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# **PNEUMONIA PART 1**

**DR UMMAR**

# Pneumonia

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An acute respiratory illness associated with recently developed radiological pulmonary shadowing which may be segmental, lobar or multilobar.

Or,

Inflammation in the lung characterized by accumulation of secretions and inflammatory cells in alveoli.



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# CLASSIFICATION

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# Pneumonia: Classifications

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## Clinically

- **Community-acquired pneumonia (CAP):**  
Onset in community or during 1<sup>st</sup> 2 days of hospitalization  
(Strep. pneumoniae most common)
- **Hospital-acquired Pneumonia(HAP/nosocomial):**  
Occurring 48 hrs after hospitalization
- **Suppurative & Aspiration pneumonia**
- **Pneumonia in immunocompromised patient:** caused by opportunistic organisms (Pneumocystis jirovecii).

# Pneumonia: Classifications..

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## Anatomically

➤ **Lobar pneumonia** if one or more lobe is involved

➤ **Broncho-pneumonia (Lobular)**

1. more patchy alveolar consolidation associated with bronchial and bronchiolar inflammation often affecting both lower lobes

2. the pneumonic process has originated in one or more bronchi and extends to the surrounding lung tissue

# Pneumonia: Classifications..

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## According to causes

- Bacterial (the most common cause of pneumonia)
- Viral pneumonia
- Fungal pneumonia
- Aspiration pneumonia
- Chemical pneumonia (ingestion of kerosene or inhalation of irritating substance)

# Pneumonia: Classifications..

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## ➤ **Typical pneumonia:**

Respiratory symptoms are more than constitutional symptoms

## ➤ **Atypical pneumonia:**

Constitutional symptoms are more than respiratory symptoms

## **(Behaviourist's classification)**

➤ **Easy pneumonia** (responds to initial treatment)

➤ **Difficult pneumonia** (fails to do so)



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# COMMUNITY-ACQUIRED PNEUMONIA (CAP)

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# Community-acquired pneumonia (CAP)

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- Onset in community or during 1<sup>st</sup> 2 days of hospitalization
- Strep. pneumoniae most common 50%
- It affects all age groups but is particularly common at the extremes of age.
- Worldwide, CAP continues to kill more children than any other illness, and its propensity to ease the passing of the frail and elderly led to pneumonia being known as the ***'old man's friend'***.

# Community-acquired pneumonia (CAP)..

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- Most cases are spread by droplet infection.
- May occur in previously healthy individuals.
- *Streptococcus pneumoniae* remains the most common infecting agent.
- Other organisms may be involved which depends on the age of the patient and the clinical context.
- **Viral infections are important causes of CAP in children, and their contribution to adult CAP is increasingly recognized**

# Community-acquired pneumonia (CAP)..

- *Mycoplasma pneumoniae* is more common in young people and rare in the elderly.
- *Haemophilus influenzae* is more common in the elderly, particularly when underlying lung disease is present.
- *Legionella pneumophila* occurs in local outbreaks centred on contaminated cooling towers in hotels, hospitals and other industrial buildings.
- *Staphylococcus aureus* is more common following an episode of influenza.

# Community-acquired pneumonia (CAP)..

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## Factors that predispose to pneumonia

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

# Community-acquired pneumonia (CAP)..

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## Organisms causing CAP

### Bacteria

- *Streptococcus pneumoniae*
- *Mycoplasma pneumoniae*
- *Legionella pneumophila*
- *Chlamydia pneumoniae*
- *Haemophilus influenzae*
- *Staphylococcus aureus*
- *Chlamydia psittaci*
- *Coxiella burnetii*  
(Q fever, 'querry' fever)
- *Klebsiella pneumoniae*  
(Freidländer's bacillus)
- *Actinomyces israelii*

### Viruses

- **Influenza, parainfluenza**
- **Measles**
- **Herpes simplex**
- **Varicella**
- **Adenovirus**
- **Cytomegalovirus (CMV)**
- **Coronavirus (Urbani SARS-associated coronavirus)**



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# PATHOPHYSIOLOGY

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# Pneumonia: mode of transmission

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- **Bacteria and viruses living in your nose, sinuses, or mouth may spread to your lungs**
- **You may breathe some of these germs directly into your lungs (droplets infection)**
- **You breathe in (inhale) food, liquids, vomit, or fluids from the mouth into your lungs (aspiration pneumonia)**

