

Community Acquired Pneumonia

Prachi Singh, DO
 Assistant Professor, Pediatric Infectious Diseases
 Director Antimicrobial Stewardship Program, Oakland
 UCSF Benioff Children's Hospital, Oakland

1

Disclosure Statement

No disclosures to report.

No active or potential conflict of interest in relation to this presentation.

2

Learning Objectives

Learner will be able to:

- Identify symptoms of community acquired pneumonia (CAP)
- Identify abnormal labs supportive of CAP diagnosis
- State the first-line antibiotic treatment for CAP
- Identify failure of outpatient antibiotic and next steps

3

Clinical Practice Guidelines

- IDSA guidelines for community acquired pneumonia were last revised in 2011
- Since then, there have been several important studies highlighting
 - Emphasis on narrow spectrum antimicrobials
 - Shorter duration of therapy

4

Clinical Presentation

Characteristic/Symptom	Frequency in children with radiographic evidence of pneumonia
Cough	95%
Abnormal temperature	91%
Anorexia	75%
Chest indrawing	55%

Lain S et al. NEJM 2015;372(9):839

5

Epidemiology

6

Is it viral or bacterial?

- EPIC STUDY Multicenter prospective population-based study of CAP in US
- Viral pathogen detected in 73%
- Bacterial pathogen in 15%

A Detection of Bacterial and Viral Pathogens

Patients (%)

Age Group (yr)

0-17 (N=2222) <2 (N=980) 2-4 (N=559) 5-9 (N=408) 10-17 (N=275)

Legend:

- No pathogen
- Bacterial pathogen only
- Bacterial-viral co-detection
- Viral-viral co-detection
- One viral pathogen only

Jain S et al. NEJM 2015;372(9):839

7

Pathogens associated with pneumonia

Pathogens associated with pneumonia can be stratified by age, immune status and exposure history

Viral	Bacterial	Fungal
<ul style="list-style-type: none"> - Influenza - Human Metapneumovirus - RSV - SARS CoV2 - Parainfluenza 	<ul style="list-style-type: none"> <i>S. Pneumoniae</i> Less common – <i>H. influenzae</i>, <i>Moraxella catarrhalis</i>, <i>Staphylococcus Aureus</i> 	<ul style="list-style-type: none"> Endemic fungi - <i>Coccidioidomycosis immitis</i> - <i>Histoplasma capsulatum</i> - <i>Blastomyces dermatitidis</i>
Neonate <ul style="list-style-type: none"> - HSV Exposures <ul style="list-style-type: none"> - Hantavirus Immunocompromised Hosts <ul style="list-style-type: none"> - Herpes viruses (VZV, HSV, HHV-6, EBV, CMV) 	Neonate <ul style="list-style-type: none"> - <i>Chlamydia trachomatis</i> - <i>Bordetella pertussis</i> Exposures <ul style="list-style-type: none"> - <i>Mycobacterium tuberculosis</i> - <i>Coxiella burnetii</i> - <i>Brucella abortus</i> - <i>Francisella tularensis</i> - <i>Leptospira</i> - <i>Chlamydia</i> 	Neonate <ul style="list-style-type: none"> - Premature infants – <i>Candida</i> spp Immunocompromised <ul style="list-style-type: none"> - <i>Aspergillus</i>

8

Streptococcus pneumoniae

- Gram positive cocci in pairs and chains
- Encapsulated organism
- Usually lobar pneumonia in older children/adolescents,
- Younger children - bronchopneumonia with scattered distribution of alveolar and parenchymal consolidation can be common
- Can cause lung abscess, necrotizing lobar pneumonia and even pneumatoceles
- Host factors
 - Children with HIV, humoral deficiencies, immunosuppressive drugs, chronic medical conditions, nephrotic syndrome, asplenia.

