Medical Services

COPD

Version 2 Final

Document control

Version history

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Changes since last version

Introduction

Definition

Chronic Obstructive Pulmonary Disease (COPD) is a chronic, progressive disorder characterised by airflow limitation.

It may be accompanied by airway hyper-reactivity, and may be partly reversible (i.e. have an additional asthmatic element).

The GOLD (Global Initiative for Chronic Obstructive Lung Disease) definition is:

A disease state characterised by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal response of the lungs to noxious particles or gases. [1]

Although the previous definition *chronic bronchitis and emphysema* no longer forms part of this definition of the disease state, these conditions are still associated with COPD.
Indeed most patients with COPD, who by definition have airflow obstruction, have features of chronic bronchitis and emphysema. [2]

COPD is disabling because of the reduced exercise tolerance resulting from impaired exchange of oxygen and carbon dioxide between the atmosphere and the pulmonary circulation.

Due to the evolution of the definition of COPD and historical diagnostic labels some people who fulfil the criteria may report themselves as having:

- Chronic obstructive airways disease
- Chronic airflow limitation
- Chronic bronchitis
- Emphysema
- Chronic asthma

Description

Aetiology

The development of COPD is associated with the inhalation of atmospheric pollutants.

The condition usually results from an inflammatory response to noxious particles and gases, causing irreversible increased airflow resistance in the smaller airways. [1]

The main cause is cigarette smoking. However, not all smokers develop COPD and some non-smokers develop the disease.

Additional aetiological factors include environmental exposure and genetic susceptibility.
The inherited deficiency of anti-protease enzyme alpha1-antitrypsin is associated with development of COPD. The affected gene has been identified and a number of variants described. 95% of people with severe deficiency have a greatly increased risk of emphysema especially in smokers. [2]

There is evidence that dusty occupations and air pollution lead to COPD. Occupational exposure to coal dust, grain, and various airborne chemicals is associated with COPD. [3]

Prevalence

COPD is one of the greatest causes of death in the world, ranking fourth in the year 2000 global mortality table. [1]
In the UK it is currently ranked sixth. [4]

COPD is an important cause of morbidity and mortality in the United Kingdom (30,000 + deaths per annum). There are an estimated 3 million people in the U.K. suffering from the disease (of whom 900,000 are diagnosed and 2.1 million undiagnosed) and GP consultation rates for COPD are up to four times that for Ischaemic Heart Disease. [5]

The prevalence of COPD is closely linked to the prevalence of smoking. The habit of cigarette smoking is becoming generally less common in wealthy countries and more common in developing countries.

Even within a single country prevalence and mortality from COPD reflect differences in smoking habits. They are generally higher in the North and West of England than in the South and East.

Over recent decades there has been a relative increase in smoking in women compared to men.

The smoking rate among UK secondary schoolgirls continues to rise, and in some age groups the figure is higher than that for boys.

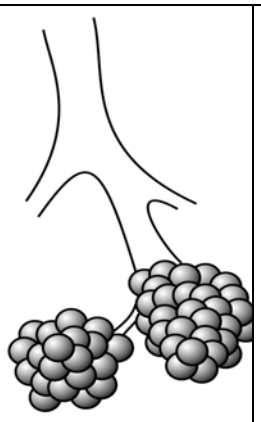
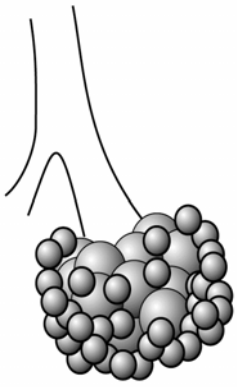
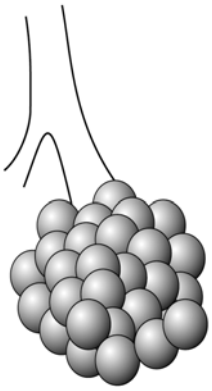
Diagnosis

History

The airflow limitation causes a history of gradually progressive breathlessness, which may be associated with wheeze, although this may not become apparent until the later stages of the disease.
The irreversible component of COPD is associated with loss of lung tissue elasticity, causing bronchioles to "collapse". The resultant "air trapping" causes hyperinflation which increases the effort of breathing.

Chronic bronchitis is associated with COPD and is defined by a history of symptoms of productive cough on most days for at least three months of two successive years (having excluded other causes of chronic productive cough). In COPD coughing is usually associated with the production of small quantities of mucoid sputum.

Emphysema is defined histopathologically as the dilatation of the terminal airspaces of the lung distal to the terminal bronchiole with destruction of their walls, without obvious fibrosis. Consequently, there are no aspects of the history referable to emphysema.

		
Stenotic bronchiole in chronic bronchitis	**Centri-acinar alveolar dilatation in emphysema**	**Panacinar dilatation in emphysema**

The presentation may therefore be of:

1. Cough and sputum.
2. Progressive breathlessness affecting activities of daily living.
3. A combination of the two.

Observation

Informal observation of the patient's activities gives a good indication of the stage of the disease and of its disabling effects.

Early stages of the disease will show little evidence of exercise intolerance, but as the disease progresses, gasping tachypnoea, mouth breathing, and the use of accessory muscles of respiration are induced at lower and lower levels of effort progressing from walking uphill and climbing stairs, to walking on the flat, and then to dressing and undressing.

When the condition has progressed even further these clinical signs will be observable at rest.

A sub-group of individuals do not have good ventilatory drive and tend to become drowsy and cyanosed with right ventricular failure (RVF) and peripheral oedema in the later stages of the disease, (formerly known as "blue bloaters"). The terms "blue bloater" and "pink puffer" are now rarely used and have little relevance to diagnosis or the assessment of disability.

