LEC. 51

MEDICINE

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Lec. 2

PNEUMONIA

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PNEUMONIA

OBJECTIVES

- ✓ *To define pneumonia .*
- ✓ *To determine methods of its classification*
- ✓ *To describe its epidemiology.*
- ✓ *To describe Community Acquired Pneumonia (CAP) and its causes and types.*
- ✓ *To identify factors that predispose to pneumonia.*
- ✓ *To recognize Clinical features of CAP.*
- ✓ *To revise characteristic features of the common causes of CAP.*
- ✓ *To asses and investigate a case of CAP.*
- ✓ *To evaluate lines of management of CAP.*
- ✓ *To recognize complications of CAP.*

INTRODUCTION

- *Pneumonia is defined as an acute respiratory illness associated with recently developed radiological pulmonary shadowing which may be segmental, lobar or multilobar.*
- *Pneumonia is an infection of the pulmonary parenchyma.*
- *Not a single disease, but a group of specific infection, each having different epidemiology, pathogenesis, clinical manifestations and clinical course.*

CLASSIFICATION

- ***Aetiology.***
- ***Morphological class*** *- bronchopneumonia vs. lobar pneumonia (lobar: homogeneous consolidation of one or more lung lobes, often with associated pleural inflammation; bronchopneumonia: more patchy alveolar consolidation associated with bronchial and bronchiolar inflammation often affecting both lower lobes).*

- ***Community acquired vs hospital acquired (nosocomial) infection.***
- ***The patient's immune status.***
  - *Community-acquired pneumonia (CAP): Outside of hospital or extended-care facility.*
  - *Hospital-acquired pneumonia (HAP): ≥ 48 h from admission.*
  - *Ventilator-associated pneumonia (VAP):≥ 48 h from endotracheal intubation.*
  - *Health care-associated pneumonia (HCAP): onset of pneumonia as outpatients in patients infected with the multidrug-resistant (MDR) pathogens usually associated with HAP.*

EPIDEMIOLOGY

- *Leading cause of death from an infectious disease*
- *6th leading cause of death in the US*
- *Mortality ranges 2-30% in hospitalized patients and averages 14%*
- *Mortality if admitted to ICU nearly 50%*
- *Community-acquired pneumonia (CAP) remains a leading cause of death worldwide despite improvement in patient management.*
- *Early recognition of lung infection and prompt initiation of adequate antibiotherapy are crucial elements to ensuring favourable outcomes.*
- *Nonetheless, in a number of cases, death occurs despite both these targets being met. In these patients, possible excessive inflammatory responses, as in sepsis and septic shock, are believed to contribute to unfavourable outcome.*

PATHOPHYSIOLOGY

- *Pneumonia results from the proliferation of microbial pathogens at the alveolar level and the host's response to those pathogens.*
- *Microorganisms gain access to the lower respiratory tract in several ways. The most common is by aspiration from the oropharynx .Small-volume aspiration occurs frequently during sleep (especially in the elderly) and in patients with decreased levels of consciousness.*
- *Many pathogens are inhaled as contaminated droplets.*
- *Rarely pneumonia occurs via hematogenous spread.*

HOST DEFENSE MECHANISMS

- *The hairs and turbinates of the nares capture larger inhaled particles*
- *The branching architecture of the tracheobronchial tree.*
- *Mucociliary clearance.*
- *The gag reflex and the cough mechanism.*
- *The normal flora adhering to mucosal cells of the oropharynx.*
- *When these barriers are overcome or when microorganisms are small enough to be inhaled to the alveolar level, resident alveolar macrophages are extremely efficient at clearing and killing pathogens.*
- *Only when the capacity of the alveolar macrophages to ingest or kill the microorganisms is exceeded does clinical pneumonia become manifest.*
- *In that situation, the alveolar macrophages initiate the inflammatory response to bolster lower respiratory tract defenses.*
- *The host inflammatory response, rather than proliferation of microorganisms triggers the clinical syndrome of pneumonia.*

COMMUNITY-ACQUIRED PNEUMONIA

- *Community Acquired Pneumonia (CAP) is an acute infection of lung tissue that develops outside of the hospital setting. The most common bacterial cause of CAP is Streptococcus pneumonia.*
- *Bacteria commonly enter the respiratory tract, but do not normally cause pneumonia. When pneumonia does occur, it is the result of:*
  1. *A very virulent microbe.*
  2. *A large "dose" of bacteria.*
  3. *An impaired host defense mechanism.*

Factors that predispose to CAP

- ✖ *Cigarette smoking.*
- ✖ *Upper respiratory tract infections.*
- ✖ *Alcohol.*
- ✖ *Corticosteroid therapy.*
- ✖ *Old age.*
- ✖ *Recent influenza infection.*
- ✖ *Pre-existing lung disease.*
- ✖ *HIV.*
- ✖ *Indoor air pollution.*

Causative organism established in 60% CAP in research setting, 20% in clinical setting.

