Community Acquired Pneumonia in Children
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Objectives
- Define Community Acquired Pneumonia (CAP)
- Discuss the epidemiology, diagnosis and treatment of CAP across the age and patient care spectrum
Disclosures

- No financial backing from anyone
- No off label drugs
- No conflicts of interest

Background

Global distribution of cause-specific mortality among children under age 5 years in 2004. Pneumonia was the leading killer of children worldwide.

The Numbers

- 150 million cases worldwide
  - 20 million severe
  - 1.9 million deaths worldwide
    - 90% in developing countries
    - 50% in Africa alone
- North America
  - 40/1000 in kids <5 years
  - 15/1000 in kids 5–15 years
  - Mortality is <1/1000; much higher morbidity

So what is pneumonia?

- Infection of the lung parenchyma
  - Lower Respiratory Tract Infection (LRTI)
- Commonly accepted clinical definition
  - Fever
  - Lower respiratory signs
  - Radiologic evidence of LRTI
- The proper diagnosis can be completely clinical
What causes pneumonia?

» It’s bug time

Let’s Talk Bugs
in relative order of frequency

» Birth–3 weeks
  ◦ Group B streptococcus, Gram-negative enterics, Cytomegalovirus, Listeria monocytogenes, Herpes Simplex, Treponema pallidum, genital Mycoplasma or Ureaplasma

» 3 weeks–3 months
  ◦ Chlamydia trachomatis, Respiratory syncytial virus (RSV), Parainfluenza (PIV), Streptococcus pneumoniae, Bordatella pertussis
Let’s Talk Bugs
in relative order of frequency

- 3 months–5 years
  - Viral (RSV, PIV, hMPV, AV, RV), *Streptococcus pneumoniae*, *Haemophilus influenzae*, *Staphylococcus aureus*, *Mycoplasma pneumoniae*, *Mycobacterium tuberculosis*

- 5 years–15 years
  - *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, *Streptococcus pneumoniae*, *Mycobacterium tuberculosis*

- Occasional pathogens
  - *Histoplasma capsulatum*, *Coccidioides immitis*, *Blastomyces dermatitidis*, *Legionella pneumophila*, *Francisella tularensis*, *Pseudomonas pseudomallei*, *Brucella abortus*, *Leptospira spp*, *Chlamydophila psittaci*, *Coxiella burnetii*, *Yersinia pestis*, Hantavirus, Varicella, Measles, Influenza, SARS, Bioterror agents, mouth flora after aspiration
Clinical Clues to CAP

- Age, time of year, local epidemiology, travel
- Fever
- Extra-respiratory symptoms
  - Headache, conjunctivitis, rash, lethargy, sore throat, GI distress
- Underlying conditions
- Ill contacts/daycare
- Previous history of pneumonia
- Foreign body risk
- TB risk

Can we really differentiate the etiology?

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Typical Cause</th>
<th>Age Group</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial</td>
<td><em>S. pneumoniae</em></td>
<td>All ages most commonly &lt;6 y/o</td>
<td>Abrupt onset, high fever, ill appearing, focal exam findings, pain, CXR infiltrate</td>
</tr>
<tr>
<td>Atypical—infant</td>
<td><em>C. trachomatis</em></td>
<td>&lt; 3 m/o</td>
<td>Tachypnea, mild hypoxia, no fever, wheezing, interstitial CXR, “happy and tachypneic”</td>
</tr>
<tr>
<td>Atypical—older</td>
<td><em>M. pneumoniae</em></td>
<td>&gt;5 y/o</td>
<td>Gradual onset, low grade fever, diffuse findings on exam and CXR</td>
</tr>
<tr>
<td>Viral</td>
<td>Take your pick</td>
<td>All ages Most commonly 3mo–5y</td>
<td>URI symptoms, +/- fever, diffuse findings, wheezes</td>
</tr>
</tbody>
</table>
What is the best clinical predictor of LRTI across the age spectrum?

» Tachypnea

Tachypnea and LRTI

» Tachypnea as a sign of pneumonia
  ◦ 50–85% sensitive
  ◦ 70–97% specific

» Yield of CXR is low if tachypnea is absent

» Grunting should also catch your attention
  ◦ May signal impending respiratory failure
Symptoms and Signs of Pneumonia

- Fever
- Cough
- Difficulty breathing
- Vomiting/poor feeding
- Irritability
- Lethargy
- Chest pain
- Abdominal pain
- Shoulder pain
- Fever
- Cough
- **Tachypnea**
- Dyspnea
- Retractions
- Nasal flaring
- Grunting
- Splinting
- Cyanosis

**Symptoms**

**Signs**

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**Physical Examination**

- Overall severity of illness
- Observe LOC of child or level of Irritability
- Observe work of breathing
- Listen first while quiet
  - Crackles
  - Decreased breath sounds
  - Dullness to percussion
  - Egophony (e→a)
  - Bronchial breath sounds
- Generate a Bacterial Pneumonia Score
### What is the BPS?

