# Chronic Obstructive Pulmonary Disease (COPD)

## Definition of COPD
- Airflow obstruction that is:
  - Not fully reversible
  - Progressive
  - Does not change markedly over several months
- Combination of airway and parenchymal damage
  - This occurs as a result of chronic inflammation and encompasses chronic bronchitis and emphysema
  - An exacerbation of COPD is a rapid and sustained worsening of symptoms beyond normal day-to-day variations

## Epidemiology of COPD
- Prevalence: an estimated 3 million people have COPD in the UK
- Incidence: approximately 1% overall and 10% in over 75 year olds

## Causes or risk factors for COPD
- Smoking
  - In UK, 90% of COPD is caused by long-term smoking
  - Smokers of >30/day have a 20x risk compared to non-smokers, although only 10-20% of heavy smokers get COPD
- Air pollution
- Biomass fuels
- Alpha-1-antitrypsin deficiency
  - Serum protease inhibitor
  - Can present with lung disease (75%) or liver cirrhosis (25%)
    - Pan-acinar (lower lobes) as opposed to centri-lobular in smoking and environmental exposures

## Causes of acute exacerbations of COPD
- Viral
  - Rhinovirus, influenza, coronavirus, adenovirus, RSV
- Bacteria
  - Common
    - Strep. Pneumonia
    - Haemophilus
    - Moraxella
    - WCC may be normal with mild symptoms
  - Rare
    - Staph aureus (during flu season)
    - Pseudomonas

## Presentations of COPD
- Exertional breathlessness
- Chronic cough
- Sputum production
- Wheeze
- Frequent winter bronchitis
- Fatigue
- Ankle Swelling
- Weight loss

Differential diagnosis of COPD
- Asthma
- Bronchiectasis
- Lung cancer
- In acute exacerbations:
  - Pneumothorax
  - Pneumonia
  - Pulmonary oedema
  - Large pleural effusion
  - PE

Investigation of COPD
- Bedside
  - Pulse oximetry
  - Sputum MCS
  - ECG
    - May show tall P-waves of cor pulmonare, RBBB and RVH (right axis deviation, prominent V1 R-wave and V6 S-wave)
  - Calculate BMI
- Bloods
  - FBC: Hb and Hct can be raised in response to chronic hypoxia
  - Blood cultures if pyrexial
  - Alpha-1-antitrypsin levels
  - Theophylline level if on maintenance therapy
- ABG
  - Normal in mild disease
  - Hypoxia and hypercapnia in advanced disease
  - Respiratory acidosis +/- partial or full metabolic compensation
- Imaging
  - CXR
    - Classically shows bullae, hyperinflation and flattened diaphragms but can be normal
  - CT (high resolution CT - HRCT)
    - Can do in expiration phase if looking for air trapping
- Echo
  - Assess cardiac function (cor pulmonare)
- Lung function tests
  - High RV and TLC
  - Low VC
  - FEV<sub>1</sub>/FVC reduced (i.e. obstructive)
    - FEV<sub>1</sub>/FVC < 0.7, FVC < 0.8 predicted
  - Little reversibility with salbutamol: <15%
  - Low KCO
    - Carbon Monoxide gas transfer coefficient reduced in proportion to severity
**Staging of Severity of COPD** {NICE 2010 COPD Guidelines}

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<tbody>
<tr>
<td>&lt; 0.7</td>
<td>≥ 80%</td>
<td>Mild</td>
<td>Stage 1 – Mild</td>
<td>Stage 1 – Mild*</td>
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<tr>
<td>&lt; 0.7</td>
<td>50–79%</td>
<td>Moderate</td>
<td>Stage 2 – Moderate</td>
<td>Stage 2 – Moderate</td>
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<tr>
<td>&lt; 0.7</td>
<td>30–49%</td>
<td>Severe</td>
<td>Stage 3 – Severe</td>
<td>Stage 3 – Severe</td>
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<tr>
<td>&lt; 0.7</td>
<td>&lt; 30%</td>
<td>Very severe</td>
<td>Stage 4 – Very severe**</td>
<td>Stage 4 – Very severe**</td>
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* Symptoms should be present to diagnose COPD
** Or FEV₁ > 50 with respiratory failure

**Management of acute exacerbations of COPD**
Mild exacerbations can be treated with antibiotics and steroids in primary care (rescue packs). In hospital:

- **ABCDE**
  - Monitoring, iv access, bloods (consider theophylline level)
  - Early CXR and ABG
  - Cultures if pyrexial

- **Oxygen**
  - Titrated to maintain sats within individualised target range
    - Usually 88-92% if unsure
  - ABG to ensure not retaining carbon dioxide

- **Bronchodilators**
  - Salbutamol 5mg
    - Nebulised (or inhaled via spacer – equally effective)
  - Ipratropium 0.5mg
    - No evidence this is more effective than salbutamol

- **Prednisolone 30mg**
  - 7-14 days
    - No advantage in a more prolonged course

- **Antibiotics**
- If febrile, sputum purulent or signs of consolidation
  - Treat as pneumonia if consolidation on CXR
  - Empirical treatment – aminopenicillin, macrolide or tetracycline – refer to local guidelines

- IV Theophylline
  - Only if no response to bronchodilator therapy

- Non-invasive ventilation (CPAP or BiPAP)
  - In patients who are still hypercapnic and hypoxic despite medical therapy
  - Has been shown to improve survival
  - Must clearly document plan for what should happen if further deterioration and ceiling of treatment
  - Contraindications
    - Confusion or agitation
      - Unless this is due to high CO₂
    - Severe dementia
    - Facial burns or trauma
    - Vomiting
    - Undrained pneumothorax
    - Copious secretions
    - Haemodynamically unstable, moribund or low GCS
      - Unless in HDU
    - Upper GI surgery or obstruction

- Doxapram if NIV not available or inappropriate
  - Stimulant of chemoreceptors. CI in epilepsy.