9

How has pneumococcal vaccine changed the epidemiology of *S. pneumoniae*

Trends in Invasive pneumococcal disease among children aged <5 years old, 1998–2016

PCV7 introduction (2000) | PCV13 introduction for children (2010)

Legend: # All serotypes, # PCV13 type

10

S. pneumoniae resistance

Resistance (%)

Year

Legend: — Penicillin — Cefotaxime

PCV7 (2000) | PCV13 (2010)

Centers for Disease Control and Prevention. Active Bacterial Core Surveillance (ABCS) Emerging Infectious Program Network. 2015. www.cdc.gov/abcs/reports-findings/surv-reports.html

11

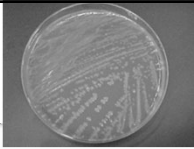
Some clinical pearls: *S. pneumoniae*

- Strep pneumoniae urine antigen is not a helpful diagnostic test → often can reflect a false positive due to nasopharyngeal colonization
- Pre-treatment with antibiotics – can result in false negatives (blood culture, pleural fluid culture).

12

Haemophilus influenzae

Gram negative coccobacilli



Haemophilus influenzae Type B has plummeted
H. flu nontypeable - up to 50% of patients colonized

- Make sputum cultures difficult to interpret - colonization vs. true pathogen

Infection in healthy children is uncommon

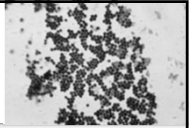
- CDC surveillance study 1999-2008:
 - 17% children (median age 1.1 years)
 - 93% were neonatal cases

J Infect. 2012 Dec; 65(6):496-504

13

Staphylococcus aureus

Gram positive cocci in clusters



- Associated with pleural effusion and empyema accompany about 90% of pulmonary infections
- Pneumatoceles occurs in more than 50% of cases
- Most cases occur in healthy children
 - Predisposing factors
 - young age
 - chronic lung disease
 - Immunosuppression
 - presence of foreign body/skin infection
- Co-infection with influenza has been implicated in severe disease

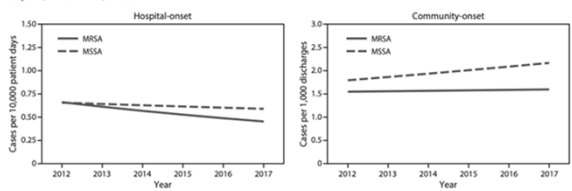
PMID: 27232677; PMCID: PMC4947938.
 Pediatrics and Practice of Pediatric Infectious Diseases, 115, 710-723.e4

14

Staphylococcus aureus

Gram positive cocci in clusters

FIGURE 2. Adjusted* hospital-onset and community-onset rates of *Staphylococcus aureus* bloodstream infections — Premier and Center Hospitals, United States, 2012–2017

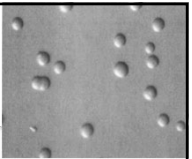


Abbreviations: MRSA = methicillin-resistant *Staphylococcus aureus*; MSSA = methicillin-susceptible *Staphylococcus aureus*.
 *Modelled relative to observed rates in 2012. Model adjusts for discharge month and year and hospital region, teaching status, bed size, and distributions of patient age, sex and race, in addition to accounting for repeated measures and clustering by facility.

<https://www.cdc.gov/mmwr/volumes/68/wr/pdfs/mm6809e1-H.pdf>

15

Mycoplasma pneumoniae



What makes it an atypical?
 - Lacks cell wall

Why does it matter?
 - Typical antimicrobials (beta-lactams) target cell-wall

Experts estimate that *M. pneumoniae* infections account for between 1 and 10 in every 50 cases of CAP

<https://www.cdc.gov/pneumonia/atypical/mycoplasma/hcp/disease-specifics.html>

16

If mycoplasma is more common ... should more patients be treated with azithromycin?

- Macrolides are one of the most commonly over prescribed antibiotic in pediatric clinic with >6 million annual doses often for LRTI
- Efficacy of use of macrolides in treatment of *M. pneumoniae* in CAP remains unclear
- 2 systematic reviews concluded there was insufficient evidence to support efficacy of treatment for *M. pneumoniae* CA-LRTI in children

Antibiotics do not result in improved outcomes

Blondi E et al. Pediatrics 2014;133:1081-90.
 Gardiner SJ et al. Cochrane Database of Sys Rev 2015;1:Art. No. CD004875.

