SESSION LEARNING OUTCOMES

- This session explains the aetiology, pathophysiology, clinical features, investigations and management of infections of the respiratory system.

- It aims to understand the following respiratory infections:
  - Acute Bronchitis
  - Pneumonia
  - Tuberculosis
  - Respiratory diseases caused by Fungi
## ACUTE BRONCHITIS AND TRACHEITIS

<table>
<thead>
<tr>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>• Acute inflammation of the trachea and the bronchial tree</td>
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</table>

<table>
<thead>
<tr>
<th>Aetiology</th>
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</thead>
<tbody>
<tr>
<td>• Infection usually bacterial or viral</td>
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<table>
<thead>
<tr>
<th>Clinical Features</th>
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</thead>
<tbody>
<tr>
<td>• Follows acute coryza</td>
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<tr>
<td>• Chest tightness, wheezing, breathlessness</td>
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<tr>
<td>• Coughing &amp; sputum</td>
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ACUTE BRONCHITIS AND TRACHEITIS

Complications

• Bronchopneumonia
• Respiratory failure
• Bronchial asthma
# ACUTE BRONCHITIS AND TRACHEITIS

## Investigations
- X ray throat and chest for trachea and lungs
- Tracheal / nasopharyngeal swab culture
- Blood oxygen levels
- Blood test to determine the cause of infection

## Treatment
- ET intubation
- Analgesics for pain relief
- Paracetamol for fever
# TRACHEAL OBSTRUCTION

<table>
<thead>
<tr>
<th><strong>Aetiology</strong></th>
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</thead>
<tbody>
<tr>
<td>• Allergic reactions</td>
</tr>
<tr>
<td>• Foreign bodies</td>
</tr>
<tr>
<td>• Throat cancers</td>
</tr>
<tr>
<td>• External tumours pressing on trachea</td>
</tr>
<tr>
<td>• Inflammation of trachea or bronchial tree</td>
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<table>
<thead>
<tr>
<th><strong>Clinical Features</strong></th>
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<tr>
<td>• Stridor</td>
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## TRACHEAL OBSTRUCTION

<table>
<thead>
<tr>
<th>Complications</th>
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</thead>
<tbody>
<tr>
<td>• Asphyxia</td>
</tr>
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<table>
<thead>
<tr>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Systematic and depending upon the cause</td>
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</table>
TRACHEAL OBSTRUCTION
PNEUMONIA

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

○ Classification
  • Clinical
    – Community acquired
    – Hospital acquired (nosocomial)
    – Pneumonia in immuno-compromised hosts
    – Pneumonia in patients with damaged lung (including suppurative and aspirational)
  • Radiological and pathological
    – Lobar
    – Bronchial
TYPES OF PNEUMONIA

PNEUMONIA

Normal bronchiole and alveoli

Pneumonia causes an accumulation of fluid in the alveoli

http://afairgo.net/wp-content/uploads/2014/05/pneumonia.jpg
COMMUNITY ACQUIRED PNEUMONIA (CAP)

- **Epidemiology**
  - In UK 5-11/1000 adults per year (5 – 12% of LRTI)
  - Incidence higher in very young and elderly
  - Pneumonia accounts for 1/5 of childhood death worldwide

- **Aetiology**
  - CAP is usually spread by droplet infection
  - Predisposing factors – cigarette smoking, URTI, alcohol, corticosteroid therapy, old age, recent influenza infection, pre-existing lung disease
COMMUNITY ACQUIRED PNEUMONIA (CAP)

- **Bacterial pneumonias** are commonly caused by
  - Streptococcus pneumoniae
  - Chlamydia pneumoniae
  - Mycoplasma pneumoniae
  - Legionella pneumoniae

- **Primary viral pneumonias** are caused by
  - influenza, parainfluenza, measles viruses
LOBAR OR STREPTOCOCCAL PNEUMONIA

Infiltration of neutrophils in alveoli

Gram (+ve) Diplococci

STAGES OF PNEUMONIA

- **Congestion**
  accumulation of bacteria

- **Red hepatisation**
  congestion and increased intra-alveolar fluid

- **Gray hepatisation**
  red cells get trapped in parenchyma

- **Resolution**
  enzymatic activity digests exudate → coughing

COMMUNITY ACQUIRED PNEUMONIA (CAP)