- Invasive ventilation - careful consideration regarding whether appropriate
- Hospital at Home/ Assisted discharge programmes

### Chronic management of COPD
- Inhaled therapy
  - Short acting bronchodilators
    - Salbutamol 200mcg prn
    - Anticholinergic – e.g. Ipratropium
    - Combination of both
  - If patient remains breathless or has exacerbations, offer the following as maintenance therapy:
    - If FEV₁ ≥ 50% - either long acting β₂ agonist (LABA) or long acting muscarinic antagonist (LAMA) e.g. tiotropium 18mcg od
    - If FEV₁ ≤ 50% - either LABA with an inhaled corticosteroid (ICS) in a combination inhaler or LAMA e.g. Symbicort (budesonide and formeterol 400/12 bd) or Seretide (fluticasone and salmeterol 500/25 bd)
      - NB – use of ICS can increase risk of infection
    - Add LAMA to LABA + ICS in patients who remain breathless or have exacerbations despite taking LABA+ICS, irrespective of their FEV₁

- Theophylline
  - Should only be used after a trial of short acting bronchodilators and LABAs, or in patients unable to use inhaled therapy

- Oral mucolytic therapy
  - Consider in patients with productive cough

- Long term nebulisers

- Long Term Oxygen Therapy (LTOT)
o Needs to use for at least 15 hours per day for any benefit and greater benefit if used for > 20 hours
o Indications:
  - PaO2 on air when stable < 7.3 or
  - PaO2 on air when stable 7.3-8.0 with:
    • Secondary polycythaemia
    • Pulmonary HTN
    • Cor pulmonale
    • Nocturnal hypoxia (Sats < 90% for > 30% time)
  • Ambulatory oxygen therapy
    o Considered in patients who have exercise desaturation, are shown to have an improvement in exercise capacity and/or dyspnoea with oxygen and have motivation to use oxygen
    o Not recommended if PaO2 > 7.3
  • Non-invasive ventilation (NIV)
    o Refer patients with chronic hypercapnic respiratory failure who have required assisted ventilation during an exacerbation or who are hypercapnic or acidotic on LTOT to a specialist centre for consideration of long-term NIV.
  • Surgery
    o Bullectomy – consider in patients who are breathless and have a single large bulla on a CT scan and an FEV1 < 50% predicted
    o Lung volume reduction surgery – Consider if FEV1 > 20%, PaCO2 < 7.3, predominantly upper lobe emphysema, TLCO > 20% predicted
    o Lung transplantation - Take into consideration age, co-morbidities, FEV1, PaCO2, homogenously distributed emphysema on CT scan, elevated pulmonary artery pressures with progressive deterioration
  • MDT approach – Respiratory Nurse Specialist, Physio (Positive expiratory pressure masks, active cycle breathing)
  • Smoking cessation
  • Immunisations – pneumococcal and influenza
  • Self-management advice and packs – encourage patients to respond promptly to symptoms of an exacerbation by:
    o Starting oral corticosteroid if increased breathlessness interfering with daily activities
    o Starting antibiotics if purulent sputum
    o Adjusting bronchodilator therapy
    o Contacting healthcare professional if no improvement in symptoms
  • Pulmonary rehab
    o Multidisciplinary programme that is individually tailored to optimise each patient’s physical and social performance
    o Incorporates a programme of physical training, disease education, nutritional, psychological and behavioural intervention
  • Manage associated anxiety and depression
  • Optimise nutritional factors
  • Palliative care – In patients with end-stage COPD which is unresponsive to other medical therapy:
    o Opioids, Benzodiazepines, Tricyclic anti-depressants
    o Access to palliative care team/ hospices

Complications of COPD
  • Progressive respiratory failure
  • Cor Pulmonale
  • Recurrent LRTIs
  • Pneumothoraces
• Post-infective bronchiectasis
• Acute renal failure (likely pre-renal)

**Prognosis of COPD**
- Mortality is 70 per 100,000 per year (down from 200 25 years ago)
- 5 year survival approx. 75%
- With acute exacerbations
  - 1/3 will be re-admitted within 3 months and 14% will die within 3 months

**Common questions concerning COPD**

**What is the micro-pathology of COPD?**
- Hypertrophy and hyperplasia of mucus-secreting goblet cells of bronchial tree
- Fibrosis and thickening of bronchial walls
- Lymphocytic infiltrate
- Emphysema - Dilatation and destruction of lung tissue distal to terminal bronchiole leading to reduced elasticity and gas exchange surface

**What is the basic differential diagnosis of COPD?**
- Asthma
- Bronchiectasis
- Lung cancer
- In acute exacerbations:
  - Pneumothorax
  - Pneumonia
  - Pulmonary oedema
  - Large pleural effusion
  - PE

**How would you manage an acute exacerbation of COPD?**
- ABCDE approach
  - Monitoring, iv access, bloods (consider theophylline level)
  - Early CXR and ABG
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**What would you do to manage COPD if these medical steps fail?**

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- Can use doxapram if NIV not available or inappropriate
  - Stimulant of chemoreceptors. CI in epilepsy.
- Invasive ventilation
  - Careful consideration regarding whether appropriate
  - Close liaison with ITU team