Goals and Objectives

- Review presentations of common pediatric infectious diseases
- Discuss evaluation and treatment of infections seen by pediatricians
- Present cases in test format, similar to that used in the examination

Case 1:

- A 9 month old child, who attends a day care center develops high fever and lethargy; he experiences a 5 minute tonic-clonic seizure.
  - CSF examination:
    - 10,000 WBC (90%PMNs and 10% lymphs)
    - Protein: 130 mg/dL
    - Glucose: 5 mg/dL
Question 1

Of the following, the most likely etiologic agent is:

- A. Herpes simplex type 1 (HSV-1)
- B. Streptococcus pneumoniae
- C. Escherichia coli
- D. Cryptococcus neoformans
- E. Mycobacterium tuberculosis

Meningitis: Cerebrospinal Fluid Findings

<table>
<thead>
<tr>
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<th>Bacterial Partially-treated</th>
<th>TB Viral</th>
<th>Para-mening focus</th>
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<td>Cells/mm³</td>
<td>20-5000 PMN</td>
<td>20-5000 PMN</td>
<td>&lt;1000 PMN, L low/n</td>
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<td>Glu low</td>
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<td>Pro</td>
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<td>Gram Stain</td>
<td>+/-</td>
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<td>Culture</td>
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Bacterial Meningitis: Signs and Symptoms

- Fever
- Stiff neck (> 2 years)
- Mental status change
- Full fontanel
- Infant < 2 years:
  - Acutely ill without other source
Bacterial Meningitis: Pathogens

- Newborns:
  - Group B streptococcus
  - E.coli, other enterics
  - Salmonella
  - Listeria monocytogenes

- After 6 weeks of life:
  - Neisseria meningitidis
  - Streptococcus pneumoniae
  - Haemophilus influenzae (type b)

- After Head Trauma:
  - Streptococcus pneumoniae

- Post-neurosurgery:
  - Klebsiella sp
  - Pseudomonas aeruginosa
  - Staphylococci
**Bacterial Meningitis: Empiric Treatment**

- **Newborns:**
  - Ampicillin + gentamicin or amikacin or cefotaxime
- **After 4 weeks of age:**
  - Cefotaxime or ceftriaxone or chloramphenicol
  - Vancomycin in PCN-resistant endemic areas

**Bacterial Meningitis: Organism Specific Therapy**

- **Meningococcus:** Penicillin for 7 days
- **H. influenzae:** 7 days-10 days, longer in complicated cases
  - Beta-lactamase negative: Ampicillin
  - Beta-lactamase positive: Ceftriaxone
- **Pneumococcus:** 10 days minimum
  - Penicillin-sensitive: Penicillin
  - Relatively penicillin-resistant: Ceftriaxone
  - Penicillin-resistant: Vancomycin+?

**Meningitis: Steroid Therapy (AAP)**

- Consider only for children > 6 weeks old
- Dexamethasone may be beneficial in cases of H. influenzae meningitis
  - Decreases risk of hearing loss
- Dose: 0.6mg/kg/d in 4 doses for 2-4 d
- Must be given prior or just after antimicrobial therapy, likely not effective if >1 h after antibiotic
Meningitis: Steroid Therapy
(AAP)

- Not for suspected or proven non-bacterial meningitis
- Not for partially treated meningitis with negative cultures
- Stop therapy if bloody stools develop and monitor closely

Meningitis: Hospital Precautions

- Droplet Isolation for 24 hours
  - *N. meningitidis*
  - *H. influenzae*

Question 2

- Culture of the cerebrospinal fluid reveals *Neisseria meningitidis*. Which of the following statements is true?
  - A. Meningococcal vaccine should be given to all contacts at the child’s day care center.
  - B. The occurrence of a seizure at the onset predicts a poor prognosis
  - C. The overall prognosis is better than if the child had meningococcemia without meningitis
  - D. Rifampin prophylaxis should be given for family contacts of this child but not for the child care contacts
Prophylaxis: Meningococcal Disease (high risk contacts, index case)

- **Rifampin:**
  - 20 mg/kg/d q 12 h X 2days
  - If age < 1 m: 5 mg/kg q12h X 2days