⇨ *"Typical":*

- *S. pneumoniae, Haemophilus influenzae, Staphylococcus aureus, Group A streptococci, Moraxella catarrhalis, anaerobes, and aerobic gram-negative bacteria.*

⇨ *"Atypical" - 20-28% CAP worldwide Legionella spp, Mycoplasma pneumoniae, Chlamydophila pneumoniae, and C. psittaci.*

- *Mainly distinguished from typical by not being detectable on Gram stain or cultivable on standard media.*

Clinical features

- *Fever, rigors, shivering, headache and vomiting.*
- *Dyspnea, cough with mucopurulentsputum (occasional haemoptysis) and pleuritic chest pain.*
- *Upper abdominal pain.*
- *Less typical presentations may be seen at the extremes of age.*
- *Signs: crackles, bronchial breathing, and whispering pectoriloquy.*

Common clinical features of community-acquired pneumonia

❖ Typical

➢ STREPTOCOCCUS PNEUMONIAE

- *Most common cause. Affects all age groups, particularly young to middle-aged.*
- *Sudden onset of fever, rigors, dyspnea, bloody sputum production, chest pain, tachycardia, tachypnea and abnormal findings on lung exam*
- *may be accompanied by herpes labialis*

➢ STAPH. AUREUS

- *Associated with debilitating illness and often preceded by influenza.*
- *Radiographic features include multilobar shadowing, cavitation, pneumatocoeles and abscesses.*
- *Dissemination to other organs may cause osteomyelitis, endocarditis or brain abscesses. Mortality up to 30%*

➢ KLEBSIELLA PNEUMONIAE

- *More common in men, alcoholics, diabetics, elderly, hospitalised patients, and those with poor dental hygiene. Predilection for upper lobes and particularly liable to suppurate and form abscesses. May progress to pulmonary gangrene.*

- **HAEMOPHILUS INFLUENZA**
  - *More common in old age and those with underlying lung disease (COPD, bronchiectasis).*
- **PSEUDOMONAS**
  - *Not a typical cause of CAP and usually associated in patients who have prolonged hospitalization, have been on broad-spectrum antibiotics, high-dose steroids, structural lung disease.*

❖ Atypical

- **MYCOPLASMA PNEUMONIA**
  - *Gram -vs bacteria with no true cell wall.*
  - *Frequent cause of CAP in adults + children.*
  - *May be asymptomatic.*
  - *Gradual onset.*
  - *Objective abnormalities on physical exam are minimal in contrast to the patients reported symptoms.*
  - *Epidemics occur every 3-4 years, usually in autumn. Rare complications include haemolytic anaemia, Stevens-Johnson syndrome, erythema nodosum, myocarditis, pericarditis, meningoencephalitis, Guillain-Barré syndrome.*
- **LEGIONELLA PNEUMOPHILA**
  - *Middle to old age.*
  - *Local epidemics around contaminated source, e.g. cooling systems in hotels, hospitals. Person-to-person spread unusual.*
  - *Some features more common, e.g. headache, confusion, malaise, myalgia, high fever and vomiting and diarrhoea.*
  - *Tends to be the most severe of the atypical pneumonias.*
  - *Laboratory abnormalities include hyponatraemia, elevated liver enzymes, hypoalbuminaemia and elevated creatine kinase.*

