

## Pneumonia

- Pneumonia is one of the most common causes of severe sepsis, and infectious cause of death in children and adults with high mortality rate.
- Pneumonia infection is divided into 3 categories:
  - Community acquired pneumonia (CAP)
  - Hospital acquired pneumonia (HAP)
  - Ventilator acquired pneumonia (VAP)
- General info:
  - The most prominent pathogen causing **community-acquired pneumonia (CAP)** in otherwise healthy adults is *Streptococcus pneumoniae*.
  - The leading causative agents in **hospital-acquired pneumonia (HAP)** are *Gram-negative aerobic bacilli*, *S. aureus*, and *multidrug-resistant (MDR) pathogens*.
  - **Aspiration pneumonia** mainly due to *anaerobic bacteria*
  - **ventilator-associated pneumonia (VAP)** is also associated with *MDR pathogens*.
  - **pneumonia in infants and children** is caused by a wider range of microorganisms, and *viruses predominate, especially RSV, parainfluenza, and adenovirus*.
  - *Mycoplasma pneumoniae* is an important pathogen in **older children**.
  - *H. influenzae type b* incidence decreased a lot by the **introduction of vaccine**
  - Pneumonia in **nursing home** can be treated as either CAP or HAP

### ❖ General management :

- Supportive care:
  - O<sub>2</sub>, bronchodilators, hydration, control fever, etc.
- Pharmacologic Therapy:
  - Initially involves the empirical use of a relatively broad-spectrum antibiotic(s) after appropriate specimens for culture and sensitivity have been obtained.
  - Later, therapy should be narrowed after detection of pathogen.
  - recommendations are generally for a class of antibiotics rather than for a specific drug.

### ❖ Management in CAP:

- most common bacterial causes of CAP are:
  - *streptococcus pneumoniae*, *Haemophilus influenzae*, *Mycoplasma pneumoniae*, *Staphylococcus aureus*, *Legionella* species, *Chlamydia pneumoniae*, *Moraxella catarrhalis*, *Respiratory viruses*.
- All pts with CAP should be treated empirically, even if its viral start ABx then after confirmation that it is viral stop the ABx.
- If ptn exposed to certain Abx class recently, use another class of Abx.
- Risk factors for MRSA and *P. aeruginosa*:
  - Prior respiratory isolation of the pathogen.
  - Hospitalization with administration of parenteral antibiotics within the last 3 months.
  - Local presence of this pathogen.

### ❖ Management of HAP/VAP:

- empiric coverage for MRSA, either **vancomycin or linezolid** is recommended.
- For patients with HAP/VAP due to *Pseudomonas aeruginosa*, the choice of antibiotic for definitive (**not empiric**) therapy should be based on the results of antimicrobial susceptibility testing.
- a 7-day course of antimicrobial therapy is recommended.
- *Pseudomonas aeruginosa* may require > 7 days.

### ❖ Initial and Definitive Treatment of HAP:

- **empiric coverage of MSSA**; piperacillin- tazobactam, cefepime, levofloxacin, imipenem, or meropenem is recommended.
- **With proven MSSA**; oxacillin, nafcillin and cefazolin are favored.

### ❖ initial and Definitive Treatment of VAP

- Empiric treatment of VAP should cover for **S. aureus, Pseudomonas aeruginosa and MRSA if risk factors present.**
- For MRSA infection, linezolid is preferred over vancomycin in:
  - Renal insufficiency.
  - high MIC MRSA isolates. (I think dr. Means that u need high dose to kill pathogen which is risky in case of using vanco)
- Aminoglycosides and colistin should be avoided in therapy of VAP, due to poor penetration of these agents in the lung tissues.
- carbapenem or ampicillin/sulbactam should be used for *Acinetobacter* HAP/VAP.
- VAP due to *Pseudomonas aeruginosa* has a high failure rate (~40%).
- *Pseudomonas aeruginosa* combine agents:
  - **Piperacillin-tazobactam, cefepime, ceftazidime, imipenem, meropenem, or aztreonam + levofloxacin, ciprofloxacin or aminoglycoside (amikacin, gentamicin, tobramycin), or polymyxins (polymyxin B, colistin).**

### ❖ Treatment:

- **Duration of treatment minimally 5 days , and ptn should be afebrile for 2-3 days.**
- **Switch from intravenous to oral therapy when ptn is hemodynamically stable and then discharge the ptn.**
- **first antibiotic dose should be administered while ptn in ER.**
- **divided into:**
  - ✓ **Outpatient setting:**
    - **Ptn without comorbidities or RF for resistant pathogen:**
      - Monotherapy: amoxicillin, doxycycline, or a macrolide (azithromycin or clarithromycin). Use only one.
    - **Ptn with comorbidities (HF,DM, use of Abx in previous 3 months):**
      - Monotherapy : respiratory fluoroquinolone (levofloxacin, moxifloxacin, or gemifloxacin),
      - Combination therapy: (amoxicillin-clavulanate or a cephalosporin) **plus** (a macrolide or doxycycline).

✓ **Inpatient setting (IV):**

- **non-severe pneumonia :**
  - beta-lactam **plus** a macrolide
  - **Or** a respiratory fluoroquinolone alone.
- **Severe pneumonia:**
  - Combination therapy : a beta-lactam (cefotaxime, ceftriaxone, or ampicillin- sulbactam) + a macrolide (azithromycin) **or** a fluoroquinolone.
- **With prior respiratory isolation of the following pathogen , you should cover empirically:**
  - MRSA: (vancomycin or linezolid)
  - P. aeruginosa: (antipseudomonal  $\beta$ -lactam ; piperacillin-tazobactam, cefepime, imipenem, or meropenem) + either ciprofloxacin or levofloxacin; should be added in all inpatients

❖ **Neonatal Pneumonia:**

- Organisms are acquired from the maternal genital tract or the nursery .
- Onset:
  - **Within hours of delivery** as part of generalized sepsis syndrome.
  - **After 7 days** (mcc in neonatal ICU).
- Treatment (empirically):
  - **vancomycin + a broad-spectrum  $\beta$ -lactam drug** (meropenem, piperacillin/tazobactam, or cefepime) are the initial treatment of choice.
  - **More specific antibiotics are substituted after sensitivity results are available.**
- **Chlamydial pneumonia:**
  - Exposure occur during delivery
  - Pneumonia develops at 2 to 18 wk.
  - Treatment:
    - erythromycin or azithromycin.
    - Father and mother should be treated
    - Erythromycin is linked to pyloric stenosis.

- **community-acquired Pneumonia in Children.**
  - Preschool-aged children: amoxicillin
  - Older children : macrolides

### Recommended Empiric **Outpatient** Treatment of Childhood CAP

**60 days to 5 years of age:**

- **Preferred regimens:** Amoxicillin for 7-10 days.
- **Alternative regimens** for patients allergic to penicillin or beta-lactam antibiotics:  
Azithromycin (5 days), clarithromycin (7-10 days),  
or erythromycin (7-10 days).

**5 to 16 years of age:** Azithromycin (5 days).

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### Recommended Empiric **Inpatient** Treatment of Childhood CAP

**60 days to 5 years of age:**

- Cefuroxime for 10-14 days.
- **In critically ill patients:** Cefuroxime + erythromycin 10-14 days, or cefotaxime + cloxacillin for 10-14 days

**5 to 16 years of age:** Cefuroxime + erythromycin 10-14 days, or azithromycin for 5 days.

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