Clinical features

• Acute illness with systemic features such as fever, rigor, shivering, vomiting, loss of appetite, headache
• Pulmonary symptoms are at first painful and dry cough, later accompanied by mucopurulent sputum
• Rust colour sputum in patients with Strep. Pneumoniae
<table>
<thead>
<tr>
<th>Investigations</th>
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</thead>
<tbody>
<tr>
<td>• Chest X ray</td>
</tr>
<tr>
<td>• Microbiological investigations</td>
</tr>
<tr>
<td>– Sputum microscopy and culture</td>
</tr>
<tr>
<td>– Blood culture</td>
</tr>
<tr>
<td>– Serology</td>
</tr>
<tr>
<td>• Assessment of gas exchange</td>
</tr>
<tr>
<td>• General blood tests</td>
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</tbody>
</table>
COMMUNITY ACQUIRED PNEUMONIA (CAP)
## COMMUNITY ACQUIRED PNEUMONIA (CAP)

### Differential diagnosis

- Pulmonary infarction
- Pulmonary TB
- Pulmonary oedema
- Malignancy
COMMUNITY ACQUIRED PNEUMONIA (CAP)

<table>
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<tr>
<td>• Rest, avoid smoking</td>
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<tr>
<td>• Oxygen</td>
</tr>
<tr>
<td>• Fluid balance</td>
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<tr>
<td>• Antibiotics</td>
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<tr>
<td>• Analgesics</td>
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<tr>
<td>• Physiotherapy</td>
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<tr>
<th>Prevention</th>
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<td>• Influenza vaccination to those at high risk</td>
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</table>
Pneumonia occurring at least 2 days after admission to hospital

Aetiology

- Predisposing factors
  - Reduced host defences
  - Aspiration
  - Bacteria introduced into LRT
  - Bacteraemia
- Majority caused by gram-negative bacteria (E. coli, Pseudomonas and Klebsiella) and Multidrug Resistant Staphylococcus Aureus
HOSPITAL ACQUIRED PNEUMONIA

Clinical features and investigations
- Similar to CAP

Management
- Antibiotics for Gram-negative bacteria
- Oxygen therapy
- Fluid support
- Monitoring (mortality 30%)
- Physiotherapy
PNEUMONIA IN THE IMMUNOCOMPROMISED PATIENT

- Majority caused by same common pathogens, but gram-negative bacteria are more of a problem
- Unusual organisms may become opportunistic pathogens

**Clinical features**

- Fever, cough, breathlessness and chest X ray changes
- Patients may develop non-specific symptoms
- Onset of symptoms less rapid in opportunistic infection
# PNEUMONIA IN THE IMMUNOCOMPROMISED PATIENT

<table>
<thead>
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<th>Investigations</th>
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<td>• Similar to other pneumonias</td>
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<th>Management</th>
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<tr>
<td>• Initial broad spectrum antibiotics and tailored according to results</td>
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</table>
SUPPURATIVE AND ASPIRATIONAL PNEUMONIA INCLUDING PULMONARY ABSCESS

Suppurative pneumonia

• Pneumonic consolidation with destruction of lung parenchyma by inflammatory process and microabscess formation

Pulmonary abscess

• Lesion with large localised collection of pus
SUPPURATIVE AND ASPIRATIONAL PNEUMONIA INCLUDING PULMONARY ABSCESSES

Aetiology

- Infection of the previously healthy lung tissue with Staph. aureus or Kleb. Pneumoniae
- Or inhalation of septic material during operation on nose, mouth or throat under GA or inhalation of vomitus during GA or coma
SUPPURATIVE AND ASPIRATIONAL PNEUMONIA INCLUDING PULMONARY ABSCESS

Clinical features

- Cough with large amount of sometimes fetid and blood stained sputum
- Pleural pain
- Sudden expectoration of copious amount of foul sputum
- High fever
SUPPURATIVE AND ASPIRATIONAL PNEUMONIA INCLUDING PULMONARY ABSCESS

Management

- Antibiotics (later modify according to results)
- Physiotherapy in pulmonary abscess
Pulmonary Abscess
# TUBERCULOSIS

## Epidemiology

- Caused by infection with *Mycobacterium tuberculosis*
- Current estimate – 1000 million will become infected between 2002 and 2020
- Reasons for re-emergence of TB
  - In developed countries
    - Immigration, HIV, social deprivation, increased elderly, drug resistance
  - In developing countries
    - Ineffective control, lack of access to health care, poverty, civil unrest, HIV, drug resistance
TUBERCULOSIS