- **Ceftriaxone:**
  - ≤12y: 125 mg IM
  - >12y: 250 mg IM

- **Ciprofloxacin** (if > 18 y, not pregnant)
  - 500mg po

Case 2

- A 2 year old boy develops a productive cough, high fever and respiratory distress 2 days following mild cold symptoms. Physical findings reveal an ill-appearing child with a temperature of 39.5 degrees C and respiratory rate of 60/minute. He has decreased breath sounds in the right lung and nasal flaring. A chest radiograph reveals a large right middle lobe infiltrate.
Question 3

Of the following, the best course of action is to intravenously administer:

- A. cefotaxime
- B. erythromycin
- C. cefoxitin
- D. nafcillin

Case 3

A 12-year old boy presents with a 10 day history of sore throat, dry cough, fever. On physical examination, the child is well appearing, has a temperature of 39.2 degrees C., a respiratory rate of 28 breaths/minute and scattered rales bilaterally. A CXR reveals bibasilar interstitial infiltrates.

12 year old boy with pneumonia
Question 4

The most likely pathogen is:
- A. Mycobacterium tuberculosis
- B. Mycoplasma pneumoniae
- C. Streptococcus pneumoniae
- D. Group A streptococcus

Question 5

The best test to make this diagnosis is:
- A. Throat culture
- B. Blood culture
- C. Throat swab PCR
- D. Titers: IGG and IGM

Pneumonia in Children

- Viral
- Streptococcus pneumoniae
- Staphylococcus aureus
- Streptococcus pyogenes (Group A streptococcus)
- Mycoplasma, Chlamydia
- Haemophilus influenzae, Moraxella catarrhalis
**Chlamydia pneumoniae**

- Severe pharyngitis, often first sign
- Hoarseness, fever, nodes
- Cough, productive
- Bronco-spasm
- Infiltrate on CXR
- WBC: normal, ESR up
- Erythromycin, tetracycline, **not** sulfonamides

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**Case 4**

- A 10 month old infant is seen in your office with a history of fever to 103 degrees F. for the past 3 days. She is not in day care. The child is playful and the physical examination in unremarkable except for fever. There are no ill contacts at home.

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**Question 5**

- The most likely virus causing this child’s fever is:
  - A. Parvovirus
  - B. Human herpes virus 6
  - C. Epstein-Barr virus
  - D. Cytomegalovirus
Human Herpesvirus 6 /Exanthem Subitum/ Roseola Infantum

- Fever: 3-5 days
- URI, mild
- Cervical adenopathy
- Rash: maculopapular < 48 hours

Roseola Infantum

- Complications
  - seizures
  - meningitis
  - encephalitis

Fever in Young Children

- N=243 (<2 years)
  - 34 (14%) HHV-6 isolated
  - Rash: 3/34

Pruksananonda P, Hall CB et al.
Primary HHV-6 infection*

- Age: 9-21 months (40% by 12 m)
- Transmission: no seasonality
- Symptomatic: 90%
  - Fever 58% (mostly older infants)
  - Fussiness 70%
  - URI: 26%
  - Rash 31%
  - Roseola: 24%
  - Visit to physician

THE CLINICAL SIGNS ASSOCIATED WITH PRIMARY HHV-6 INFECTION AND PROPORTION OF CHILDREN WITH PRIMARY HHV-6 INFECTION

THE PROPORTION OF VISITS FOR ACUTE FEBRILE ILLNESSES EVALUATED IN AN EMERGENCY DEPARTMENT CAUSED BY HHV-4 PRIMARY INFECTION FROM BIRTH TO 36 MONTHS OF AGE
Case 5

A 30 year old teacher calls your office seeking advice. She is 10 weeks pregnant and there has been an outbreak of "slapped cheek" disease in her school with some cases in her classroom.

Question 6

Of the following, the best advice for this teacher would be:
A. Advise her that the risk to the fetus is low
B. Recommend an ultrasound to look for hydrops fetalis in the beginning of her third trimester
C. Recommend referral to a high risk obstetrical service to follow serial US and to prepare for in utero transfusion
D. Recommend that she takes a leave of absence from work until the outbreak is over

Parvovirus: Manifestations

- Asymptomatic
- Slapped Check Disease
- Transient Aplastic Anemia
- Stillbirth/ Hydrops/ Congenital Anemia
- Anemia: Immune suppressed host
- Arthritis
Case 6

A 6 month old infant born to a woman with HIV infection is seen in your office with a 3 day history of URI symptoms with cough. She has developed a high fever today and on exam is mildly tachypneic but otherwise has no focal findings. CXR shows an interstitial, diffuse infiltrate.
Question 7

