Infections in Pregnancy

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Objectives

• Review the common and some uncommon infections that occur in pregnancy
• Review the diagnosis and treatment of those infections
• Review how these infections may impact the pregnancy including preterm labor and delivery
APPENDICITIS

Appendicitis
• Common cause of acute abdomen in pregnancy
• 1 in 1500 pregnancies
• Similar to the general population

Appendicitis - Epidemiology
• Pregnancy loss rate about 3% for appendectomy
• Rate increases to about 10% if peritonitis is present
• Induces premature delivery about 5% of the time
• Delay in diagnosis of 18-75% depending on trimester
Appendicitis - Diagnosis

- RLQ pain (80%)
- RUQ pain
- Anorexia not reliable in pregnancy
- Rule out other source (urine and chest)
- Ultrasound, CT and MRI are useful but can be operator dependent
  - Diameter of < 6mm considered normal
Appendicitis - Treatment

- Surgery is standard
- Can delay if active labor, otherwise should proceed as quickly as possible
- Can be done laparoscopically or open depending on the clinical situation
- Broad spectrum antibiotics with anaerobic coverage

Appendicitis
Pregnancy Implications

- Preterm contractions 80%
- Preterm delivery 5-14%
- Fetal loss 1-5% if unruptured
- Maternal mortality is uncommon today

PYELONEPHRITIS
### Acute Pyelonephritis

- Occurs in 1-2.5% of pregnancies
- Risk factors
  - Prior history
  - Asymptomatic bacteriuria
  - Urinary tract calculi

### Acute Pyelonephritis

- Pathogenesis
  - Increase in urinary pH
  - Increased bladder capacity
  - Incomplete bladder emptying and decreased tone
  - Glycosuria

### Acute Pyelonephritis

- *E. coli* is the most common pathogen
- Others:
  - *Klebsiella sp.*
  - *Enterobacter sp.*
  - *Proteus sp.*
Acute Pyelonephritis

• Diagnosis:
  – Fever/chills
  – Flank pain
  – Dysuria, urgency, frequency
  – Pyuria and bacteriuria
  – Positive urine culture

• Management: Initial hospitalization is standard
  • IV hydration
  • IV antibiotics
  • CXR and ABG if dyspnea or vital sign aberrations to evaluate for ARDS
  • Antipyretics

Antibiotics

• Parenteral Treatment Options
  – Ceftriaxone 1-2 grams q 24 hours
  – Cefepime 2 grams q 8 hours
  – Cefotetan 2 grams q 12 hours
  – Cefotaxime 1-2 grams q 8 hours
  – Cefazolin 1-2 grams q 8 hours
  – Ampicillin-sulbactam 1.5 grams q 6h
  – Piperacillin-tazobactam 3.75 grams q6-8h
Antibiotics

- Outpatient Oral Regimens
  - Amoxicillin 500mg TID
  - Amoxicillin-clavulanate 785/125 mg BID
  - Trimethoprim-sulfamethoxazole 160/800mg BID

- Suppression Therapy
  - Nitrofurantoin 100 mg PO daily
    • Decreases recurrence from 60% to about 3%

LISTERIA

Listeriosis

- Listeria monocytogenes
- Gram-positive bacteria
- Two main sources
  - Nonpasteurized food
  - Vaginal flora
Listeriosis

- May present with flu-like symptoms
- Maternal infection tends to be mild
- Rare cases can have sepsis, may be more common in second and third
- Neonatal infection is the greater concern

Listeriosis

- Must maintain index of suspicion
- Culture blood and cervix
- Must ask specifically for Listeria in Gram stain
- Gram-positive pleomorphic rods with rounded ends is highly suggestive

Listeriosis

- Treatment
  - Penicillin G/ampicillin
  - Aminoglycoside
  - Duration is about 7 days
Listeriosis

- *Listeria monocytogenes*
- Gram-positive bacteria

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**MEASLES (RUBEOLA)**

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Measles (Rubeola)

- Single-stranded RNA virus
- Respiratory droplet transmission
- 75-90% infection after exposure
- Incidence decreased significantly since the advent of vaccination
- Recent outbreaks
  - Unvaccinated preschoolers
  - Previously vaccinated college students
Measles (Rubeola)

• Clinical symptoms 10-14 days after exposure
  – Fever
  – Malaise
  – Coryza
  – Sneezing
  – Cough
  – Photophobia
  – Kopi Spots

Measles (Rubeola)

