Pneumonia In Children
Case scenario # 2

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History:

- A previously healthy 4 year old boy is brought to an urgent care center by his mother for difficulty breathing for one day.
- Three days prior he had developed a runny nose, cough, and low grade fevers with a temperature maximum of 38.3 degrees C.

- He continued to take liquids well, but his solid intake has decreased.
- His temperature this morning was 39.4 degrees C and he was breathing fast and working hard to breathe.

- He does not have any ill contacts.
- He has never been hospitalized or had any surgeries.
- He was born at term without any complications.
- He is not taking medications other than acetaminophen.
- His immunizations are up to date for his age (except he had not received the pneumococcal conjugate vaccine).
- His parents and 10 year old sister are healthy and the remainder of his family history is non-contributory.

- There are no smokers in the household, and he has not traveled recently.
- He does not have a history of choking or vomiting.
- He has not had frequent ear or skin infections.
- He does not have a history of foul-smelling stools.

Physical Examination:

- **Vital Signs**: Temp:40 degrees C

  Pulse: 130 bpm

  BP:100/70

  Oxygen saturation:87% in room air.
- **Growth parameter**: His height and weight are in the 50th percentile for his age.
- He is awake and alert, in moderate respiratory distress.
- His nasal mucosa is erythematous with yellowish discharge.

- His lips and mucous membranes are dry.
- He has several small anterior cervical lymph nodes.
- **Lungs**: *Moderate subcostal, intercostal, and supraclavicular retractions*, symmetric expansion.

  dullness to percussion at the right base, increased vocal fremitus over the right base, decreased air entry over right lower lobe with crackles, no wheezes.

- **Heart:** Tachycardia, regular rhythm without murmur.
- **Pulses** are 2+, and capillary refill time is 3 seconds.
- His **abdomen**, **skin**, and **neurological examinations** are unremarkable.

❑Investigations:

CBC WBC 20,000, 70% segs, 11% bands, 15% lymphs, 3% monos, 1% eos.

Hemoglobin 12.4, platelet count 280,000.

Chest X ray:

- Right lower/middle lobe opacity consistent with a bacterial pneumonia (technically "air/space disease", commonly called infiltrates.)

Management:

- He is given supplemental oxygen (with subsequent improvement in oxygen saturation). Treatment if hypoxia is mandatory.
- Hospitalization arrangements are made.
- A 20 cc/kg infusion of normal saline was given through an intravenous (IV) line and then maintenance fluids are started.
- A blood culture is obtained and he is started on a broad spectrum antibiotics **(IV cefuroxime)**.
- Vancomycin is added to cover possibility of *resistant streptococcus and staph-aureus*

Progress:

- He improves over the next day.
- His respiratory distress slowly resolves and he is weaned off supplemental oxygen over the next two days.
- His blood culture shows no growth.
- He is discharged home on high dose amoxicillin for a total of 10-14 days of therapy.

- His discharge diagnosis is

Bacterial pneumonia.

Empiric Treatment in Children

Clinical Circumstances	Presumed CABP	Presumed Atypical Pneumonia
<5 y (preschool)	Oral amoxicillin (90 mg/kg/day in 2 doses). Alternative: oral amoxicillin-clavulanate (amoxicillin component 90 mg/kg/day in 2 doses [max 4 g/day])	Oral azithromycin (10 mg/kg on day 1, then 5 mg/kg/day qd on days 2-5). Alternatives: oral clarithromycin (15 mg/kg/day in 2 doses for 7-14 days) or oral erythromycin (40 mg/kg/day in 4 doses)
≥5 y	Oral amoxicillin (90 mg/kg/day in 2 doses to max 4 g/day); may add macrolide to β-lactam for empiric therapy. Alternative: oral amoxicillin-clavulanate (amoxicillin component 90 mg/kg/day in 2 doses [max 4 g/day])	Oral azithromycin (10 mg/kg on day 1, then 5 mg/kg/day qd on days 2-5) to max 500 mg on day 1, then 250 mg qd on days 2-5. Alternatives: oral clarithromycin (15 mg/kg/day in 2 doses to max 1 g/day) or erythromycin or doxycycline for pts >7 y
Inpatient (All Ages)		
Fully immunized with conjugate vaccines for Hib, *S pneumoniae*; minimal local penicillin resistance in invasive strains of pneumococcus	Ampicillin or penicillin G. Alternatives: ceftriaxone or cefotaxime. Add vancomycin or clindamycin for suspected CA-MRSA	Azithromycin (added to β-lactam, if diagnosis in doubt). Alternatives: clarithromycin or erythromycin; doxycycline for pts >7 y; levofloxacin for pts who have reached growth maturity or cannot tolerate macrolides
Not fully immunized for Hib, *S pneumoniae*; significant local penicillin resistance in invasive strains of pneumococcus	Ceftriaxone or cefotaxime; add vancomycin or clindamycin for suspected CA-MRSA. Alternative: levofloxacin. Add vancomycin or clindamycin for suspected CA-MRSA	Azithromycin (added to β-lactam, if diagnosis in doubt). Alternatives: clarithromycin or erythromycin; doxycycline for pts >7 y; levofloxacin for pts who have reached growth maturity or cannot tolerate macrolides

Antibiotic Choice—Outpatient

(Table from pediatric care online – AAP)

Age of Child	Infant / Preschool-Age		School-Age	
Recommendation	**No antibiotics**	**Amoxicillin**	**Amoxicillin**	**Azithromycin**
Comments	Antibiotics NOT routinely required because viral pathogens are most prevalent.	First-line therapy if previously healthy and immunized. Provides excellent coverage for *S. pneumoniae.*	First-line therapy if previously healthy and immunized. Consider atypical bacterial pathogens.	For treatment of older children with findings compatible with CAP **caused by atypical pathogens.**
Strength	**Strong**	**Strong**	**Strong**	**Weak**
Evidence Quality	**High**	**Moderate**	**Moderate**	**Moderate**

What are possible reasons for presumed treatment failure (in patient already on 1st line therapy for lobar pneumonia)?

