
MANAGEMENT OF PNEUMONIA

Dr C. MUASYA
LECTURER
CLINICAL PHARMACOLOGY

Definition

- **Pneumonia is an infection of the pulmonary parenchyma.**

Classification

- **Pneumonias are typically classified as being either**
 - A. Community -acquired Pneumonia (CAP) or**
 - B. Health care-assoc pneumonia (HCAP)**

1. COMMUNITY-ACQUIRED PNEUMONIA (CAP)

Essentials of diagnosis of CAP

I. Symptoms & signs of an acute lung infectn (REF**)**

II. Occurs outside of the hosp or < 48 hrs after admisn in a ptnt who is not hospitalized or residing in a long-term care facility for $\geq$ 14/7 b4 the onset of symptoms.

Pathogenesis of CAP(READ)

Important risk factors for ↑ morbidity & mortality from CAP

- **The CURB-65 criteria may be used as a severity-of-illness score**
- **It includes five variables**

risk factors 2

- i. Confusion [C] -Altered mental status**
- ii. Urea >7 mmol/L [U]**
- iii. RR ≥ 30 breaths/min (adult) [R]**
- iv. BP, systolic ≤ 90 mm Hg or diastolic ≤ 60 mm Hg) [B] - Hypotensn**
- v. Age ≥ 65 yrs [65] - Advanced age**

Interpretation of the CURB-65 score

- **Patients with a score of 0 have a 30-day mortality rate is 1.5%**
 - **They can be Rx as outpatients**
- **With a score of 2 the 30-day mortality rate is 9.2%**
 - **These patients should be admitted to the hosp**

Interpretation 2

- **Among patients with scores of ≥ 3 mortality rates are 22% overall**
 - **these patients may require admission to an ICU.**

**Comorbid medical conditns
assoc with ↑sed morbidity &
mortality from CAP**

- a) Neoplastic dx**
- b) Liver dx**
- c) CCF**
- d) Cerebro-vascular dx**
- e) Renal dx**

Cause of CAP

- **Bacteria are more commonly identified than viruses**
- **The most common bacterial pathogen identified is *S. pneumoniae*, accounting for ~ 2/3 of bacterial isolates**
- **≥ 2 causes are identified in up to 5% of cases.**

Other common bacterial pathogens include:

- i. H. influenzae**
- ii. Mycoplasma pneumoniae**
- iii. Chlamydia pneumoniae**
- iv. S. aureus**
- v. Neisseria meningitidis**
- vi. M catarrhalis**
- vii. Klebsiella pneumoniae**
- viii. Other gram -ve rods &**
- ix. Legionella species.**

Common viral causes of CAP:

- i. Influenza virus**
- ii. Respiratory syncytial virus (RSV)**
- iii. Adenovirus &**
- iv. Parainfluenza virus.**

Rx considerations for CAP

- **It is difficult to consistently differentiate “typical” from “atypical” causes of pneumonia.**
- **As a result, recommendations for empiric Rx should be based on epidemiologic data.**

Rx of considerations 2

- **Rx recommendations can be divided into those for patients who can be treated as outpatients & those who require hospitalization**

A. Rx of outptnts

- **Empiric antibiotic (AB) therapy is largely directed at Strep. pneumoniae infectns. 3 scenarios**

I. Rx of mild CAP

II. Other Rx options in a previously healthy ptnt, no ABs use in past 3/12 who does not require admisn

III. Rx of an outpatient with comorbidities or ABs use in past 3 months

I. Rx of mild CAP

- **Oral amoxicillin is the preferred AB, at a dose of at least 500 mg 8-hrly.**

Rx of outptnts 2

II. Other Rx options for a ptnt with CAP who was previously healthy & no AB use in past 3/12 who does not require hospitalization include one of the following:

(1)Macrolides

- i. Clarithromycin 500 mg po bid**
- ii. Azithromycin 500 mg po o.d for 3 days or**
- iii.Erythromycin (250–500 mg p.o qid)**

Rx of outpatients 3

(2) Doxycycline 100 mg po bid.

(3) Fluoroquinolones (with enhanced activity against *S. pneumoniae*) = resp FQs e.g

i. Gatifloxacin 400 mg po o.d

**ii. Levofloxacin 500-750 mg po o.d
or**

iii. Moxifloxacin 400 mg po o.d

Alternative Rx for CAP

- 1. Amoxicillin -potassium clavulanate, espec for suspected aspiration pneumonia 500 mg po tds (625mg) or 875 mg po bid(1g)**

Alternative Rx for CAP 2

2. Some 2nd & 3rd gen cephalosporins, s.a

- i. Cefuroxime axetil (250–500 mg po, bd)**
- ii. Cefpodoxime proxetil (100–200 mg po bd) or**
- iii. Cefprozil (250–500 mg po, bd)**