• Other symptoms
  – Face and neck rash that spreads to trunk and extremities
  – Last about 7-10 days
  – Otitis media
  – Bronchiolitis
  – Pneumonia
  – Hepatitis
  – Encephalitis

Measles (Rubeola)

Diagnosis

• Diagnostic Criteria
  – Fever of 38.3 C or greater
  – Characteristic rash that lasts longer than 3 days
  – Cough
  – Coryza
  – Conjunctivitis
• Detect IgM-specific Ab or 4x change in IgG between acute and convalescent sera
Measles (Rubeola)
Pregnancy Implications

- Increase in maternal mortality in small case series
- Slightly increased risk of spontaneous abortion
- Slightly increased risk of preterm delivery
- No increased risk of congenital anomalies
- Risk of transplacental passage causing neonatal measles

Mumps

- Infection of parotid and salivary glands
- Can also affect brain, pancreas and gonads
- RNA virus
  - Transmitted by saliva and respiratory droplet
  - Incubation is 14-18 days

MUMPS
Mumps

• Clinical diagnosis
• Prodrome: fever and malaise
• Parotitis, usually bilateral

Mumps

• Usually self-limited
• Rare associations
  – Aseptic meningitis
  – Pancreatitis
  – Mastitis
  – Thyroiditis
  – Myocarditis
  – Nephritis
  – Arthritis

Mumps

• Pregnancy Effects
  – Spontaneous abortion
  – Case reports of congenital infection
  – Association with endocardial fibroelastosis
Mumps

- Treatment
  - Supportive
  - Generally self-limited
- Vaccination
  - Live-attenuated
  - No known harm described in pregnancy

VARICELLA

Varicella-Zoster

- DNA virus part of the herpesvirus family
- Causes chickenpox (varicella) and shingles (zoster)
- Aside from pain and discomfort, shingles poses little threat to the pregnancy
Varicella

• 1 to 5 cases per 10,000 pregnancies
• Droplet transmission or direct contact
• Presentation
  – Disseminated, purulent and vesicular rash mostly on abdomen and back
  – Occurs in patches and goes from vesicle to pustule

Varicella

• Self-limiting in children
• In adults
  – 20% develop pneumonia
  – 1% develop encephalitis
• Diagnosis: Presence of anti-VZV IgM antibody

Evaluation

• Query all pregnant women about previous exposure
• 95% of adults are immune
• If unsure, check for anti-VZV IgG
  – 75% of unsure women have prior serologic immunity
  – If negative, imperative to avoid sick contacts
Prophylaxis

• If exposed, should be treated in 72-96 hours
  – VZIG previous tested, but difficult to obtain in the US
  – Oral acyclovir 800 mg 5x/day for 7 days
  – Oral valacyclovir 1 gram 3x/day for 7 days
• Treatment dose is the same as above

Treatment

• IV acyclovir
  – Pneumonia
  – Encephalitis
  – Disseminated infection
  – Immunosuppression

Varicella

• Pregnancy Effects (rare)
  – Spontaneous abortion
  – IUFD
  – Congenital anomalies
• Ultrasound findings
  – IUGR
  – Microcephaly/Ventriculomegaly
  – Echogenic liver
  – Limb anomalies
Varicella Vaccine (Varivax)

- Live virus
- ≤ 12 years old: single dose
- >12 years old: two doses 4-6 weeks apart
- Not recommended in pregnancy
- May be considered in breastfeeding mothers

PNEUMONIA

Pneumonia

- Prevalence of 1/118 to 1/2,288
- Most common nonobstetric infection that contributes to maternal mortality
- Prior to the development of antibiotics, mortality was almost 25%
- Now about 0-4%
Risk Factors for Pneumonia

- HIV
- Poorly controlled asthma
- Cystic fibrosis
- Most cases have no risk factors

Obstetric Complications

- Preterm labor
- Maternal mortality
- Perinatal Mortality

Diagnosis

- Clinical symptoms combined with chest radiograph findings
- Radiograph findings can vary according to causative agent
- The majority of the time, no pathogen is identified and the treatment is empiric
Bacterial pneumonias
- Acute onset
- Fever, chills, productive cough
- Consolidation on chest x-ray with possible air bronchograms

Bacterial Pneumonia
- *Streptococcus pneumoniae*
  - Brownish sputum
  - Gram-positive diplococci
  - Asymmetric consolidation with air bronchograms on chest radiograph
- *Haemophilus influenzae*
  - Gram-negative coccobacillus
  - Consolidation with air bronchograms in the upper lobes
Bacterial Pneumonia