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ax. Temp ≥39°C</td>
<td>3</td>
</tr>
<tr>
<td>Age ≥9 mo</td>
<td>2</td>
</tr>
<tr>
<td>ANC ≥8,000</td>
<td>2</td>
</tr>
<tr>
<td>Bands ≥5%</td>
<td>1</td>
</tr>
<tr>
<td>CXR findings</td>
<td>-3 to 7</td>
</tr>
<tr>
<td>Total</td>
<td>-3 to 15</td>
</tr>
</tbody>
</table>


### BPS CXR Scoring

<table>
<thead>
<tr>
<th>Finding</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infiltrate</td>
<td>Well defined, lobar, (sub)segmental</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Poorly defined, patchy</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Interstitial, peribronchial</td>
<td>-1</td>
</tr>
<tr>
<td>Location</td>
<td>Single lobe</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Multiple lobes, well defined</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mult sites, perihilar, poorly defined</td>
<td>-1</td>
</tr>
<tr>
<td>Pleural fluid</td>
<td>Minimal angle blunting</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Obvious fluid</td>
<td>2</td>
</tr>
<tr>
<td>Abscess, bullae, pneumatocele</td>
<td>Equivocal</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Obvious</td>
<td>2</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>Subsegmental (multiple sites)</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>Lobar (RML or RUL)</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>Lobar (any other)</td>
<td>0</td>
</tr>
</tbody>
</table>
How good is this system

- BPS ≥ 4
  - Sensitivity: 100%
  - Specificity: 94%
  - PPV: 76%
  - NPV: 100%
- May not have captured all kids with pneumonia due to exclusion criteria, but the findings make sense.
- Somewhat cumbersome to use in a busy hospital
- Not validated in outpatient setting

Laboratory Evaluation

- NONE
  - If you think they can be treated as an outpatient
- Viral tests?
- Challenge to you...
  - Skip the CXR if they are well enough to be treated as an outpatient and your exam and history are consistent with pneumonia
- CBC
- Blood culture
- CXR
- Viral screening?
- ESR/CRP – not useful
- Urinary *S. pneumoniae* antigen?
- Procalcitonin?

Outpatient | Inpatient
Management

- 2 discussions
  - Outpatient
  - Inpatient

The first question
Does the patient need to be admitted?

- Reasons to admit
  - **Hypoxemia** <90–92% on room air
  - Respiratory distress
  - Dehydration
  - Other medical conditions
  - Outpatient failure
  - Altered mental status/toxic appearance
  - <60 days old
  - Lacking one of Dr Maul’s 3 C’s
    - Car, Communication, Clue
### Outpatient Management

- **2mo to 2 yr**
  - High dose amoxicillin
- **2 yr to 5 yr**
  - High dose amoxicillin ± macrolide
- **>5 yr**
  - Amoxicillin + macrolide
- **Type I PCN allergy**
  - Macrolide ± clindamycin
- **Non-type I PCN allergy**
  - Cephalosporin ± macrolide
- **Amoxicillin**
- **Azithromycin**
- **Clarithromycin**
- **Cefdinir**
- **Cefpodoxime**
- **Cefuroxime axetil**
- **Ceftriaxone**
- **Clindamycin**

### Outpatient Treatment

- **Antipyretics prn**
- **Hydration**
- **Diet as tolerated**
- **Avoid antitussive agents or decongestants**
- **Recheck them in 48 hours**
  - Sooner if worsening
Inpatient Management

- <60 days old
  - Ampicillin + [gentamicin OR cefotaxime]
    - Add vancomycin if concerned for MRSA
    - If Chlamydia is a concern, erythromycin or azithromycin IV ± cefotaxime
  - See Sanford guide for specifics

Fact or fiction
- Hydration
- Chest physiotherapy
- Bronchodilators
- Nutrition
- Antibiotics
Hydration

- PO, NGT, SQ, IV
  - Route doesn’t matter, safety does
- “IV fluids are an actual therapeutic intervention, not a right of hospital admission.”

Chest Physiotherapy

- No good data to direct the use of this practice
- Data to suggest that it is not beneficial
  - Fever lasts 1–3 days longer in CPT group
  - No improvement in LOS, improvement in cough, FEV1, clinical resolution
- Sounds to me like it’s time to make this stop
### Adjunctive Therapy

- No published evidence about use in patients who are not wheezing
- Malnourished children with pneumonia do worse
- Need early thoughts about restoring adequate nutrition when hospitalized
- Skip BRAT diet
  - Use BREATH diet
    - Baby Resumes Eating All Things Healthy

### Bronchodilators

### Nutrition

### Inpatient Antibiotic Management

#### Uncomplicated

- < 2 yr old
  - Ampicillin OR cefotaxime
- ≥ 2 yr old
  - [Ampicillin OR cefotaxime OR ceftriaxone] AND macrolide

#### Complicated

- [Cefotaxime OR ceftriaxone] AND
  - [vancomycin OR clindamycin]

#### < 2 yr old

- [Cefotaxime OR ceftriaxone] AND
  - vancomycin

#### > 2 yr old

- [Cefotaxime OR ceftriaxone] AND
  - Vancomycin ± macrolide

### Floor

### PICU

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3/19/2010
Complicated Pneumonia

- Needs a more in depth discussion
- Has many controversies
- Will save it for another day, but let’s hit some highlights

Complicated Pneumonia

- Major suppurative complications
  - Necrotizing pneumonia
    - Rare, very ill appearing, requires >4 wks of abx for treatment
  - Lung abscess
    - Pneumatocele, air-fluid level, generally after aspiration in a child with seizure disorder or neuromuscular problem, polymicrobial, think about TB, aspiration
Parapneumonic Effusions

- Very common
- Sterile
- Resolve without intervention
- Becoming more common
- Fever, fatigue, chest pain, respiratory distress
- Imaging helps guide therapy
- Need fluid to guide therapy and promote recovery

Simple | Emphyema

Empyema

- Management is controversial
  - Drainage alone
  - Thoracostomy with fibrinolytics
  - VATS
  - Open thoracotomy
Follow up Radiographs

- If the child is getting better, don’t get them
  - CXRs can stay abnormal for 8 weeks or more
- Repeat images may be of benefit for children not improving or not responding to therapy

Prevention

- Hand hygiene
- Cough hygiene
- Avoiding tobacco smoke
- Breastfeeding
- Avoiding sick contacts
- Immunizations
  - Hib, PCV7 (PCV13), DTaP, Tdap, PPSV23, influenza
- Asthma control
References