- Appropriate interventions at this point would include all of the following except:
  - A. Obtain an NP swab for DFA for RSV, adenovirus, parainfluenza and influenza viruses
  - B. Obtain a blood culture and begin ceftriaxone
  - C. Administer high dose intravenous trimethoprim-sulfamethoxazole to the infant
  - D. Send a serum HIV antibody test on the infant

HIV Infection: Diagnosis, Infants<15 months

- Maternal antibody transmitted
- Viral culture
- PCR by DNA, Viral load
- ELISA at 18 months

CONFIRM TESTS!
**HIV Infection: Infants <15 months: Diagnosis is virologic**

- PCR (DNA or RNA)
  - 14-21 days
  - 4-6 months
- Elective:
  - Birth: PCR DNA*
  - ELISA at 12-18 months

*30-40% of infected infants are PCR + by 48 hours

**Diagnosis of HIV infection in infancy: Exclude diagnosis by**

- HIV-1 DNA or RNA PCR after 2 weeks of age and one specimen after 4 weeks
- HIV-1 DNA or RNA test at or after 8 weeks of age
- HIV antibody – after 6 m and no other signs of HIV infection
- Test antibody at 18 months of age: optional

**HIV Infection: Transmission**

- In Utero/Perinatal (20-30%)
  - Can be almost completely prevented if mother and infant are treated
- Breastfeeding
- Blood/blood products
- IV drug use
- Sexually transmitted
HIV Infection: Manifestations

*Pneumocystis carinii* pneumonia (PCP)
Lymphoid interstitial pneumonitis (LIP)
Failure to thrive
  - Lymphadenopathy
  - Hepatosplenomegaly
  - Abnormal CBC
Recurrent bacterial infections
  - *Streptococcus pneumoniae*

Pediatric AIDS: Immune Defects

T cell defect: Lymphopenia, CD4 +
Qualitative T cell defects
  - Cytotoxic responses: abnormal
  - Proliferative responses: abnormal
    - antigens
    - mitogens
B cell hyperactivity
  - Elevated IgG, IgA, IgM
  - Poor antibody response to vaccines

Pediatric AIDS: PCP
Prophylaxis

- Begin TMP/SMX prophylaxis:
  - Infants born to HIV infected mother
  - After an episode of PCP
  - Low CD4 count: (<20%)
    - <1500 cells/ml (<30%)   0-12 months
Antiretroviral Therapy

Low CD4 count:

- <1750 cells/mm³ (<30%) 0-12 months
- <1000 cells/mm³ (<25%) 13-24 months
- <750 cells/mm³ (<20%) 2-6 years
- <500 cells/mm³ >6 years

Case 7

- A 2 year old boy has had swollen lymph nodes in the left anterior cervical chain for several weeks. He has had low grade fever but no other illness. He lives in a suburban area, is not in child care, and has no known exposure to anyone with tuberculosis. His PPD shows 9 mm induration. His chest radiograph is normal.

Question 8

- The best therapy for this child is:
  - A. Course of INH, rifampin and pyrazinamide
  - B. A biopsy of the node mass for culture
  - C. A course of clarithromycin and rifampin
  - D. Excision of the lymph node
Definition of Positive PPD (5TU)

- **Reaction ≥ 5 mm**
  - contact with person with known or suspected TB
  - immunocompromised child
  - child suspected of having tuberculous disease

Definition of Positive PPD (5TU)

- **Induration ≥ 10mm**
  - children less than 4 years of age
  - children with any chronic condition
  - children whose exposure to TB is deemed to be increased
- **Induration ≥ 15mm**
  - children who are 4 years and older and have no risk factors for tuberculosis

TB skin test for children (TST)

- Contacts of adult with TB
- From endemic areas
- Children with HIV
- Incarcerated youth

**Interferon-gamma release assay (IGRA):**
not reliable in children less than 5 years of age; recommendations pending
Preventative Therapy:
Indications:
+ PPD without active disease (even if BCG) and/or child exposed to adult with active disease (for 3m)

- INH for 9 months daily (12 months if HIV+)
  - DOT can be 2X/week for 9 months
- Rifampin: 6 months daily

TB in a Child is a Sentinel Event

- Identify the adult contact!
- Diagnosis: often clinical initially and therapy empiric
  - first morning sputum: send 3
  - clinical setting (e.g. Aseptic meningitis in a young child with exposure)

Answers to Questions
1. B 9. D
2. C
3. A
4. B
5. C
6. B
7. A
8. D