- *Klebsiella pneumoniae*
  - Gram-negative rod
  - Pleural effusion
  - Cavitations on x-ray
- *Staphylococcus aureus*
  - Pleuritis, chest pain and purulent sputum
  - Consolidation without air bronchograms

Atypical Bacterial Pneumonias

- *Mycoplasma pneumoniae, Legionella pneumophila and Chlamydia pneumoniae*
  - Gradual onset
  - Low-grade fever
  - Mucoid sputum
  - Patchy infiltrates without obvious consolidation

Viral Pneumonia

- Influenza
- Varicella
**Influenza Pneumonia**

- 4 million cases per year in US
- Sixth leading cause of death
- Pregnant: Viral infiltration
- Non-pregnant: Bacterial superinfection
- Appears to be worse in the third trimester

**Primary Influenza Pneumonia**

- Rapid progression from unilateral to bilateral infiltrate
- Respiratory failure may develop quickly
- Antibiotics should be started assuming superinfection
- Antiviral agents can also be used

**Varicella pneumonia**

- Presents 2-5 days after onset of fever and rash
- May have cough, dyspnea, pruritic chest pain
- Warrants automatic ICU admission in pregnancy
- Treat with acyclovir 7.5 mg/kg every 8 hours
Varicella pneumonia

- Third trimester is most common time
- Maternal mortality increased significantly over non-pregnant
- Acyclovir improves survival significantly

Pneumonia
Pregnancy Concerns

- Decreased ventilatory reserve
- Immunosupression
- Hospitalization?

Pneumonia
Work-up

- ABG
- Chest x-ray
- Sputum Gram's stain and culture
- Blood culture
Pneumonia Treatment
• Antibiotic treatment should be initiated within 4 hours of arrival to the hospital
• Empiric treatment: 2 agents
  – Third-generation cephalosporin
    • Ceftriazone or cefotaxime
  – Macrolide: azithromycin
  – Goal is to cover typical and atypical organisms
• Oxygen to maintain PO2 at 70 mmHg or greater

Pneumonia Treatment
• Transition to oral agents (cephalosporin) when clinically improving and afebrile for 48 hours
• Treatment should total 10-14 days

Pneumonia What if it doesn’t work?
• Consider viral causes and treat accordingly
• Have a low threshold to protect airway
• If there is concern for oxygenation, continuous monitoring should be utilized if the fetus is viable
• Elective delivery has not been shown to improve respiratory function
Pneumococcal Vaccination

- Vaccine is safe in pregnancy
- Consider in those with risk factors
  - Sickle cell disease
  - Surgical splenectomy
  - Other immunosuppression

INFLUENZA

Influenza

- RNA virus
- Type A: epidemics
- Type B: Mild clinical disease
- Type C: Less frequent and not covered by vaccine
Influenza

• Responsible for 200,000 hospitalizations/year
• Pregnancy women suffer disproportionally
• Rates of infection are highest in children
  – In turn then is passed on to pregnant women
• Epidemics occur November to March

Influenza

• Respiratory droplet transmission
• Incubation period is 1-5 days
• Disease can range from mild to fatal

Influenza - Symptoms

• Abrupt onset of:
  – Malaise, myalgia or headache with fever
  – Dry, non-productive cough,
  – Coryza
  – Mild dyspnea
  – Sore throat
• Secondary bacterial pneumonia can develop
Influenza - Diagnosis

- Viral culture
- Serum antibody levels
- Chest x-ray

Influenza - Treatment

- Mostly supportive
- Observe for preterm labor
- Consider zanamivir (10mg BID x 5d) or oseltamivir (75-150 mg PO BID x 5 d)
- Amantadine not recommend in pregnancy
- Antibiotics for superimposed pneumonia

Influenza Obstetric Implications

- Increased incidence of preterm labor, especially with superinfection
- Pneumonia seems to disproportionately affect pregnant women
- Respiratory morbidities are greater due to physiologic pulmonary changes of pregnancy
Influenza Vaccine

• Recommended for women pregnant during the flu season
• IM injection recommended
• Intranasal not recommended

Infections and Preterm Birth

• Genital infections have the highest associations with preterm birth
• Systemic and non-genital infections have also been found to have higher rates of preterm birth
• Likely there is a common pathway that is cytokine mediated responsible for labor activation for many different infections

Questions?

• Thank you