Pediatric Infectious Disease: A Focus on AOM, RSV, Bronchitis, Pharyngitis

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Objectives
• Upon completion of this lecture, the participant will be able to:
  – Identify statistics related to incidence/prevalence of various respiratory/ENT conditions in children
  – Discuss the signs and symptoms of AOM, RSV, Bronchitis and Pharyngitis
  – Discuss treatment options for the above conditions

Pathogens and Resistance
**Causative Upper and Lower Respiratory Pathogens**

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Moraxella catarrhalis*

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**Streptococcus Pneumoniae**

- Gram positive diplococci
- Most common cause of Community Acquired Pneumonia
  - Also the most common bacterial cause of OM and sinusitis
- 70% of children and 30% of adults have nasopharyngeal colonization
- Disease results from a microaspiration

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**Mechanism for the Development of Antimicrobial Resistance**

- *Streptococcus pneumoniae*
  - Many mechanisms for resistance
  - Most common mechanism: Resistance from an alteration in the penicillin binding proteins which reduce/eliminate binding of penicillin to the proteins
Mechanism for the Development of Antimicrobial Resistance

• *Streptococcus pneumoniae*
  - Erythromycin resistance: ribosome modification and alteration in antibiotic transport
  - Of increasing concern is the ermAM gene. This gene confers cross-resistance to other 14, 15, and 16 membered rings (clarith, azith)

Penicillin-Resistant S. pneumoniae

% Penicillin Resistant

Where are we now?

• *S. Pneumoniae*
  - 25% - 50% are not fully responsive to penicillins
  - 33% is resistant to macrolides

www.jfponline.com/Pages.asp?AID=1926&UID=22190 accessed 02-19-07
Of Increasing Concern…

- The first clinical isolate of *S. pneumoniae* to exhibit a high level of resistance to fluoroquinolones was found in 2001 in Taiwan.

Streptococcus Pneumoniae

- Most likely to be present with recurrent disease and least likely of all pathogens to resolve without treatment
- <30% chance of spontaneous resolution; Some sources say <10%

H. Influenzae

- Gram negative coccobacillus
  - Bronchotrachial tree becomes colonized and microaspiration occurs
- Most commonly seen among smokers, children of smokers and daycare children
  - 33% - 35% of *H. influenzae* is beta lactamase producing
  - TRUST results (Tracking Resistance in the United States)
    - 31.3% produced B lactamase in 99-2000
    - TMP-SMX resistance increased to 14% from 11.9%
    - Ampicillin resistance decreased from 33.9% to 30.7%
**M. Catarrhalis**

- Gram negative bacillus
- Implicated in recurrent OM and Sinusitis
- Will often spontaneously resolve if left untreated
- 90% - 98% beta lactamase producing

**Clinically-When Do You Suspect Resistance?**

- One of the largest predictors of drug resistance is recent antibiotic use
  - Usually defined as within the previous 6 weeks
  - 3-4 fold increased risk of DRSP
- Other risk factors include:
  - Daycare settings, Nursing homes
  - Age > 65
  - Poor hygiene
  - Recurrent antibiotic use

**Why is Resistance Becoming Such a Problem?**

- Antibiotic Overuse
  - 50% of prescriptions are not needed
  - 100 million prescriptions for antibiotics yearly
  - 50 million not needed
  - Increased use of prophylactic antibiotics
  - Animal husbandry
  - Disinfectant soaps / cleansers
  - Managed care organizations
Why is Resistance Becoming Such a Problem?

• Antibiotic Misuse
  - Not prescribing the correct antibiotic
  - Not taking as prescribed (entire course, tid)

There is still hope....

