diagrams to manage GBS depending on GS and PROM or not

• Newborn management in 2 categories
  – Full diagnostic evaluation
  – Limited diagnostic evaluation

• Algorithm now applies to all newborns regardless of maternal GBS status
Signs of neonatal sepsis?  Yes → Full diagnostic evaluation*  Antibiotic therapy†

No → Maternal chorioamnionitis?§

Yes → Limited evaluation¶

No → Antibiotic therapy†

GBS prophylaxis indicated for mother?**

Yes → Mother received intravenous penicillin, ampicillin, or cefazolin for ≥4 hours before delivery?

Yes → Observation for ≥48 hours††§§

No → Routine clinical care‡‡

No → ≥37 weeks and duration of membrane rupture <18 hours?

Yes → Observation for ≥48 hours††¶¶

No → Either <37 weeks or duration of membrane rupture ≥18 hours?

Yes → Limited evaluation¶

No → Observation for ≥48 hours††
Case Presentation 2

- 30 Year old G3, P2 mom at 31 weeks gestation
- Presents at L&D complaining of leaking fluid for the last couple of hours
- VS: BP 108/60, HR 70, RR 20, T 97.6 (36.4 C)
- Monitored for 1 hour FHR 130-145, reactive with no decelerations.
- No uterine contractions are perceived by mom or recorded on the monitor
Case Presentation 2

• This mom is a candidate for expectant management because of which of the following?
  A. She is afebrile and has no other symptoms of infection.
  B. Her fetus is in the vertex position.
  C. A normal amount of amniotic fluid by U/S is present.
  D. She is not a candidate for expectant management.
Case Presentation 2

During your assessment, you note that she is nitrazine negative, but positive for vaginal pooling and ferning. These findings would lead you to believe that she is which of the following?

A. Probably not ruptured because nitrazine is the most accurate test.

B. Most likely ruptured because many factors may interfere with nitrazine testing.

C. Definitely ruptured because ferning is 100% accurate

D. Most likely infected because that causes a positive fern test result.
Neonatal Sepsis

• Neonatal Sepsis

• Bacteremia

• Early onset sepsis

• Late onset sepsis
Risk Factors

Maternal
- chorioamnionitis
- PROM
- GBS colonization
- UTI
- fever
- low socioeconomic class

Neonatal
- prematurity
- low birth weight
- indwelling catheter
- endotracheal tube
Early Onset Disease

- 0-6 days of age (0-72 hours of age in some studies)
- Acquired from maternal genital tract
- GBS, E. coli, Listeria, H. Flu, enterococcus
- Multisystem, pneumonia
- Mortality 15-45%
Late Onset Disease

- 7 – 90 days of age (onset greater than 72 hrs in some studies)
- Acquired from maternal genital tract and postnatal environment
- Staph coag negative, Staph aureus, Pseudomonas
- Focal, high risk of meningitis
- Mortality 10-20%
Bacteria Associated with Neonatal Sepsis

- Group A streptococci (1930’s)
- Staphylococci (1950’s)
- Group B Streptococci (1970’s)
- Gram negative rods (1970’s)
- Coagulase negative staphylococci (1980’s)
Infectious Agents

- Group B Streptococcus
- Escherichia coli
- Listeria monocytogenes
- Haemophilus influenzae
- Pseudomonas, Klebsiella, Serratia
- Herpes simplex virus
- Candida
Group B Streptococcus

• 5-30% women are colonized with GBS
• Half of colonized women’s babies will become colonized at birth
• Approximately 1% colonized infants will develop GBS disease
Group B Streptococcus

• Selective intrapartum chemoprophylaxis can prevent early onset disease
• Universal screening recommended in 1996 and modified in 2002 to suggest all pregnant women be screened with vaginal/rectal swab at 35-37 wks and antibiotic prophylaxis given during labor to GBS+ women, preterm labor and PreROM
• Modified again in 2010: revised the algorithms for screening in PML and Premature ROM; emphasized the neonate’s clinical appearance
Early Onset GBS disease