# Pathophysiology

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- The streptococci reach the alveoli and lead to inflammation and pouring of an exudates into the air spaces
- WBCs migrates to alveoli, the alveoli become more thick due to its filling consolidation, involved areas by inflammation are not adequately ventilated, due to secretion and edema
- This will lead to partial occlusion of alveoli and bronchi causing a decrease in alveolar oxygen content



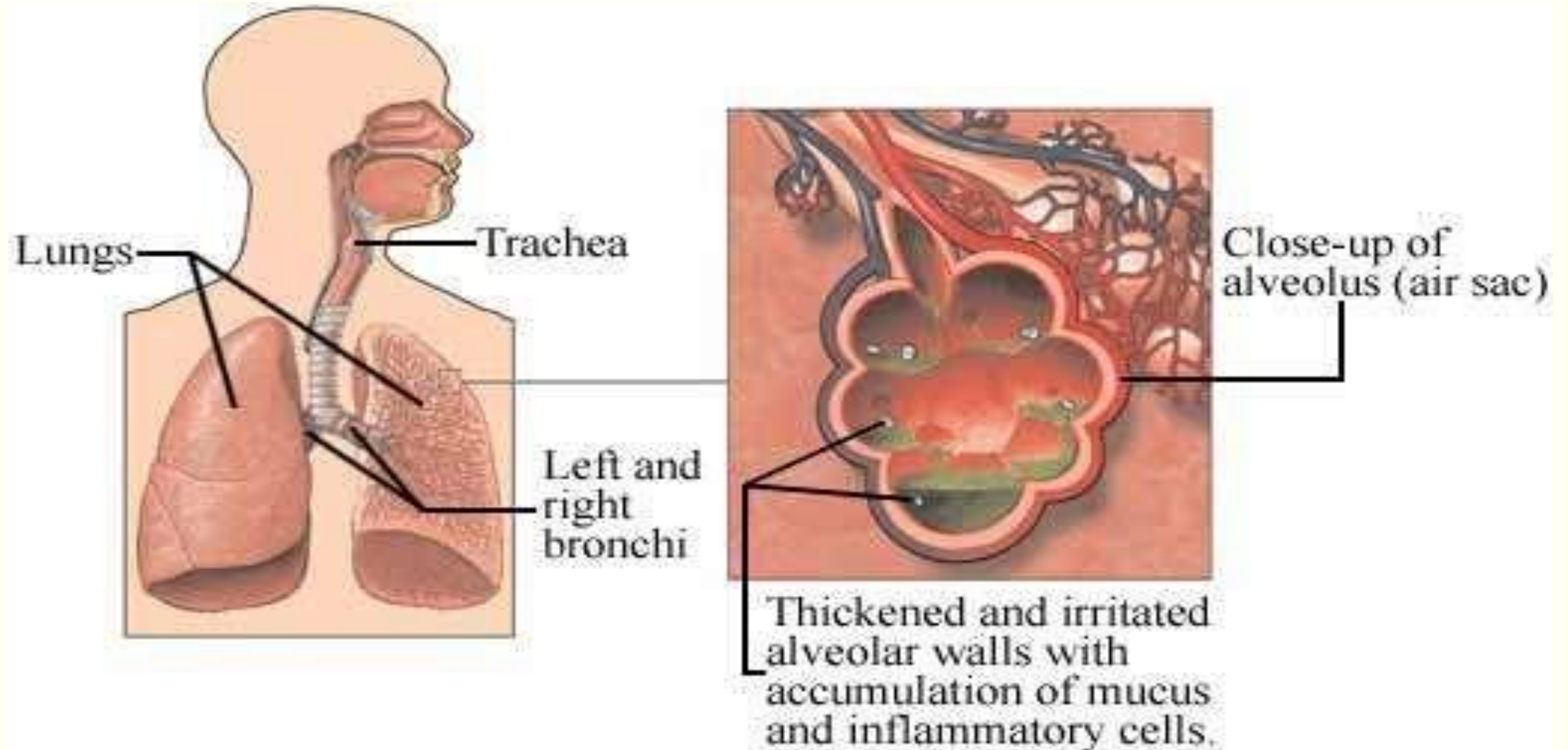
# Pathophysiology..

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- Venous blood that goes to affected areas without being oxygenated and returns to the heart (*ventilation-perfusion mismatch*)
- This will lead to arterial hypoxemia and even death due to interference with ventilation

# Pathophysiology..

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# CLINICAL FEATURES

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# Clinical features

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- Pneumonia, particularly lobar pneumonia, usually presents as an acute illness.
- Systemic features such as fever, rigors, shivering and malaise predominate and **delirium may be present**.
- The appetite is invariably lost and headache frequently reported.