• Reducing antibiotic usage can reverse resistance
• Choosing the most appropriate antibiotic for the patient can also reverse resistance
• Educating patients about the importance of antibiotic compliance can reduce resistance

Otitis Media
Otitis Media

- Number one diagnosis among healthcare providers caring for children
- By the age of 3, 2/3’s of all children will have had an OM; 1/3 will have had it > 3 times
- Most common amongst boys, winter months, bottle fed babies, preemies, daycare children, children of smokers, and individuals with craniofacial abnormalities

Otitis Media

- Epidemiology
  - Eustachian tube is much shorter, floppy, and horizontal in children when compared with adults
  - Between ages 7-12, eustachian tube resembles that of an adult

Otitis Media

- Symptoms
  - Fever
  - Pain
  - Discharge from ear
  - Tugging or batting at the ear
  - Irritability, crying, lethargy
  - Decreased appetite
  - Decreased sleep
  - Recent URI
Otitis Media

- Signs
  - Red, bulging tympanic membrane
  - Retracted with pus, fluid or air bubbles
  - No movement with insufflation
  - Inability to see normal landmarks
  - Occasionally-hole in the tympanic membrane

Variations of Tympanic Membrane

- Normal TM
- Acute OM
- Otitis Media with Effusion

AOM

- S. pneumoniae
  - Gram-positive diplococci
  - => 25% PCN-resistant via altered protein-binding sites
  - Very unlikely to resolve on own
  - Usually the sickest
Acute OM

- H. influenzae
  - Gram-negative bacilli
    - \( \geq 40\% \) amoxicillin-resistant via beta-lactamase production
- M. Catarrhalis
  - 90-95% beta-lactamase producing
  - Likely to resolve on own

Bullous Myringitis

- Mycoplasma
- Intensely painful
- Treatment is with a macrolide

Latest Guidelines from AAP and AAFP

- Published May 2004
- Pediatrics Volume 115; Number 5
- Article may be found at www.aap.org
Diagnosis of AOM

- History of acute onset
- Identify presence of middle ear effusion
  - Bulging TM
  - Decreased or absent mobility of TM
  - Air-fluid level present
  - Otorrhea
- Identify signs of middle ear inflammation
  - Erythematous TM
  - Otitis media, which interferes with function/sleep

Criteria for Initial Antibacterial-Agent Treatment or Observation in AOM

<table>
<thead>
<tr>
<th>Age</th>
<th>Certain dx</th>
<th>Uncertain dx</th>
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<td>&lt; 6 mo</td>
<td>Antibacterial therapy</td>
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Wright, 2008
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Observation

- Observation without antibiotics is an option for this group with uncomplicated AOM
- Observation x 48 – 72 hours
- Limit treatment to symptom relief
Observation Option

• Observation is now recommended after compiling 30 years of information
• 7 – 20 children must be treated for 1 child to derive benefit from the antibiotics
• By 24 hours, 61% have had a decrease in symptoms whether he/she received antibiotics or placebo
• By 7 days, 75% have had a resolution of symptoms

Recommended Antibacterial Agents in AOM

<table>
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<tr>
<th>Temp = 39°C and/or Severe Otalgia</th>
<th>Clinically defined treatment failure at 48-72 hours after initial management with observation option</th>
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<tr>
<td></td>
<td>Recommended</td>
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<td>Amoxicillin 80–90 mg/kg/day</td>
</tr>
<tr>
<td>No</td>
<td>Amoxicillin-clavulanate 90 mg/kg/day of amoxicillin with 6.4 mg/kg/day of clavulanate</td>
</tr>
<tr>
<td>Yes</td>
<td>Cefixime</td>
</tr>
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<td>1 or 3 days</td>
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Types of Hypersensitivity

• Non-Type I
  - Rash
• Type I
  - Urticaria or anaphylaxis
### Recommended Antibacterial Agents in AOM