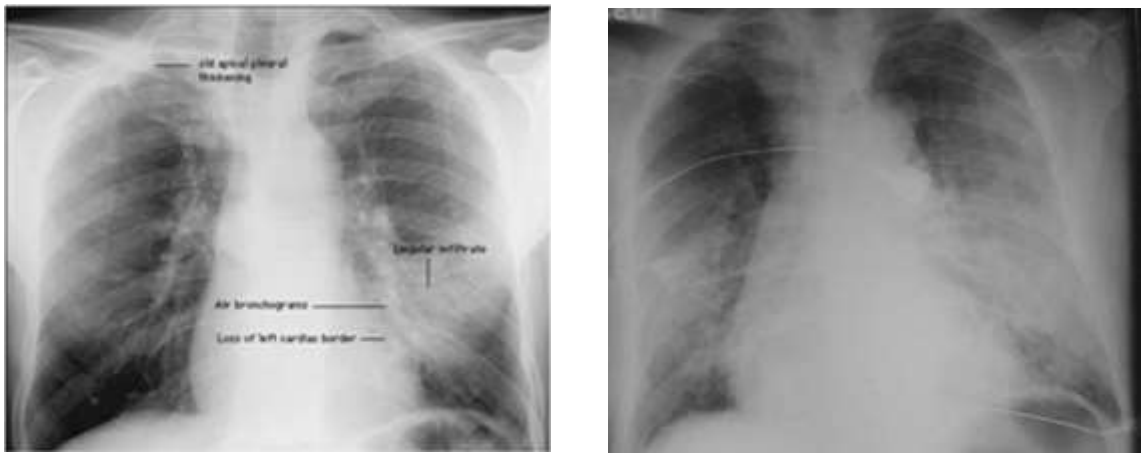
- **CHLAMYDIA PNEUMONIAE**
  - *Young to middle-aged.*
  - *Large-scale epidemics or sporadic; often mild, self-limiting disease. Headaches and a longer duration of symptoms before hospital admission.*
  - *Usually diagnosed on serology.*

Differential diagnosis of CAP

- *Pulmonary infarction.*
- *Pulmonary/pleural TB.*
- *Pulmonary oedema (can be unilateral).*
- *Pulmonary eosinophilia (p. 713).*
- *Malignancy: bronchoalveolar cell carcinoma.*
- *Rare disorders: cryptogenic organising pneumonia/ bronchiolitis obliterans organising pneumonia (COP/ BOOP).*

Investigations

- *To exclude other conditions that mimic pneumonia , assess the severity, and identify the development of complications.*
- *A chest X-ray usually provides confirmation of the diagnosis.*



Chest X-ray – Pneumonia

- *Microbiological investigations*
  - *Severe disease.*
  - *Notification (Legionella pneumophila).*
  - *In patients who do not respond to initial therapy.*
  - *Provides useful epidemiological information.*
- *Sputum: direct smear by Gram and Ziehl-Neelsen stains. Culture and antimicrobial sensitivity testing.*
- *Blood culture: frequently positive in pneumococcal pneumonia.*
- *Serology: acute and convalescent titres for Mycoplasma, Chlamydia, Legionella, and viral infections. Pneumococcal antigen detection in serum or urine.*
- *PCR: mycoplasma can be detected from swab of oropharynx.*
- *Pulse oximetry and arterial blood gas.*
- *The white cell count: a very high (> 20 × 109/l) or low (< 4 × 109/l) white cell count may be seen in severe pneumonia.*
- *Urea and electrolytes and liver function tests.*
- *C-reactive protein.*

CURB-65

To assess severity and determining site of care:

- ***C**onfusion (disorientation to person, place or time).*
- ***U**rea (BUN > 7 mmol/L).*
- ***R**espiratory Rate (RR > 30 breaths/minute).*
- ***B**lood Pressure (systolic< 90 mmHg-diastolic< 60 mm Hg).*
- ***65** (years of age or greater).*

One point for each prognostic variable

0-1 treat as outpatient, 2 general inpatient admission, 3-5 intensive care admission

Management

- *Oxygen.*
- *Fluid balance.*
- *Antibiotic therapy.*
- *Nutritional support.*
- *Treatment of pleural pain.*
- *Physiotherapy.*

OXYGEN

- *All patients with tachypnoea, hypoxaemia, hypotension or acidosis with the aim of maintaining the PaO2 ≥ 8 kPa (60 mmHg) or SaO2 ≥ 92%.*
- *High concentrations (EXCEPT in COPD).*
- *Assisted ventilation should be considered at an early stage in those who remain hypoxaemic despite adequate oxygen therapy.*

ANTIBIOTIC TREATMENT FOR CAP

- ***Uncomplicated CAP***
  - *Amoxicillin 500 mg 8-hourly orally.*
  - *If patient is allergic to penicillin Clarithromycin 500 mg 12-hourly orally or*
  - *Erythromycin 500 mg 6-hourly orally.*
  - *If Staphylococcus is cultured or suspected, Flucloxacillin 1-2 g 6-hourly I.V. plus.*
  - *Clarithromycin 500 mg 12-hourly I.V.*
  - *If Mycoplasma or Legionella is suspected Clarithromycin 500 mg 12-hourly orally or I.V. or Erythromycin 500 mg 6-hourly orally or I.V. plus*
  - *Rifampicin 600 mg 12-hourly I.V. in severe cases.*
- ***Severe CAP***
  - *Clarithromycin 500 mg 12-hourly I.V. or*
  - *Erythromycin 500 mg 6-hourly I.V. plus*
  - *Co-amoxiclav 1.2 g 8-hourly I.V. or*
  - *Ceftriaxone 1-2 g daily I.V. or*
  - *Cefuroxime 1.5 g 8-hourly I.V. or*
  - *Amoxicillin 1 g 6-hourly I.V. plus flucloxacillin 2 g 6-hourly I.V.*