# Clinical features..

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- Pulmonary symptoms include cough, which at first is characteristically short, painful and dry, but later accompanied by the expectoration of mucopurulent sputum.
- Rust-coloured sputum may be seen in patients with *Strep. pneumoniae*, and the occasional individual may report haemoptysis.
- Pleuritic chest pain may be a presenting feature and, on occasion, may be referred to the shoulder or anterior abdominal

# Clinical features..

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- **Upper abdominal tenderness is sometimes apparent in patients with lower lobe pneumonia or if there is associated hepatitis.**
- **Less typical presentations may be seen in the very young and the elderly.**

# Clinical features..

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On examination,

➤ The **respiratory and pulse rate** may be raised and the blood pressure low, while **an assessment of the mental state may reveal a delirium.**

These are important indicators of the severity of the illness

➤ Not all patients are **pyrexial** but this is a helpful diagnostic clue if present.

➤ **Oxygen saturation** on air may be low, and the patient cyanosed and distressed.

# Clinical features..

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On examination..

- **Chest signs vary, depending on the phase of the inflammatory response.**
- **When consolidated, the lung is typically dull to percussion and, as conduction of sound is enhanced, auscultation reveals bronchial breathing and whispering pectoriloquy; crackles are heard throughout.**
- **However, in many patients, signs are more subtle with reduced air entry only, but crackles are usually present.**



# Clinical features..

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On examination..

- **An assessment of nutrition is important as, if poor, the response to treatment will be impaired, particularly in the elderly.**
- **On occasion, inferences as to the likely organism may be drawn from clinical examination. For example, the presence of herpes labialis may point to streptococcal infection, as may the finding of 'rusty' sputum.**
- **The presence of poor dental hygiene should prompt consideration of *Klebsiella* or *Actinomyces israelii*.**

# Clinical features..

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## Chronic Pneumonia

- **Symptoms creep in slowly**
- **Fever that lasts a week**
- **Coughing for three weeks**
- **Enlarged cervical & axillary lymphnodes**
- **Haemoptysis**
- **Recurrence of symptoms after finishing antibiotic course**

# Differential diagnosis of pneumonia

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- **Pulmonary infarction**
- **Pulmonary/pleural TB**
- **Pulmonary oedema (can be unilateral)**
- **Pulmonary eosinophilia**
- **Malignancy: bronchoalveolar cell carcinoma**
- **Rare disorders: cryptogenic organising pneumonia/  
bronchiolitis obliterans organising pneumonia (COP/BOOP)**
- **Venous thromboembolism, Pulmonary haemorrhage**
- **ARDS**
- **Drug toxicity**



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# INVESTIGATIONS

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# Investigations

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## **The aims of investigation are**

- **Confirm the diagnosis**
- **Exclude other conditions**
- **Assess the severity**
- **Identify the development of complications**

## Investigations..

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### ➤ Full blood count

- **Very high ( $> 20 \times 10^9/L$ ) or low ( $< 4 \times 10^9/L$ ) white cell count: marker of severity**
- **Neutrophil leucocytosis  $> 15 \times 10^9/L$ : suggests bacterial aetiology**
- **Haemolytic anaemia: occasional complication of *Mycoplasma***

### ➤ Erythrocyte sedimentation rate/C-reactive protein: **Non-specifically elevated**

### ➤ Blood culture: **Bacteraemia: marker of severity**

# Investigations..

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- Urea and electrolytes:
  - **Urea > 7 mmol/L (~20 mg/dL): marker of severity**
  - **Hyponatraemia: marker of severity**
- Liver function tests:
  - **Abnormal if basal pneumonia inflames liver**
  - **Hypoalbuminaemia: marker of severity**
- Serology: **Acute and convalescent titres for *Mycoplasma*, *Chlamydia*, *Legionella* and viral infections**
- Cold agglutinins: **Positive in 50% of patients with *Mycoplasma***
- Arterial blood gases: **Measure when  $SaO_2 < 93\%$  or when severe clinical features to assess ventilatory failure or acidosis**

## Investigations..

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### Sputum

#### ➤ Sputum samples

**Gram stain, culture and antimicrobial sensitivity testing. Gram stain of sputum showing Gram-positive diplococci characteristic of *Strep. pneumoniae*.**