1. Ineffective antibiotic coverage
   a. Lack of coverage for actual etiology, e.g. organism is atypical
   b. Resistant organism

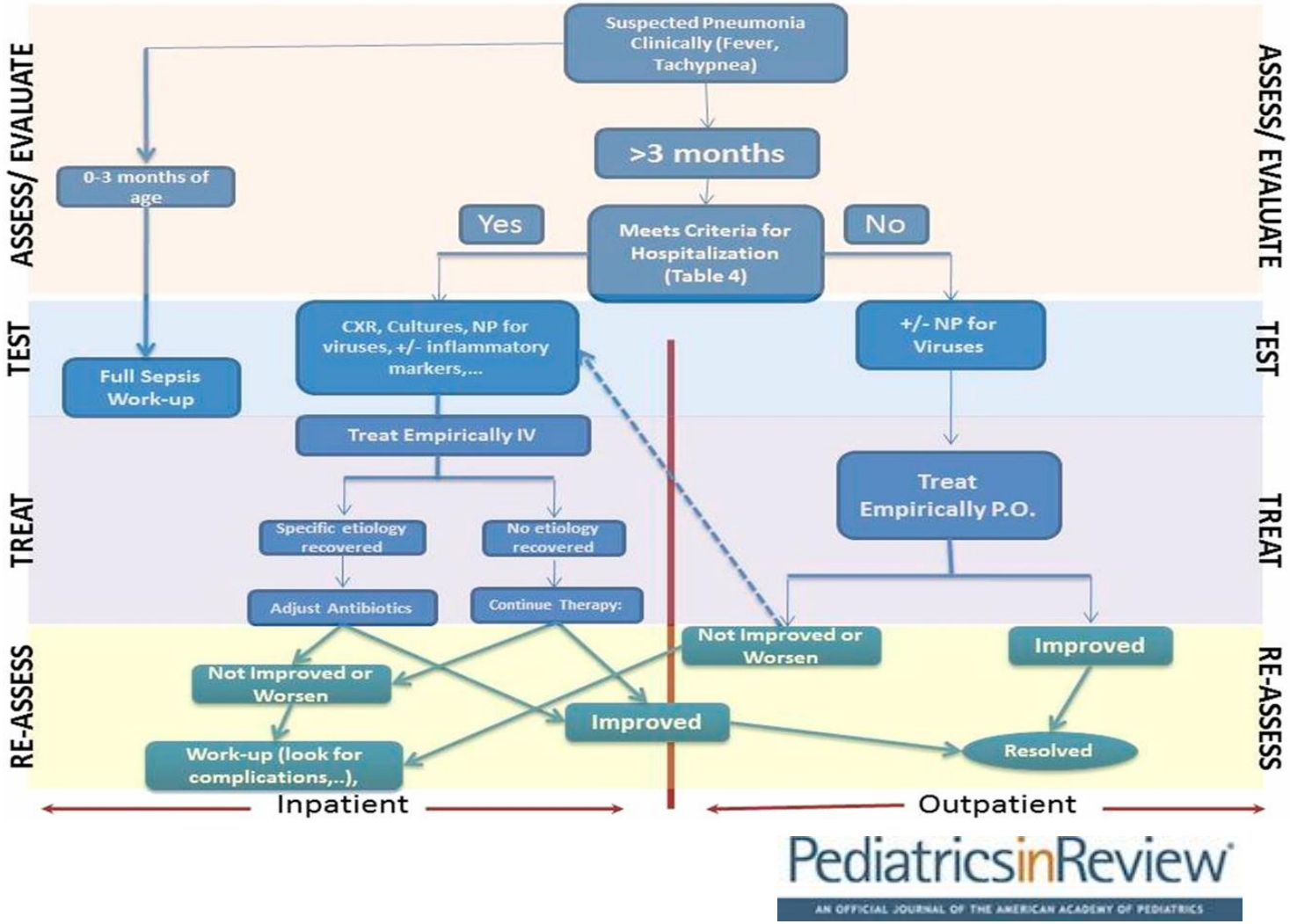
2. Pneumonia complications (more likely with bacterial rather than atypical or viral pneumonias)
   a) Pleural effusion or empyema (distant breath sounds, friction rub on exam)

3. Alternative or coincident diagnosis e.g. Foreign body aspiration.

Indications for admission:

- *Hypoxia* (oxygen saturations < 90 to 92%)
- *Infants < 3 months* with suspected bacterial infection.
- *Respiratory distress* (grunting, difficulty breathing, poor feeding).
- T*achypnea* (< 12 months w/ RR > 70 or children with RR > 50).
- *Inability to maintain hydration* or oral intake
- *Failure of outpatient therapy* (48 to 72 hours with no response).
- *Caretaker unable to provide appropriate observation* or comply with prescribed home therapy.

General approach to childhood pneumonia



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Future Reading

- Nelson Text book of paediatrics.
- https://www.uptodate.com/contents/pneumonia-in-children-epidemiology-pathogenesis-and-etiology

THANKS