III.Rx of an outpatient with comorbidities or ABs use in past 3/12

- **Select an alternative from a different class, either**
 - i. A respiratory FQ or**
 - ii. A β -lactam AB plus a macrolide**

- **Preferred β - lactam ABs:**

- **High-dose amoxicillin (1 g tid) or amoxicillin/clavulanate (2 g bid);**

- **Alternatives:**

- a. **Ceftriaxone (1–2 g IV bid)**

- b. **Cefpodoxime (200 mg PO bid)**

- c. **Cefuroxime (500 mg PO bid)**

Recommendations for duration of Rx

- **This is influenced by:**
 - i. Severity of illness**
 - ii. The etiologic agent**
 - iii. Response to therapy**
 - iv. Other medical problems**
 - v. Complications.**
- &**

Recommendations for duration of Rx 2

- **Rx for a minimum of 5/7**
- **Continue Rx until the patient is afebrile for at least 48 - 72 hrs**
 - **This is usually sufficient for pneumonia due to *S pneumoniae*.**

- **A min of $\frac{2}{52}$ of Rx is appropriate for pneumonia due to:**
 - i. S aureus**
 - ii. P. aeruginosa**
 - iii. Klebsiella**
 - iv. Anaerobes**
 - v. Mycoplasma pneumoniae**
 - vi. Chlamydia pneumoniae or**
 - vii. Legionella species.**

B. Rx of hospitalized ptnts

- **Empiric AB Rx for ptnts with CAP who require hospitalization can be divided into :**
 - I. Ptnts who can be Rx in a general medical ward &**
 - II. Ptnts who require Rx in an ICU.**

I. Ptnts who only require general medical ward care usually respond to:

- a. An extended-spectrum β -lactam AB (s.a ceftriaxone or cefotaxime) plus a macrolide (clarithromycin or azithromycin is preferred if H. influenzae infectn is suspected) or**
- b. A resp FQ**

Alternative Rx for general med ward ptnts

- **a β -lactam/ β -lactamase inhibitor (ampicillin-sulbactam or piperacillin-tazobactam) plus a macrolide**

II. Rx of patients requiring ICU admisn

- **A macrolide or a resp FQ plus either:**
 - i. **An extended-spectrum cephalosporin (ceftriaxone, cefotaxime) or**
 - ii. **A β -lactam/ β -lactamase inhibitor (BLI)**

Other considerations in Rx of hospitalized patients

a. Rx of Patients with penicillin allergies

- **Resp FQ with or without clindamycin.**

Other considerations in hospitalized patients 2

b. Patients with suspected aspiration pneumonia should receive either:

i. A resp FQ with or without clindamycin

ii. Metronidazole or

iii. A β -lactam/ β -LI

Other considerations in hospitalized patients 3

- c. Patients with structural lung dxs s.a bronchiectasis or cystic fibrosis benefit from empiric therapy with the following until sputum culture & sensitivity results are available**
 - a. An antipseudomonal penicillin, carbapenem, or cefepime plus**
 - b. A resp FQ**

Other considerations in hospitalized patients 4

- **Almost all ptnts who are admitted in hosp for Rx of CAP should receive IV ABs**
- **Duration of AB Rx is the same as for outpatients with CAP**

Prevention of CAP

The main preventive measure is vaccination.

- i. Polyvalent pneumococcal vaccine has the potential to prevent or lessen the severity of majority of pneumococcal infections in immunocompetent patients [Synflorix (PCV 10) & Prevenor (PCV 13)]**

- ii. Haemophilus Influenza type b (Hib) vaccine [single or in penta/hexa valent vaccine]**
- iii. The influenza vaccine is effective in preventing severe dx due to influenza virus with a resulting +ve impact on both 1^o influenza pneumonia & 2^o bacterial pneumonias**

2. HEALTH CARE-ASSOC PNEUMONIA (HCAP)

Essentials of diagnosis

- 1. Definition: Pneumonia developing > 48 hrs after admission to the hosp & excludes any infection present at the time of admission.**
- 2. At least 2 of the following:**
 - i. fever**
 - ii. cough**
 - iii. leukocytosis**
 - iv. purulent sputum.**

Essentials of Δ 2

- 3 New or progressive parenchymal infiltrate on CXR.**
- 4 The highest-risk ptnts are those requiring ICU care or mechanical ventilation.**
 - **However, majority of cases occur in ptnts who are not in the ICU**

General Considerations

- **HCAP** is the 2nd most common cause of infection among hospital inpatients &
- Is the leading cause of death due to nosocomial infection with mortality rates ranging from 20% to 50%

Pathogenesis

- **Colonization of the pharynx & possibly the stomach with bacteria is the most important step in the pathogenesis of HCAP**
- **Pharyngeal colonization is promoted by**
 - I. exogenous factors**
 - II. patient factors**

(Read about these)

- **Aspiration of infected pharyngeal or gastric secretions delivers bacteria directly to the lower airway.**
- **Impaired cellular & mechanical defense mechanisms in the lungs of hospitalized ptnts raise the risk of infection after aspiration has occurred**

- **The role of the stomach in the pathogenesis of HCAP:**

- **Elevations of gastric pH due to antacids, H₂-RAs, PPIs or enteral feeding is assoc with gastric microbial overgrowth, tracheobronchial colonization, & HCAP**

- **Sucralfate, a cytoprotective agent that does not alter gastric pH, is assoc with a lower incidence of ventilator-associated pneumonia.**

- **The most common organisms responsible for HCAP**

-P. aeruginosa

-S. aureus

-Enterobacter

-K. pneumoniae

-E. coli.