# TUBERCULOSIS

## Predisposing factors

- Age – children, elderly
- First generation immigrants from high prevalence countries
- Overcrowding
- Immunosuppression
- Type I diabetes
- X ray evidence of healed TB
# TUBERCULOSIS

## Pathogenesis

- **M. tuberculosis** spread by droplet inhalation
- **M. bovis** from drinking non-sterilised milk of infected cows
- Bacilli enter lungs → engulfed by macrophages → helper T cells produce cytokines → recruitment of monocytes and formation of granulomas limiting the replication and spread of organism
- Classical granulomas with central caseous necrosis (primary lesion Ghon focus)
- Primary lesion with regional lymph node involvement (Ghon complex)
Pathogenesis continued…

- If bacilli spread before immunity established → secondary foci in lymph nodes, serous membrane, meninges, bones, liver, kidneys and lungs
- Or scar tissue then grows around the tubercle (granuloma) completing the isolation of the bacilli generally taking around 10 days to complete
- Tuberculosis can now remain dormant sometimes for life, however if the immune system is compromised or bacilli escape active disease reoccurs
DEVELOPMENT OF TB

TUBERCULOSIS

Clinical features

• Primary TB
  – Can be asymptomatic with a very gradual onset of the disease, diagnosis not completed until the disease is advanced. Flu like symptoms may be present

• Miliary TB
  – 2 – 3 weeks of fever, night sweats, weight loss, dry cough
  – Other symptoms would relate to what parts of the body are affected
Clinical features continued…..

- Pulmonary TB
  - Dry cough leading to productive haemoptytic sputum
  - Chest pain
  - Shortness of breath
  - Flu like illness

- Extrapulmonary TB common in HIV patients (20% in HIV negative)
# TUBERCULOSIS

## Investigation for diagnosis
- Sputum, tissue biopsy (microscopy & culture)
- Tuberculin test

## Control and prevention
- BCG vaccine
- Identification and contact tracing

## Treatment
- Anti TB drugs (multiple drugs to prevent resistance)
NATURAL HISTORY AND SPECTRUM OF TB

HEALED LESIONS
(organisms not viable)

LATENT LESIONS
(organisms dormant; pulmonary or extrapulmonary)

PRIMARY COMPLEX
(localized caseation)

PROGRESSIVE PRIMARY TB

SECONDARY TUBERCULOSIS

PROGRESSIVE SECONDARY TB

LOCALIZED CASEATING DESTRUCTIVE LESIONS
(pulmonary or extrapulmonary)

REACTIVATION

REINFECTION

Cavity
Caseation
Scar

Caseation

Scar

Liver
Spleen

Massive hematogenous dissemination

Miliary TB

Massive hematogenous dissemination

Miliary TB

INCREASING IMMUNITY

 localized lesions, more caseation

HEALING LESIONS

Localized lesions, more caseation

Spreading lesions, little caseation

Primary infection

Weeks

Years

TUBERCULIN REACTIVITY


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endeavour.edu.au
39
Primary TB


Secondary TB

Miliary TB
RESPIRATORY DISEASES CAUSED BY FUNGI

Aspergillosis

- Bronchopulmonary aspergillosis caused by Aspergillus fumigatus
- Allergic bronchopulmonary aspergillosis (ABPA) is hypersensitivity reaction to A. fumigatus involving bronchial wall and periphery of the lungs
- More common in autumn and winter & associated with asthma
# ABPA

## Clinical features

- Fever, breathlessness, productive cough with bronchial casts and worsening of asthmatic symptoms

## Investigations

- Chest X ray
- Skin test
- Blood test

## Management

- Steroid, physiotherapy
ASPERGILLOSIS (cultured)

http://www.sciencephoto.com/image/13579/530wm/B2500683-Culture_of_Aspergillus_fumigatus_fungus-SPL.jpg
Student Feedback Surveys

Your feedback is important to us!

In the first fifteen minutes of the next class for this subject you will be provided with the opportunity to complete the Student Feedback Survey for BIOC211.

Please bring your laptop, tablet, or smart phone to your next class so that you can complete the survey in class time.
Main classifications of lung diseases are: obstructive, restrictive, ventilation, and perfusion. Classification of common diseases like asthma, emphysema, and pneumonia. Khan Academy.

Readings and Resources

Resources:

- **Set Textbooks:**

- **Additional textbooks:**
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