17

When should I think about TB?

Every single time

When should I work up TB?

- Depends on risk factors, exposures and a good history
 - Younger age (< 5)
 - Non-US born, travel or residence to an endemic setting
 - TB contact or contact with high risk populations (recent immigrants, incarcerated individuals)
 - Malnutrition
 - Immunocompromised (HIV, malignancy, transplant, TNF-alpha inhibitors)

18

Pediatric Tuberculosis

Key is evaluation

- Presentation of TB is different in infants/toddlers than in adolescents
 - >7 years - reactivation disease → fever, night sweats, hemoptysis
 - Younger infants → symptoms can be non-specific, failure to thrive, mediastinal adenopathy
- QuantiFERON & PPD can be negative in setting of active TB
- Radiologic findings - mimics aspiration pneumonia & obstructive disorders, can also cause pleural disease

19

Diagnostics

20

Clinical Practice Guidelines (CPG): Diagnostics for Outpatient CAP

- **Clinical Diagnosis – based on history and physical exam findings**
- **Recommended**
 - **Consider CXR if diagnosis uncertain**
 - Routine CXRs are not necessary to confirm the diagnosis of suspected community-acquired pneumonia in healthy children with mild disease. CXR findings do not consistently alter patient management and they do not differentiate viral from bacterial etiology. Typical findings may be absent in early disease or in patients with significant dehydration.
- **Not recommended**
 - CBC w/ diff, CRP, ESR, Blood culture

<https://www.chop.edu/clinical-pathway/pneumonia-community-acquired-clinical-pathway>

21

Treatment

22

Outpatient Treatment

- **Community-acquired pneumonia, 3 months-5 years old, outpatient therapy:**
Antimicrobial therapy is not routinely indicated unless suspected bacterial etiology ; **if suspected typical bacterial etiology:** Amoxicillin 45 mg/kg/dose (max 1000 mg/dose)* enterally bid ; Note: Atypical pneumonia is rare in this age group
- **Community-acquired pneumonia, > 5 years old, outpatient therapy:**
Amoxicillin 45 mg/kg/dose (max 1000mg/dose)* enterally bid

Bradley et al., *CID*, 2011;53(7):e25–e76; PMID 21880587

23

Penicillin Allergy?


Identify true risk for allergies

"Higher risk for allergic reaction"	"Lower risk for allergic reaction"
This includes patients who report history of reaction including: <ul style="list-style-type: none"> • Hives/urticaria • Angioedema (swelling) • Laryngeal edema • Wheezing / Dyspnea • Hypotension • Treatment with epinephrine • Intubation • Patient unable to give any history due to medical condition (or caregiver unavailable to provide information) 	This includes patients who report history of reaction limited to: <ul style="list-style-type: none"> • Itching only • Mild, self-limited rash (not hives) without internal organ involvement • EMR lists allergy, but patient and/or caregiver do not recall any details about the reaction
<small>*In addition to the above "higher risk" criteria, patients with the following allergy history suggestive of a Severe Type B-IV Reaction should generally not receive antibiotics of the same class without further evaluation by an allergy or infectious diseases specialist:</small> <ul style="list-style-type: none"> • Lesions or ulcers involving the mucous membranes; skin desquamation (suggests Stevens-Johnson Syndrome/Toxic Epidermal Necrolysis) • Rash, fever, and lymph node, liver, and/or kidney involvement (suggests Drug Reaction with Eosinophilia and Systemic Symptoms [DRESS] or Drug induced hypersensitivity syndrome [DIHS]) • Fever, urticarial rash, arthritis (suggests serum sickness) 	