- **Proteus, Serratia marcescens, H influenzae, and streptococci account for most of the remaining cases.**

Other causes of HCAP

- **Anaerobic organisms**
 - a. Bacteroides**
 - b. Anaerobic streptococci**
 - c. Fusobacterium**
- **Mycobacteria, fungi, chlamydiae, viruses, rickettsiae, & protozoal organisms are uncommon causes of HCAP**

Rx of HCAP

1. Empiric therapy for mild to mod HCAP in a ptnt without unusual risk factors or a ptnt with severe early-onset (within 5/7 after hospitalization) HCAP may consist of:

Rx of HCAP 2

- i. A 2nd -generatn cephalosporin**
- ii. An antipseudomonal
3rd gen cephalosporin
or**
- iii. A combination of a β -lactam AB
& β -lactamase inhibitor**

2. Empiric therapy for ptnts with severe, late-onset ($\geq 5/7$ after hospitalization) HCAP or with ICU or ventilator-assoc pneumonia should include a combinatn of ABs directed against the most virulent organisms, particularly:

a. *P. aeruginosa*

b. *Acinetobacter* species &

c. *Enterobacter* species.

- **The AB regimen should include an aminoglycoside or FQ plus one of the following:**
 - i. An antipseudomonal penicillin**
 - ii. An antipseudomonal cephalosporin**
 - iii. A carbapenem**

Rx of HCAP cont

- **Vancomycin is added if infection with MRSA is of concern, espec in ptnts with**
 - a. Coma**
 - b. Head trauma**
 - c. Diabetes mellitus**
 - d. Renal failure, or**
 - e. Ptnts in ICU**

Rx of HCAP cont

- **Anaerobic coverage with clindamycin or a β -lactam/ β -LI combinatn may be added for ptnts who have risk factors for anaerobic pneumonia, including**
 - a. Aspiratn**
 - b. Recent thoraco-abdominal surgery, or**
 - c. An obstructing airway lesion.**

- **A macrolide is added when ptnts are at risk for Legionella infectn, s.a those receiving high-dose corticosteroids.**
- **After results of sputum, blood, & pleural fluid cultures have been obtained, it may be possible to switch to a regimen with a narrower spectrum.**

- **Duration of AB Rx should be individualized based on**
 - a. The pathogen**
 - b. Severity of illness**
 - c. Response to therapy, &**
 - d. Comorbid conditns.**
- **Rx for gram -ve bacterial pneumonia should continue for at least 14–21 days.**

PULMONARY INFILTRATES IN THE IMMUNOCOMPROMISED HOST

- **These may arise from infectious or noninfectious causes.**

1. Infectn may be due to:

- Bacteria**
- Mycobacteria**
- Fungi**
- Protozoa**
- Helminthic or**
- Viruses**

2. Noninfectious processes

- i. Pulmonary edema**
- ii. Alveolar hemorrhage**
- iii. Drug rxns**
- iv. Pulmonary thrombo-embolic dx**
- v. Malignancy**
- vi. Radiation pneumonitis**

NB: These may mimic infection

Rx of the immunocompromised host

- **Although almost any pathogen can cause pneumonia in a compromised host, two clinical tools help the clinician narrow the differential diagnosis.**
 - 1) Knowledge of the underlying immunologic defect**
 - 2) The time course of infectn**

1. Significance of underlying immunologic defect

- **Specific immunologic defects are assoc with particular infections as follows:**
 - I. Defects in humoral immunity predispose to bacterial infections**
 - II. Defects in cellular immunity lead to infections with viruses, fungi, mycobacteria, & protozoa**

Significance of underlying immunologic defect

2

III. Neutropenia & impaired granulocyte function predispose to infections from *S aureus*, *Aspergillus*, gram -ve bacilli, & *Candida*.

2. Significance of the time course of infectn

- **A fulminant pneumonia is often caused by bacterial infection, while an insidious pneumonia is more likely to be caused by viral, fungal, protozoal, or mycobacterial infectn**

The time course of infectn 2

- **Pneumonia occurring within 2–4 wks after organ transplant is usually bacterial**
- **If it occurs several months or more after transplantation P jiroveci, viruses (eg, CMV), & fungi (eg, Aspergillus) are more likely**