Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease (COPD) is characterised by persisting respiratory symptoms due to airflow obstruction that is not fully reversible. The airflow limitation is usually progressive and is associated with an abnormal inflammatory response of the lungs to noxious particles or gases. The airflow obstruction is due to a combination of airway and parenchymal damage. COPD is now the preferred term for patients with airflow obstruction who were previously diagnosed as having chronic bronchitis or emphysema[1].

Airflow obstruction is defined as a reduced post-bronchodilator FEV1/FVC ratio (where FEV1 is forced expiratory volume in 1 second and FVC is forced vital capacity), such that FEV1/FVC is less than 0.7. If FEV1 is 80% or more of predicted normal, a diagnosis of COPD should only be made in the presence of respiratory symptoms - eg, breathlessness or cough[1].

The respiratory drive is normally largely initiated by PaCO$_2$ but in COPD hypoxia can be a strong driving force, which can therefore be reduced if the hypoxia is corrected.

Aetiology[2]

Abnormalities in the airways or alveoli are caused by exposure to noxious particles or gases. Most commonly this is due to cigarette smoking; however, other toxins and pollutants may be involved including:

- Air pollution (outdoors, but also indoor pollution from cooking and heating using the burning of biomass fuels).
- Tobacco from other types of inhalation such as pipes, cigars and water-based pipes such as the hookah.
- Marijuana smoking.
- Occupational exposure to dusts, fumes and chemicals.

Other possible risk factors include:

- Gender - COPD is more common in women.
- Age - COPD becomes more common with increasing age.
- Developmental problems - lack of maturation due to prematurity or low birth weight.
- Recurrent respiratory infections in childhood.
- Asthma.
- Alpha-1 antitrypsin deficiency.
- Low socio-economic status.

Asthma and COPD may overlap, and this is an entity yet to have a universal definition[3].

Epidemiology[1, 4]

- Globally, COPD is the fourth leading cause of death and expected to be the third by 2020.
- An estimated three million people are affected by COPD in the UK. COPD is underdiagnosed. 60-85% of patients, mainly with mild-to-moderate disease, are thought to remain undiagnosed.
- Most patients are not diagnosed until they are in their fifties. COPD is closely associated with levels of deprivation - rates of COPD are higher in more deprived communities.
- COPD is often associated with comorbidities, particularly cardiovascular disease, metabolic syndrome, lung cancer, osteoporosis, muscle weakness, depression and anxiety.

Diagnosis[1]

A diagnosis of COPD should be considered in patients over the age of 35 who have a risk factor (generally smoking) and who present with exertional breathlessness, chronic cough, regular sputum production, frequent winter ‘bronchitis’ or wheeze.

Smoking: an up-to-date smoking history, including pack years smoked (number of cigarettes smoked per day, divided by 20, multiplied by the number of years smoked) should be documented for everyone with COPD. An assessment of their ‘readiness to change’ should also be made.

Airflow obstruction and the diagnosis of COPD should be confirmed with post-bronchodilator spirometry.
Disease severity and staging[1]

Disability in COPD can be poorly reflected in the FEV1. A more comprehensive assessment also includes:

- Degree of airflow obstruction and disability.
- Frequency of exacerbations.
- Prognostic factors such as breathlessness, carbon monoxide lung transfer factor, health status, exercise capacity, body mass index (BMI), partial pressure of oxygen in arterial blood (PaO2) and presence of cor pulmonale.

Severity by FEV1

Severity of airflow obstruction in terms of FEV1 as a percentage of predicted can be assessed in those with post-bronchodilator FEV1/FVC <0.7. Symptoms should be present to diagnose COPD in people with mild airflow obstruction.

NICE guidelines of 2010 and the 2018 report from GOLD (Global Initiative on Obstructive Lung Disease) recommend the following staging[1, 2]:

- Stage 1 - mild: FEV1 ≥80% of predicted.
- Stage 2 - moderate: FEV1 50-79% of predicted.
- Stage 3 - severe: FEV1 30-49% of predicted.
- Stage 4 - very severe: FEV1 <30% of predicted. (or for NICE, FEV1 less than 50% but with respiratory failure).

