## 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 exacerbations 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, coronvirus, 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
    - $FEV_1$/FVC reduced (i.e. obstructive)
        - $FEV_1$/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}

| | | NICE clinical guideline 12 (2004) | ATS/ERS[a] 2004 | GOLD 2008[b] | NICE clinical guideline 101 (2010) |
|---|---|---|---|---|---|
| Post-bronchodilator $FEV_1/FVC$ | $FEV_1$ % predicted | **Severity of airflow obstruction** | | | |
| | | | Post-bronchodilator | Post-bronchodilator | Post-bronchodilator |
| < 0.7 | ≥ 80% | | Mild | Stage 1 – Mild | Stage 1 – Mild* |
| < 0.7 | 50–79% | Mild | Moderate | Stage 2 – Moderate | Stage 2 – Moderate |
| < 0.7 | 30–49% | Moderate | Severe | Stage 3 – Severe | Stage 3 – Severe |
| < 0.7 | < 30% | Severe | Very severe | Stage 4 – Very severe** | Stage 4 – Very severe** |

* Symptoms should be present to diagnose COPD
** Or $FEV_1$ > 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 Thephylline
    - 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 $CO_2$
        - 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 $FEV_1 \geq 50\%$ - either long acting $\beta_2$ agonist (LABA) or long acting muscarinic antagonist (LAMA) e.g. tiotropium 18mcg od
        - If $FEV_1 \leq 50\%$ - 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 $FEV_1$
- Theophylline
    - Sould 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)

    - Needs to use for at least 15 hours per day for any benefit and greater benefit if used for > 20 hours
    - 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
    - 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
    - Not recommended if PaO2 > 7.3
- Non-invasive ventilation (NIV)
    - 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
    - Bullectomy – consider in patients who are breathless and have a single large bulla on a CT scan and an $FEV_1$ <50% predicted
    - Lung volume reduction surgery – Consider if $FEV_1$ > 20%, $PaCO_2$ < 7.3, predominantly upper lobe emphysema, TLCO > 20% predicted
    - Lung transplantation - Take into consideration age, co-morbidities, $FEV_1$, $PaCO_2$, 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:
    - Starting oral corticosteroid if increased breathlessness interfering with daily activities
    - Starting antibiotics if purulent sputum
    - Adjusting bronchodilator therapy
    - Contacting healthcare professional if no improvement in symptoms
- Pulmonary rehab
    - Multidisciplinary programme that is individually tailored to optimise each patient's physical and social performance
    - 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:
    - Opioids , Benzodiazepines, Tricyclic anti-depressants
    - 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 and acute exacerbation of COPD?**

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

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    - Upper GI surgery or obstruction
- 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