24

Penicillin Allergy

- Lower risk for allergic reaction
 - Oral cephalosporin (Cefprozil, Cefuroxime, Cefixime)
- High risk for allergic reaction
 - Azithromycin 10 mg/kg/dose enterally x 1 dose on day 1, then 5 mg/kg/dose enterally daily on days 2-5




25

EW0

Duration of therapy

Uranga A. JAMA Intern Med. 2016;176(9):1267-1268.
 Bielecki et al. JAMA. 2021 Nov 2;326(17):1713-1724. PMID: 34726708
 Perrone et al. JAMA Pediatr. 2021 May 1;175(5):474-482.
 Williams et al. JAMA Pediatr. 2022 Mar 1;176(3):253-261. PMID: 35049020

3-5 days is non-inferior to longer course (7-10 days) for outpatients and patients discharged from ED




26

When to consider hospitalization?


- Signs of respiratory distress
 - SpO2 <90%, need for supplemental oxygen
- Dehydration
- Moderate to severe respiratory distress
 - >70 breaths per minute for infants <12 months, >50 bpm older children; difficulty breathing, grunting, apnea
- Complications
 - Empyema, abscess, necrotizing process
- Failure of outpatient therapy
 - Worsening or no response in 48-72 hours

Uptodate. Pneumonia in children: Inpatient treatment Author: William J Barson, MD



27

Managing Patient & Family Expectations




28

Patient and Family Expectations

- Dialogue Around Respiratory Illness Treatment (DART)
 - Online modules: <https://www.uwimtr.org/dart/>
- Based on extensive analysis of provider communication strategies that lead to:
 - Not prescribing antibiotic when not indicated
 - Higher caregiver satisfaction
 - Shorter visit time
- Training modules implemented in pediatric primary care practices associated with lower antibiotic use for ARTI

Mangione-Smith R, et al. Arch Pediatr Adolesc Med 2006;60:945-52
 Stivers T. Soc Sci Med 2005;60:949-64.
 Mangione-Smith R, et al. Ann Fam Med 2015;13:221-7.
 Kronman MP, et al. Pediatrics 2020;146:e20200038




29

Key elements of DART communication approach

<https://www.uwimtr.org/dart/>

Review your exam findings to make the case for your diagnosis	"... ears and throat look good, lungs sound good too ..."
Deliver a clear diagnosis	"So it looks like a bad cold."
Give a two part treatment recommendation with the negative recommendation first followed immediately by positive recommendation for symptom relief	" On the one hand , an antibiotic won't help. On the other hand , here's what you can do for these symptoms ..."
Provide a contingency plan	"Definitely call us back if ..."



30

Slide 26

EW0 Can you summarize the duration of therapy into one or two slides?
Elizabeth Walters, 2023-02-08T14:24:55.822

CASE

- 4-year-old being evaluated in outpatient clinic for cough and fever
 - Started with cough, congestion, runny nose
 - Attends pre-school, parents reported multiple kids with "pink eye" at school recently
 - Fever started 1-day ago, range 38.1C to 38.4C
 - Eating and drinking well, good energy especially when does not have fever
- Physical exam
 - Vitals: Tmax 38F, RR: 35-40 bpm, HR: 100bpm, SpO2 95% on RA
 - General: well-appearing toddler, playing with toy car
 - HEENT: Clear rhinorrhea, ears: TM visualized: slightly red, light reflex present
 - Lungs: no focal consolidation, referred upper airway sounds
 - Remainder of exam normal



31

CASE

- 4-year-old with 2 days of cough, runny nose and 1 day of fever
 - + sick contacts
- Most likely diagnosis is viral infection
 - Viral etiologies are more common than bacterial
 - Sick contacts in daycare, more likely to be viral
 - Physical exam – no focal consolidation on auscultation
 - Overall well-appearing, no need for labs
- Using DART communication approach
 - **On the one hand**, an antibiotic won't help. **On the other hand**, here's what you can do for these symptoms – give ibuprofen/acetaminophen for symptom relief
 - Call us back in 48-hours if his fevers are not improving, sooner if there are other concerning symptoms.



32