#### ➤ Oropharynx swab

**PCR for *Mycoplasma pneumoniae* and other atypical pathogens**



## Investigations..

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### ➤ Urine

**Pneumococcal and/or *Legionella* antigen**

### ➤ Pleural fluid

**Always aspirate and culture** when present in more than trivial amounts, preferably with ultrasound guidance

# Investigations..

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## Other markers of severity of Pneumonia

- **CXR** ⇒ **One lobe involved**
- **Pao<sub>2</sub> <8kPa**
- **Low albumin(<35gm/L)**
- **WBC(<4000/cmm or >20000/cmm)**
- **Blood culture positive**

# Investigations..

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## Chest X-ray

### ➤ **Lobar pneumonia**

- **Patchy opacification evolves into homogeneous consolidation of affected lobe**
- **Air bronchogram (air-filled bronchi appear lucent against consolidated lung tissue) may be present.**

### ➤ **Bronchopneumonia:** Typically patchy and segmental shadowing

### ➤ **Complications:** Para-pneumonic effusion, intrapulmonary abscess or empyema

### ➤ ***Staph. aureus:*** Suggested by multilobar shadowing, cavitation, pneumatocoeles and abscesses

# Investigations..

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For evaluation of PSI

➤ **CBC**

**HCT, TC, DC**

➤ **RBS**

➤ **Blood Urea**

➤ **Serum electrolytes**

➤ **CXR**

➤ **ABG Analysis**

➤ **Pulse oximetry**



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# MANAGEMENT

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# Management

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**The principles of management focusing on**

- **Adequate oxygenation**
- **Appropriate fluid balance**
- **Antibiotics**

**In severe or prolonged illness,**

- **Nutritional support may be required**
  
- **Evaluate the effectiveness of administered medications**
- **Explain all procedures to the patient and family**

# Management...

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## Oxygen

➤ **Oxygen should be administered to all patients with**

- **tachypnoea,**
- **hypoxaemia,**
- **hypotension or**
- **acidosis**

➤ **The aim of maintaining the PaO<sub>2</sub> at or above 8 kPa (60 mmHg) or the SaO<sub>2</sub> at or above 92%.**

# Management....

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## Oxygen

- **High concentrations (35% or more), preferably humidified, should be used in all patients who do not have hypercapnia associated with COPD.**
- **Continuous positive airway pressure (CPAP) should be considered in those who remain hypoxic despite this and these patients should be managed in a high-dependency or intensive care environment, where mechanical ventilation can be rapidly employed.**



# Management...

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## Intravenous fluids

- **These should be considered in patients with severe illness, older patients and those who are vomiting.**
- **Otherwise, an adequate oral intake of fluid should be encouraged.**
- **Inotropic support may be required in patients with shock**

# Management...

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## Antibiotics

**Prompt administration of antibiotics improves the outcome.**

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**e initial choice of antibiotic** is guided by

- **clinical context,**
- **severity assessment,**
- **local knowledge of antibiotic resistance patterns**
- **any available epidemiological information.**

**The choice of empirical antibiotic therapy is considerably more challenging, due to**

- **Diversity of pathogens**
- **Drug resistance.**

# Management...

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## Antibiotics : Uncomplicated CAP:

**Amoxicillin 500 mg 3 times daily orally**

➤ If patient is allergic to penicillin: **Clarithromycin 500 mg twice daily orally**

or **Erythromycin 500 mg 4 times daily orally**

➤ If Staphylococcus is cultured or suspected: **Flucloxacillin 1–2 g 4 times daily IV** plus **Clarithromycin 500 mg twice daily IV**

➤ If Mycoplasma or Legionella is suspected: **Clarithromycin 500 mg twice daily orally or IV** or **Erythromycin 500 mg 4 times daily orally IV** plus

**Rifampicin 600 mg twice daily IV** in severe cases

# Management...

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## Antibiotics : Severe CAP:

**Clarithromycin 500 mg twice daily IV or**

**Erythromycin 500 mg 4 times daily IV**

**plus**

**Co-amoxiclav 1.2 g 3 times daily IV or**

**Ceftriaxone 1–2 g daily IV or**

**Cefuroxime 1.5 g 3 times daily IV or**

**Amoxicillin 1 g 4 times daily IV plus flucloxacillin 2 g 4 times daily IV**

# Management...

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**Antibiotics:** Oral antibiotics are usually adequate unless the patient has a

- **severe illness,**
- **impaired consciousness,**
- **loss of swallowing reflex, or**
- **functional or anatomical reasons for malabsorption.**