• Onset less than 7 days of age
• Nearly half of infected babies will be symptomatic at birth and nearly all have Sx in less than 24 hours of age
• 25-40% sepsis, 35-55% pneumonia, 5-10% meningitis
• 5-10% mortality
Late onset GBS disease

- Onset 7 days or later
- May occur despite no signs/symptoms of infection at birth
- 30-40% meningitis, osteomyelitis, septic arthritis, cellulitis
- 2-6% mortality
Escherischia coli

• Most common GNR causing neonatal disease; majority of E. coli causing disease have K1 antigen
• 20-30% infants are colonized at birth from the mother’s GU tract but <1% colonized infants develop disease
• Nosocomial transmission, seeding from GI tract
Escherichia coli

- Early and late onset patterns
- May present as neutropenia, sepsis, meningitis, UTI, pneumonia, diarrhea
- Galactosemia associated with increased risk of E coli UTI
Clinical Presentation

• Temperature imbalance (hypo and hyperthermia)
• Respiratory distress (tachypnea, grunting, cyanosis)
• Apnea
• Feeding difficulties (unwilling to eat, vomiting)
• Lethargy
Clinical Presentation

- Glucose abnormalities
- Mottled, cyanotic, petechiae, rash
- Rales (crackles) on auscultation of chest
- Delayed capillary refill, faint pulses
- Hypotonic, irritable
Laboratory Evaluation

• CBC/differential
  – WBC<5000, ANC<1000, I/T >0.2
  – ANC= (WBC)x(%poly+%bands)
  – I/T ratio = bands/bands+ poly
  – Thrombocytopenia

WBC 10.0 with 25 poly, 5 bands
ANC= (10,000) X (.25+.05)= 3,000
I/T = 5/ (5+25) = 0.16
CBC

Study of 856 near term/term asymptomatic infants born to moms with chorioamnionitis

- 96% blood culture negative
- 99% of negative BCx babies had >1 abnl CBC
- No bacterial infections in first 3 weeks of life

CBC is great screening tool but results should be combined with other labs and clinical impression
Immature to Total Ratio (I:T)

- An increased IT ratio is called a left shift. IT shows an increase in the number of immature cells.
- An IT ratio of >.25 may indicate sepsis.

Bands

Bands + Segs
CBC for I:T Calculations

- WBC: 20,000
- Differential
  - Polys (Segs or Neuts): 48%
  - Bands: 12%
  - Lymphs: 20%
  - Monos: 17%
  - Eso: 3%
I:T Calculations

• I:T ratio \[ \frac{\text{Bands}}{\text{Bands} + \text{Segs}} \]
  Bands + Segs

• \[ \frac{12}{60} = 0.2 \] (not indicative of sepsis)

• IF WBC 3000, Segs 30, bands 15
  – \[ \frac{15}{45} = 0.33 \] (indicative of sepsis)
Laboratory Evaluation

• Blood culture
  – Minimum volume of blood 0.5 ml in first month of life
  – Majority will be positive in the first 24 hrs

• C-reactive protein
  – Made in the liver
  – Acute phase reactant with nonsustained rise in blood 8-24 hours after insult
  – Useful for tracking success of therapy in severe infections
Laboratory Evaluation

- CSF
  - Difficult to predict CSF results since there is overlap of normal and abnormal in neonates
  - Values may vary with age and gestation
    - Preterm WBC 0-25, term WBC 0-22, glucose 25-120, preterm protein 65-150, term protein 20-170
    - <1% babies with meningitis have normal CSF findings
  - Gram stain may show organisms with few WBC
  - Nearly 50% of meningitis cases have negative blood cultures
Treatment