- *Patients with severe CAP should not receive corticosteroids, unless shock that requires vasopressor infusion is present.*
- *In addition, corticosteroids should not be given in case of influenza-related respiratory distress.*
- *Patients exposed to NSAIDs during the early stage of CAP had a worse presentation of CAP, more pleuropulmonary complications and required noninvasive ventilatory support more often, such as high-flow oxygen therapy.*
- *59- A patient was treated for right sided lobar pneumonia, he started to improve but 5 days latter fever recurred with chills, night sweats and chest pain in deep breathing, O/E dull chest percussion note on the right side, chest X- ray showing D-shaped opacity. Which one of the followings is the most likely cause?*
  - *A- Chylothorax.*
  - *B- Empyema.*
  - *C- Hemothorax.*
  - *D- TB.*
  - *E- Lung abscess.*

Complications of CAP

- *Para-pneumonic effusion-common.*
- *Empyema.*
- *Retention of sputum causing lobar collapse.*
- *DVT and pulmonary embolism.*
- *Pneumothorax, particularly with Staph. aureus.*
- *Suppurative pneumonia/lung abscess.*
- *ARDS, renal failure, multi-organ failure.*
- *Ectopic abscess formation (Staph. aureus).*
- *Hepatitis, pericarditis, myocarditis, meningoencephalitis.*
- *Pyrexia due to drug hypersensitivity.*

Indications for referral to ITU

- *CURB score of 4-5, failing to respond rapidly to initial management.*
- *Persisting hypoxia (PaO2 < 8 kPa (60 mmHg)), despite high concentrations of oxygen.*
- *Progressive hypercapnia.*
- *Severe acidosis.*
- *Circulatory shock.*
- *Reduced conscious level.*

HOSPITAL-ACQUIRED PNEUMONIA

It refers to a new episode of pneumonia occurring at least 2 days after admission to hospital. Older people are particularly at risk, as are patients in intensive care units, especially when mechanically ventilated, in which case the term ventilator-associated pneumonia (VAP) is applied.

HEALTH CARE-ASSOCIATED PNEUMONIA (HCAP)

It refers to the development of pneumonia in a person who has spent at least 2 days in hospital within the last 90 days, attended a haemodialysis unit, received intravenous antibiotics, or been resident in a nursing home or other long-term care facility.

Aetiology

When HAP occurs within 4-5 days of admission (early-onset), the organisms involved are similar to those involved in CAP; however, late-onset HAP is more often attributable to Gram-negative bacteria (e.g. Escherichia, Pseudomonas and Klebsiella species), Staph. aureus (including methicillin-resistant Staph. aureus (MRSA)) and anaerobes.

Factors predisposing to hospital-acquired pneumonia

- *Reduced host defences against bacteria*
- *Aspiration of nasopharyngeal or gastric secretions.*
- *Bacteria introduced into lower respiratory tract.*
- *Bacteraemia.*

Clinical features and investigations

HAP should be considered in any hospitalised or ventilated patient who develops purulent sputum ,new radiological infiltrates, an otherwise unexplained increase in oxygen requirement, a core temperature > 38.3°C, and a leucocytosis or leucopenia. Appropriate investigations are similar to those outlined for CAP, although whenever possible, microbiological confirmation should be sought. In mechanically ventilated patients, bronchoscopy-directed protected brush specimens or broncho-alveolar lavage (BAL) may be performed.