**Temp = 39°C and/or Severe Otalgia**

<table>
<thead>
<tr>
<th>At diagnosis for patients being treated initially with antibacterial agents</th>
<th>Recommended</th>
<th>Alternative for Penicillin Allergy</th>
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<tr>
<td><strong>No</strong></td>
<td>Amoxicillin 50-60 mg/kg/day</td>
<td>Non-Type I: Cefdinir, Cefuroxime, or Cefpodoxime</td>
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<td><strong>Yes</strong></td>
<td>Amoxicillin-clavulanate 90 mg/kg/day of amoxicillin with 6.4 mg/kg/day of clavulanate</td>
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<td><strong>Yes</strong></td>
<td>Ceftriaxone—3 days</td>
<td>Clindamycin</td>
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### Remember...
- For children with OM and tympanostomy tubes:
  - You may also utilize topical medications
    - Floxin Otic (Ofloxacin) 0.3% solution
      - Age 1 - 12 years: 5 drops into affected ear bid x 10 days
    - Ciprodex (Ciprofloxacin):
      - 6 months and up: 4 drops into the affected ear bid x 7 days
Duration of Treatment for AOM

- Regimens evaluated
  - Numerous treatment options were evaluated
- Treatment success evaluated at 12-14 days
- Results
  - Similar response in all patients between short-course (e.g., 5 days) and standard-course (e.g., 10 days) therapy
  - Patients <2 years old and those in a daycare setting may achieve better results with 10-day therapy
  - Current recommendation: 5-7 days for all others


Bronchiolitis

- Bronchiolitis is the most common lower respiratory tract infection in infants and is usually caused by a viral infection
- Most common cause: respiratory syncytial virus
- RSV is responsible for >50% of all cases
- Other causes: adenovirus and influenza
- Most commonly seen in the winter and spring
Bronchiolitis

- Respiratory infection that affects the tiny airways (bronchioles)
- These airways lead to the lungs
- Airways become inflamed and swell
- They fill with mucus – making it very difficult for the child to breathe

Bronchiolitis

- Affects infants and young children most often because their small airways become blocked by mucous more easily than older children
- Usually occurs between birth and 2 years of age
- Peak occurrence: 3 – 6 months

Bronchiolitis

- More common in the following individuals
  - Males
  - Bottle fed babies
  - Children in crowded conditions
  - Day care children
  - Cigarette smoke exposed children
Burden of Illness

• Typically, bronchiolitis is a mild illness
• Risk factors for more severe illness include:
  - Prematurity
  - Heart or lung disease
  - Weakened immune system

Complications of Bronchiolitis

• Hospitalization
• Respiratory distress
• Children with this condition are more likely to develop asthma later in life

Signs and Symptoms

• Usually presents as the common cold initially
  - Nasal congestion
  - Runny nose
  - Cough
• These symptoms typically last for 1-2 days and then symptoms begin to worsen
  - Fever
  - Vomiting after coughing
Signs and Symptoms

- Cough worsens
- Wheezes frequently occur
  - High pitched sounds indicating a difficulty with air movement
- Worsening respiratory distress may occur
  - Retractions
  - Flaring of the nostrils
  - Irritability
  - Tachycardia and tachypnea

Contagiousness

- RSV is contagious as are the other viruses that frequently cause bronchiolitis
- Spread via tiny drops of fluid that become airborne with coughing or sneezing

Incubation Period and Duration

- Incubation period is:
  - Days – 1 week
  - This is dependent upon which virus is responsible for the infection
- Duration of symptoms
  - Typically, 7 days but children with severe cases may cough for weeks
Treatment

- Symptomatic treatment is the most common treatment
  - Increased fluids
  - Cool mist vaporizer to thin the secretions
  - Tilting the child’s mattress up may be beneficial
- Antibiotics are not helpful

Pharmacotherapy

- Nebulized epinephrine
- Nebulized ipratropium bromide
- Corticosteroids
- Inhaled corticosteroids

Prevention of RSV

- Synagis (palivizumab)
  - Approved for the prevention of RSV disease in children younger than 24 months of age who are at high risk for serious RSV disease
  - Synagis has not been approved for treatment of RSV infection
  - Synagis is given as a monthly shot to protect children from contracting RSV during November – May
  - High risk children include: babies who were born two months or more premature (32 weeks gestation or less
Bronchitis

• Definition: Inflammatory condition of the tracheobronchial tree
  - Acute bronchitis
    • Most cases of acute bronchitis are viral (90-95%)
  - Chronic bronchitis

• 90% - 95% of bronchitis cases are viral
• 5% or so are bacterial
  - Most frequent cause of bacterial bronchitis - atypical pathogen (i.e. mycoplasma)
Treatment for Bronchitis

• Symptomatic
• Increase fluids
• Steam
• Guiafenesin or similar
• First generation antihistamine
• Cough syrup – usually not helpful or effective

Bronchitis

• Treatment
  - Antibiotics rarely needed
    • If needed, atypical pathogen coverage
  - Prednisone
    • Short, non-tapering burst is often very effective

Pertussis
What Is Pertussis?