• Initiation of broad spectrum coverage usually is a penicillin and an aminoglycoside
  – Ampicillin 100mg/kg/dose every 12 hrs and gentamicin 4-5 mg/kg/dose every 24-48 hrs
• Choice of antibiotic(s) depends on nursery’s history and identification of organism
  – GBS: ampicillin, penicillin
  – GNR: ampicillin+ gentamicin
  – H flu: cefotaxime
  – Listeria: ampicillin +/- gentamicin
Treatment

• Duration depends on organism and presence of meningitis
  – 10 days: GPC without meningitis
  – 14 days: GPC with meningitis, GNR without meningitis
  – 21 days: GNR with meningitis
Case 1

1790 gm 31 4/7 wk PMA female born to G5P3 B+/Ab-/RPRNR/RI/HIV-/GBS na with ROMx25hrs; c/s for decels; mom rx’d with ampi/erythro (no fever/chorio)

Baby had Apgars 8 and 10, room sats 95%; sepsis eval done and A/G given
CBC: Hg 21, plt 163K, WBC 5.7 with 7 PMN, 85 L

Transported to Level 3 NICU
Case 1

F/U CBC: WBC 3.3 with 18%PMN, 27%B, 41%L; plt 123K
Spinal fluid: 8150 rbc, 285 wbc, 161 protein and gram stain 1+wbc, no organisms

Blood culture grew “GNR” identified as H.flu resistant to amp. Abx changed to cefotaxime
CBC on dol 4: WBC 10.3 with 65%PMN, 30%L

Baby remained in RA, few episodes of apnea noted and caffeine started
CSF and second blood culture remained negative
14 day course of cefotaxime
Haemophilus influenza

• Pleomorphic Gram negative coccobacillus
• H. Flu B used to be #1 cause of pediatric meningitis; causes pneumonia, bacteremia, epiglottitis, septic arthritis, cellulitis
• Since HIB vaccine, incidence decreased by 99%
• Non-typeable H. flu causes otitis media
Case 2

2.2kg 34 wk PMA male infant born to G1P1 with PML and PPROMx30hrs, mother treated with antibiotics and received antenatal steroids

Baby delivered via SVD, Apgars 9 and 9, to NICU with mild respiratory distress treated with CPAP/RA, sepsis evaluation

CBC: Hg 17, plt 311K, WBC 15.3 with 50%PMN, 1%B, 37%L
Feedings initiated, blood sugars nl, phototherapy
Case 2

At 5 days of age, baby had emesis, temperature elevation and apnea. Sepsis evaluation done, ox/gent started.

CBC: Hg 15, plt 118K, WBC 5.8 with 47%PMN, 1% meta, 1% myelo, 39%L

At 6 days of age, WBC 21.9 with 49%PMN, 28%B, 17%L, plt 86K
Blood and CSF Cx positive for GNR so cefotaxime added to oxacillin/gent
Case 2

At 7 days of age, baby had seizures with abnormal EEG and GMH on head US.

CBC: plt 69K, WBC 31.3 with 68%P, 1%B
CSF: 1780 rbc, 7110 wbc, glucose 38, protein 753 and
  GS=GNR, Cx= E. coli
Oxacillin discontinued

At 10 days of age, baby’s WBC remains high, thrombocytopenia resolved, and CSF negative GS and negative Cx.
Case 2

At age 14 days, gentamicin discontinued (9 days treatment) and cefotaxime continued for 21 days after negative CSF culture

MRI: no abscess, no significant hydrocephalus, mild brain atrophy

EEG: no seizure activity

CSF: 4 rbc, 52 wbc, protein 186, glucose 29, Cx negative

Passed hearing screen, myoclonus on exam, discharged to home at age 34 days
Neonatal Meningitis

• More common in the first month of life than any other time period
• Occurs in 1/2500 babies; preterm babies have 10X risk of meningitis
• Can be part of early and late onset sepsis or a focal infection in late onset infection
• GBS, GNR and Listeria are the most common isolates
Neonatal Meningitis