Mangement

- *Empirical antibiotic therapy.*
- *Adequate Gram-negative cover by a third-generation cephalosporin + aminoglycoside,*
- *or a monocyclic β-lactam (e.g. aztreonam) and flucloxacillin,*
- *or meropenem.*
- *MRSA is treated with intravenous vancomycin.*

SUPPURATIVE PNEUMONIA, ASPIRATION PNEUMONIA AND PULMONARY ABSCESS

- *These conditions are considered together, as their aetiology and clinical features overlap. Suppurative pneumonia is characterised by destruction of the lung parenchyma by the inflammatory process.*
- *'Pulmonary abscess' is usually taken to refer to lesions in which there is a large localised collection of pus, or a cavity lined by chronic inflammatory tissue, from which pus has escaped by rupture into a bronchus.*

Risk factors

- *Inhalation of septic material during operations or of vomitus during anaesthesia or coma.*
- *Bulbar or vocal cord palsy.*
- *Stroke.*
- *Achalasia or oesophageal reflux.*
- *Alcoholism.*
- *Local bronchial obstruction from a neoplasm or foreign body.*
- *Aspiration tends to localise to dependent areas of the lung such as the apical segment of the lower lobe in a supine patient.*
- *Infections are usually due to a mixture of anaerobes and aerobes.*
- *In a previously healthy lung, the most likely infecting organisms are Staph. aureus or Klebsiella pneumonia.*
- *Injecting drug-users are at particular risk of developing haematogenous lung abscess, often in association with endocarditis affecting the pulmonary and tricuspid valves.*
- *A non-infective form of aspiration pneumonia-exogenous lipid pneumonia- may follow the aspiration of animal, vegetable or mineral oils.*

Investigations

- *Radiological features :*
- *Lobar or segmental consolidation or collapse.*
- *Abscesses are characterised by cavitation and fluid level.*
- *Sputum and blood culture.*

Clinical features of suppurative pneumonia

- *Cough productive of large amounts of sputum which is sometimes fetid and blood-stained.*
- *Pleural pain common.*
- *Sudden expectoration of copious amounts of foul sputum occurs if abscess ruptures into a bronchus.*

Clinical signs

- *High remittent pyrexia.*
- *Profound systemic upset.*
- *Digital clubbing may develop quickly (10-14 days).*
- *Chest examination usually reveals signs of consolidation; signs of cavitation rarely found.*
- *Pleural rub common.*
- *Marked weight loss.*

Management

- *Oral treatment with amoxicillin 500 mg 6-hourly is effective in many patients. Aspiration pneumonia can be treated with co-amoxiclav 1.2 g 8-hourly. If an anaerobic bacterial infection is suspected (e.g. from fetor of the sputum), oral metronidazole 400 mg 8-hourly should be given.*
- *Parenteral therapy with vancomycin or daptomycin can also be considered.*
- *Prolonged treatment for 4-6 weeks may be required in some patients with lung abscess*
- *Physiotherapy is of great value, especially when suppuration is present in the lower lobes or when a large abscess cavity has formed. In most patients, there is a good response to treatment, and although residual fibrosis and bronchiectasis are common sequelae, these seldom give rise to serious morbidity. Surgery should be contemplated if no improvement occurs despite optimal medical therapy.*

PNEUMONIA IN THE IMMUNOCOMPROMISED PATIENT

- *Patients immunocompromised by drugs or disease are at high risk of pulmonary infection. The majority of infections are caused by the same pathogens that cause pneumonia in non-immunocompromised individuals, but in patients with more profound immunosuppression, unusual organisms, or those normally considered to be of low virulence or non-pathogenic, may become 'opportunistic' pathogens.*
- *In addition to the more common agents, the possibility of Gram-negative bacteria, especially Pseudomonas aeruginosa, viral agents, fungi, mycobacteria, and less common organisms such as Nocardia asteroides, must be considered. Infection is often due to more than one organism.*

Clinical features

- *These typically include fever, cough and breathlessness, but are less specific with more profound degrees of immunosuppression. In general, the onset of symptoms tends to be less rapid when caused by opportunistic organisms such as Pneumocystis jirovecii and in mycobacterial infections, than with bacterial infections.*
- *In P. jirovecii pneumonia, symptoms of cough and breathlessness can be present several days or weeks before the onset of systemic symptoms or the appearance of radiographic abnormality.*

Diagnosis

- *As many patients are too ill to undergo Invasive investigations safely, 'induced sputum' may offer a relatively safe method of obtaining microbiological samples.*
- *HRCT is useful in differentiating the likely cause.*

Management

- *The causative agent is frequently unknown and broad-spectrum antibiotic therapy is required, such as:*
  - *a third-generation cephalosporin, or a quinolone, plus an anti-staphylococcal antibiotic, or*
  - *an anti-pseudomonal penicillin plus an aminoglycoside.*
- *Thereafter treatment may be tailored according to the results of investigations and the clinical response. Depending on the clinical context and response to treatment, antifungal or antiviral therapies may be added.*

… END …