- Acute respiratory tract infection
- *Bordetella pertussis* (gram-negative aerobic bacillus)
- Highly communicable\(^1\)
- Morbidity in all ages, particularly infants\(^1\)
- Causes prolonged coughing\(^1\)
- Difficult to diagnose

Reference:

Reported Pertussis Cases in the United States (1922-2004)

Why Are the Number of Reported Pertussis Cases Increasing?

- Incomplete immunization of children\(^1\)
- Vaccine immunity is variable and wanes over time\(^2,3\)
- Persistent human reservoir
- Better awareness of disease as a result of improved diagnostic testing
- Under- and misdiagnosis results in ongoing transmission
- Inadequate use of chemoprophylaxis in close contacts
- Adolescent/adult booster vaccine only recently licensed

References:
2. CDC. *MMWR.* 2004;53(30):693.

References:
1. CDC. *MMWR.* 2002;51:73-76.
Reported Pertussis Cases Are the Tip of the Iceberg

- Nationwide, a small percentage of pertussis cases are actually reported
- Underreporting may be greatest among adolescents and adults

Infant Pertussis Remains a Concern

Transmission of Pertussis

- Pertussis is transmitted to and from all age groups.
- Highly contagious; with 80% secondary attack rates among susceptible household contacts.
- Transmission of pertussis to household members has been documented.
- Young infants are at high risk of morbidity and mortality.
- Adolescents get pertussis from household contacts and schoolmates.
- Adults get pertussis from work and household contacts; parents (adult and adolescent) give pertussis to their infants.
Pertussis in Young Infants

- Infants <6 months have the highest age-specific incidence rate\(^1\)
- Among infants <1 year of age\(^2\)
  - 53% occur at <2 months old (no vaccination)
  - 29% occur at 2-6 months old (incomplete vaccination)
- Source: Shift from young sibling to adolescent or adult. A parent or sibling is involved in 50-75% of cases in which a source is identified\(^3\)
- Importance of a parent as source increases with younger infant age: mothers are 2x more likely to be the source for infants than fathers\(^3\)
- Protection afforded by maternal antibodies is limited\(^4\)

References:

Infant Pertussis: Who Is the Source?

- 616 infant cases from 4 states
- 264 cases had a known or suspected source

Sources:
- Mother 32% (N=264)
- Sibling 20%
- Father 15%
- Grandparent 8%
- Other 25%

Health-care Professionals Involved in Transmission of Pertussis

- Physicians 1912 Schwenkenbecher
- Nurses 1972 Kurt et al
- Physicians 1992 Etkind et al
- Nurses 1995 Christie et al
- Nurses 1997 Matlow et al
- Nurses and Physicians 2005 CDC
When Is Pertussis Communicable?

- Persons with pertussis become highly infectious during the catarrhal period.
- Some individuals, especially infants, may be infectious for a period of time longer than shown above.


Diagnostic Laboratory Findings in Pertussis

- Positive culture
- Positive serologic tests
- Increased WBC with an absolute lymphocytosis
- DFA—variable sensitivity/specificity

Adapted from: Mortimer EA. In: Krugman's Infectious Diseases of Children. 10th ed. Mosby Year Book, Inc; 1998:335-349.