Severity by breathlessness

For this the Medical Research Council (MRC) dyspnoea scale is used[1]:

- Grade 1: not troubled by breathlessness except on strenuous exertion.
- Grade 2: short of breath when hurrying on level ground or walking up a slight incline.
- Grade 3: walks slower than contemporaries because of breathlessness, or has to stop for breath when walking at own pace.
- Grade 4: stops for breath after walking about 100 metres or stops after a few minutes of walking on level ground.
- Grade 5: too breathless to leave the house or breathless on dressing or undressing.

Management

Management (including referral and indication for surgery) is covered in the separate articles:

- Management of Stable COPD.
- Acute Exacerbations of COPD.
- Use of Oxygen Therapy in COPD.
- Pulmonary Rehabilitation.

An effective COPD management plan includes prevention (reduction of risk factors, particularly smoking cessation), assessment and monitoring of disease and its progression, pharmacological intervention as symptoms require, and prevention of infection (all patients with COPD should be offered pneumococcal vaccination and an annual influenza vaccination)[1].

Take a multidisciplinary approach. Pulmonary rehabilitation has been proven to be effective in improving symptoms and quality of life[5]. Consider referring people with excessive sputum to a physiotherapist. Consider referring people to social services and occupational therapy if they have difficulties with activities of daily living or disability. Community respiratory teams provide invaluable support and advice. Comorbidities may also need referral and/or primary care team management.

Complications

- Chronic hypoxaemia causes slowly progressive pulmonary hypertension with the development of right ventricular hypertrophy and possible cor pulmonale.
- Pneumothorax.
- Respiratory failure.
- Arrhythmias, including atrial fibrillation.
- Infection.
- Secondary polycythaemia.
- Depression.

Prognosis[1]

The BODE index (BMI, airflow Obstruction, Dyspnoea and Exercise capacity index) should be used to assess the prognosis when the component information is available: measurement of the BODE index includes measurement of BMI, FEV1 as a percentage of predicted, dyspnoea (modified MRC score) and exercise tolerance (six-minute walking distance). The BODE index has been shown in a number of studies to be a better predictor of exacerbations, hospital admissions and mortality than using only FEV1[8].
COPD is progressive and patients deteriorate but the natural history of the disease varies in different people. COPD is the fifth leading cause of death in the UK. More than 90% of COPD-related deaths occur in the over-65 age group. COPD is an important comorbidity in those dying from other smoking-related diseases, especially coronary heart disease and lung cancer.

Five-year survival from diagnosis is 78% in men and 72% in women with clinically mild disease (defined as not requiring continuous drug therapy), but falls to 30% in men and 24% in women with severe disease defined as requiring oxygen or nebulised therapy.

The mean age of death of patients with severe COPD is 74.2 years compared with 77.2 years in patients with mild disease and 78.3 years in individuals who did not have COPD.

In patients who stop being exposed to cigarette smoke and other noxious substances, the disease may continue to progress but the rate of declining lung function may slow.

Repeated exacerbations lead to irreversible decline in lung function and efforts should therefore be made to reduce exacerbations. Patients who have frequent exacerbations have a more rapid decline in lung function, poorer quality of life, and greater mortality.[7]

Increased rates of hospital admissions for exacerbations are associated with increasing risk of death.[8]

Comorbidity is common and has a significant adverse impact on prognosis.[2]

**Prevention**

- Smoking cessation and restriction of other potential risk factors - eg, occupational dusts and chemicals.
- Reduce the risk of exacerbations - eg, influenza and pneumococcal immunisation.
- Some individuals may find it helpful to access an air pollution forecast to avoid exacerbations - in the UK this can be done via the GOV.UK Dept for Environment, Food and Rural Affairs (DEFRA) website for the daily air quality index in their area.

**Further reading & references**

1. Chronic obstructive pulmonary disease; NICE Clinical Guideline (June 2010)
2. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease; Global Initiative for Obstructive Lung Disease (GOLD) 2015
3. Asthma, COPD and Asthma - COPD Overlap Syndrome (ACOS); Global Initiative for Asthma (GINA) and Global Initiative for Chronic Obstructive Lung Disease (GOLD), 2015

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