• Meningitis is found in 25% bacteremic infants
  – 40% present with seizures, 30% have bulging fontanel, 15% nuchal rigidity
• No improvement in morbidity or mortality
  – Sequelae may include hydrocephalus, deafness, ventriculitis, subdural effusions, atrophy, developmental delay, CP
  – Mortality/morbidity depends on causative organism
Case 3

2700 gm 40 3/7 wk PMA IDM male to G1P0 GBS negative mom, ROM 11 hours, no fever, vacuum assisted vaginal delivery with mec stained AF, Apgars 8 and 8

At 2 days family witnessed dusky episode and described seizure-like activity. Sepsis evaluation performed

CBC: Hct 45, plt 116K, WBC 2.8 with 6P, 2B, 89L.

Baby treated with A/G and acyclovir and transported to Level 3 NICU
Case 3

Baby developed PPHN treated with HFV and NO; seizures treated with phenobarbital; hypotension and poor cardiac function on ECHO; and coagulopathy

CBC: WBC 5.1 60P/14B/19L
Blood culture grew E. coli

Baby developed fixed, dilated right pupil. MRI showed Grade 3 IVH, no abscess
Case 3

Spinal tap done at 12 days of age negative GS

Treated 21 days with cefotaxime and discharge to home planned.

13 days after abx completion (1 day prior to discharge day) baby had acute respiratory decompensation and placed on mechanical ventilation
Case 3

Sepsis evaluation done and baby started on antibiotics. Blood and ETT aspirate cultures grew E. coli, urine negative, CSF negative (after abx)

Pediatric ID consulted and recommended 42 day course of ceftriaxone

Baby was discharged to home at 78 days of age with microcephaly, failed hearing screen, seizures, and hydrocephalus on MRI
Herpes Simplex Virus

- DNA virus family with CMV, EBV and VZ
- 75% of neonatal HSV infections are caused by Type 2 HSV
- 1/3000 to 1/20,000 births
- Primary lesion: 25-60% infection
- Secondary lesion: less than 5% infection
Neonatal Risk Factors for HSV

Primary maternal genital infection
Prematurity
Fetal scalp monitoring
Prolonged rupture of membranes
Clinical Perinatal HSV

Disseminated (20%)

4-10 DOL
fever, irritability, poor feeds, respiratory distress, HSM
60% skin lesions, up to 75% have CNS mortality 20%; 30-50% normal outcome if treated.
Clinical HSV Infection

Skin-Eye-Mucous membrane (40-45%)

6-9 DOL

conjunctivitis, keratitis, chorioretinitis

papulovesicular lesions, pustules with erythematous base occurring at site of trauma

Minimal mortality, 90% normal outcome
Clinical Perinatal HSV

**CNS** (30-35%)

10-18 DOL

fever, seizures, skin lesions

15% mortality, 30% normal development
Diagnosis of HSV

• Low suspicion
  – Surface cultures of NP, eye and rectum 12 -24 hrs after delivery

• High suspicion
  – Surface cultures, blood culture, CBC, CSF (PCR), urine, skin lesion
  – Liver function, coags, head imaging, EEG
  – Acyclovir for 14-21 days
Take Home Messages

• Symptoms, signs of infection in a newborn are nonspecific therefore the history and lab evaluation will help you determine “normal” transition findings from infection

• A solitary CBC may not helpful so repeat the CBC in 12-24 hrs

• Spinal tap does not need to be part of the “rule out” but should be considered with symptomatic babies and babies with +BCx
All of the following may raise your index of suspicion for neonatal infection except
A. Fetal tachycardia and maternal fever
B. Thick meconium noted 4 hours PTD
C. 35 weeks gestation
D. GBS urinary tract infection during pregnancy
• Chest X-ray findings of congenital pneumonia are similar to
  – A. Meconium aspiration
  – B. Respiratory Distress Syndrome (RDS)
  – C. Transient Tachypnea of the Newborn (TTN)
  – D. All of the above
  – E. None of the above