**In most patients with uncomplicated pneumonia, a 7-day course is adequate, although treatment is usually required for longer in those with *Legionella*, *staphylococcal* or *Klebsiella pneumonia*.**

# Management...

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## **Antibiotics:**

### **Duration of therapy**

**5 -7 days - outpatients**

**10-14 days – Mycoplasma, Chlamydia, Legionella**

**14+ days - chronic steroid users**

**14-21days – Staph. aureas, Legionella spp**

**[Am J Respir Crit Care Med 163:1730-54, 2001]**

# Management...

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## Pain

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- **It is important to relieve pleural pain, as it may prevent the patient from breathing normally and coughing efficiently.**
- **For the majority, simple analgesia with paracetamol, co-codamol or NSAIDs is sufficient.**
- **In some patients, opiates may be required but these must be used with extreme caution in patients with poor respiratory function, as they may suppress ventilation.**

## Physiotherapy

**May help expectoration in those who suppress cough because of pleural pain.**

# Management...

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- **Maintain a patent airway and adequate oxygenation**
- **Use suction if the patient can't produce a specimen**
- **Provide a high calorie, high protein diet & soft foods**
- **Provide a quiet, calm environment, with frequent rest periods**
- **Monitor the patient's ABG levels, especially if he's hypoxic**
- **Assess the patient's respiratory status**
- **Auscultate breath sounds at least every 4 hours**



# Management...

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## Delayed resolution means

- **Physical signs persist for more than 2 weeks and**
- **Radiological features persist for more than 4 weeks after antibiotic therapy.**

## Non-resolution means

- **If radiological opacity persists after 8 weeks (with treatment/after antibiotic therapy).**

# Management...

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~~Delayed resolution suggests~~

- I the diagnosis is incorrect**
- II Incorrect microbiological diagnosis**
- III. Fungal, tubercular or atypical pneumonia**
- IV. recurrent aspiration**
- V. Improper antibiotic or insufficient dose**
- VI. pneumonia may be secondary to a proximal bronchial obstruction**
- VII. complication has occurred (Empyema or atelectasis)**
- VIII. Bronchial obstruction (bronchial carcinoma, adenoma, foreign body)**
- IX. Immunocompromised patient (HIV, DM, lymphoma, leukemia, multiple myeloma).**

## Assessment of Nonresponders

### Wrong Organism

Drug-resistant Pathogen:  
(bacteria, mycobacteria, virus, fungus)  
Inadequate Antimicrobial Therapy

### Wrong Diagnosis

Atelectasis  
Pulmonary Embolus  
ARDS  
Pulmonary Hemorrhage  
Underlying Disease  
Neoplasm

### Complication

Empyema or Lung Abscess  
*Clostridium difficile* Colitis  
Occult Infection  
Drug Fever



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# REFERRAL TO ITU

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# Hospital CURB-65

Any of:

- **Confusion\***
- **Urea** > 7 mmol/L
- **Respiratory rate** > 30/min
- **Blood pressure** (systolic < 90 mmHg or diastolic < 60 mmHg)
- **Age** > 65 years

\*Mental Test Score of 8 or less, or new disorientation in person, place or time.

Score 1 point for each feature present

CURB- 65 score 0 or 1

Likely to be suitable for home treatment

2

Consider hospital-supervised treatment  
Options may include

- Short-stay inpatient
- Hospital-supervised outpatient

3 or more

Manage in hospital as severe pneumonia  
Assess for ICU admission, especially if CURB-65 score = 4 or 5

# Indications for referral to ITU

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- **CURB score of 4–5, failing to respond rapidly to initial management**
- **Persisting hypoxia ( $PaO_2 < 8 \text{ kPa}$  ( $60 \text{ mmHg}$ )), despite high concentrations of oxygen**
- **Progressive hypercapnia**
- **Severe acidosis**
- **Circulatory shock**
- **Reduced conscious level**

Thank you

The image shows a hand-drawn card with the words "Thank you" written in a vibrant green, cursive script. The text is surrounded by intricate black ink illustrations of various leaves and floral motifs. A large, dark green leafy branch curves around the left side of the word "Thank". To the right of "Thank", there are several individual leaves and a small sprig with three leaves. Below "Thank", there are more leaves and a small sprig. The word "you" is positioned below "Thank" and is also surrounded by leaves and a sprig. The entire design is set against a plain white background, which is placed on a light brown, textured surface.