Diagnostic Tests for Pertussis

- NP culture on special media (Regan-Lowe, Bordet-Gengou)
- PCR
- Serologic tests
- Increased WBC with an absolute lymphocytosis
- DFA—variable sensitivity/specificity
Treatment of Cases and Chemoprophylaxis of Close Contacts

- Erythromycin estolate or erythromycin ethylsuccinate (EES) 40–50 mg/kg/day (max 2 g/day) in 2–4 divided doses for 7–14 days*
- Azithromycin 10–12 mg/kg/day (max 500mg/day) 1 dose/day for 5 days†
- Clarithromycin 15–20 mg/kg/day (max 1g/day) in 2 divided doses for 7 days

Reference:

* Use caution when using macrolides, especially erythromycin, in infants less than 2 weeks old.
† Azithromycin may be given as 10–12 mg/kg/day (max 500 mg/day) on day 1 and 5 mg/kg/day (max 250 mg/day) on days 2–5.

Treatment of Cases and Chemoprophylaxis of Close Contacts (cont’d)

- For patients allergic to macrolides:
  - Trimethoprim-sulfamethoxazole 8mg TMP/40mg SMX/kg/day (max 320mg TMP/1600mg/day) in 2 divided doses for 14 days
- All of these agents reduce transmission of B pertussis and ameliorate early symptoms
- No antibiotic lessens the severity or shortens the duration of cough in patients who are already experiencing paroxysmal episodes
- Caution must be exercised using macrolides, especially erythromycin, in infants <2 weeks old (pyloric stenosis)
- Penicillins/cephalosporins are not effective

References:

PHARYNGITIS
Pharyngitis

- Epidemiology
  - Group A Beta Hemolytic Strep
    - Most interest because of its association with severe complications
    - Peritonsillar abscesses, rheumatic fever, post-streptococcal glomerulonephritis - complications
    - Rheumatic fever: 20/100,000 people in early 1900’s, now 1:100,000
      - Recent increase in cases
      - Many cases in individuals without sore throat

Pharyngitis

- Symptoms
  - Group A Beta Hemolytic Strep
    - Rapid onset of sore throat
    - Fever 103-104
    - Swollen glands
    - Children often complain of abdominal pain
    - Usually-no URI symptoms
    - Headache
    - Decreased appetite
    - Dysphagia
    - Irritability

Exudative pharyngitis

Differentials include:
- Strep pharyngitis
- Peritonsillar abscess
- Mononucleosis
- Viral pharyngitis
Plan

- Diagnostic
  • Throat culture: 24 hour is the gold standard
  • Quick strep: 85-100% specificity; 31-95% sensitivity
  • Must swab both tonsils for best results
  • Consider mononucleosis
Pharyngitis

Even with a best case scenario, 1/3 - 1/2 of cases of strep pharyngitis are missed or overdiagnosed using history and physical examination only!!!

MUST DO A THROAT CULTURE

Remember…
Children with mono have strep pharyngitis 50% of the time

Pharyngitis

• Plan
  - Therapeutic: Strep Pharyngitis
    • PCN VK-standard
    • Treatment is for 10 days
    • Warm water gargles
    • Tylenol/NSAID’s
  - Educational
    • Contagion
    • Quick improvement
    • Discard toothbrush
Peritonsillar Abscess

• Generally begins as an acute febrile URI or pharyngitis
• Condition suddenly worsens
  - Increased fever
  - Anorexia
  - Drooling
  - Dyspnea
  - Trismus

Peritonsillar Abscess

• Physical examination
  - May appear restless
  - Irritable
  - May lie with head hyperextended to facilitate respirations
  - Muffled or “hot potato voice”
  - Stridor may be present
  - Respiratory distress

Peritonsillar Abscess

• Physical examination findings
  - Fiery red asymmetric swelling of one tonsil
  - Uvula is often displaced contralaterally and often forward
  - Large, tender lymphadenopathy
Peritonsillar Abscess

Important Reminder
• If respiratory distress is severe, do not examine the pharynx

Treatment
• Aspiration of the abscess may be performed for an accurate diagnosis and treatment
• CT scan of the head and neck
  – Monitor airway at all times
• ENT consult is essential
• Usual management
  – IV antibiotics
  – Inpatient management
Thank You For Your Attention

I Would Be Happy To Entertain
Any Questions

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