Examination

There may be no abnormalities in the early stages of the disease. Abnormal clinical findings will become apparent in the later stages.

Respiratory Features.
The clinical features primarily affect the respiratory system.

Inspection: The chest may be "barrel shaped" with increased AP diameter and held in the position of near full inflation. The shoulders are held in a "shrugged" attitude.

Measurement of expansion: Reduced expansion may be detected with a tape measure. The normal change in chest circumference between full inspiration and full expiration is approximately 5 cms in the average male.

Percussion: Resonance may be increased and drum-like as the chest is continually hyper-inflated .

Auscultation: Breath sounds may be quieter than normal due to reduced airflow and the expiration phase is prolonged. There may be added wheezy sounds (high pitched expiratory rhonchi)

Abdominal palpation: The overexpansion of the lungs may make the liver appear larger by downward displacement.

Cardiovascular Features.
Central cyanosis from polycythaemia and hypoxia may be present. Progressive lung damage results in pulmonary hypertension. This may progress to signs of right ventricular failure with raised jugular venous pressure (J.V.P.), peripheral oedema, right parasternal pulsation from a hypertrophied right ventricle, increased splitting of the 2nd. heart sound and true hepatomegaly (cor pulmonale).

Systemic Features.
With severe COPD many patients show evidence of poor nutrition, muscle wasting and weight loss, though this may be masked by the development of peripheral oedema.

Special tests

The gold standard for diagnosis is by spirometry with reversibility testing (British Thoracic Society and GOLD). [1] [6]
Similarly the NICE guidelines for COPD (February 2004) recommend that all health care professionals managing patients with COPD should have access to spirometry and be competent in the interpretation of the results.

CXR	Chest X-ray findings correlate poorly with physiological findings. CXR can be useful to exclude other causes of dyspneoa.
CT	High-resolution computerised tomography can demonstrate the parenchymal lung destruction of emphysema. (This investigation is rarely performed).
FEV_1	This is measured by spirometry – and is the Forced Expiratory Volume in the first second of expiration. It is the single best diagnostic test in patients with airflow limitation. FEV_1 measured/FEV_1 predicted shows some correlation with effort intolerance.[6]
FVC	This measures the Forced Expiratory Vital Capacity in the first 4 seconds of expiration. The ratio FEV/FVC remains normal in restrictive lung disease but is less than 75% in diffuse airflow obstruction. The FEV/FVC ratio is the single best indicator of airflow limitation.
PEF	Peak expiratory flow rate (also known as PFR) measured with a standard peak flow meter. PEF (measured) /PEF (predicted) correlates fairly well with effort intolerance but not as well as FEV_1. PEF underestimates the degree of airway resistance.[7]
D_{CO}	The diffusing capacity of carbon monoxide is a special test providing information on gas transfer from the alveoli to the pulmonary circulation. Emphysema causes a reduction in the transfer factor and coefficient (↓KCO).
P_{aO2}	Arterial oxygenation is reduced in severe disease
$VO_{2\ max}$	The maximum rate of oxygen uptake on exercise testing on a treadmill or bicycle ergometer is the best measure of effort tolerance.[8]
MET	This is a measure of energy expenditure as a multiple of resting energy expenditure. For example a 70kg man while sitting may expend 1.2 kcal/min, when walking at 4 kph he expends 3.6 kcal/min – i.e. 3 METs.

Table of diagnostic features and terms

Term	Definition	Diagnostic criteria
Chronic Bronchitis	Cough and sputum for 3 months in 2 successive years	History of symptoms
Airways obstruction	Diffuse peripheral airway narrowing with increased resistance to airflow	↓ FEV_1 ↓PEF
Asthma	Reversible airways obstruction with airway inflammation and hyper-responsiveness	Bronchodilator and steroid response
Emphysema	Dilatation of the terminal airspaces with destruction of alveoli	Histopathology CT scan ↓K_{CO}
Respiratory failure	Failure to maintain arterial oxygen and CO_2 tensions	↓ P_aO_2 ↑PCO_2
Cor pulmonale	Chronic lung disease causing pulmonary hypertension and leading to right heart hypertrophy.	Oedema ↑JVP ECG Echocardiography
Effort tolerance	Maximum energy expenditure	Measured in METs VO_2 max

Diagnostic criteria for COPD (under GOLD or NICE guidelines) is post bronchodilator FEV_1 <80% of predicted FEV_1 **and** FEV_1/FVC <70% of predicted FEV_1/100%FVC.

However, it has to be acknowledged that these definitions of levels of abnormality have not been supported by the American Thoracic Society (ATS) nor the European Respiratory Society. [18] [19]

Differential Diagnoses

Other causes of breathlessness and productive cough should be excluded.

The most important differential diagnosis to make is between Asthma and COPD.

The differentiating features are in the history and in the investigations.

Clinical features differentiating COPD and asthma

FEATURE	COPD	Asthma
Smoker or ex-smoker	Nearly all	Possibly
Symptoms under age 35	Rare	Common
Chronic productive cough	Common	Uncommon
Breathlessness Persistent and progressive	Common	Variable
Night time waking with breathlessness and/or wheeze	Uncommon	Common
Significant diurnal or day to day variability of symptoms	Uncommon	Common
Day to day variation in PEF	Minimal	Usual
Response to bronchodilators	Poor	Good

The table in Appendix A gives other, less common, differential diagnoses.

Treatment

The first line of treatment is to advise patients to stop smoking. They should also be advised to avoid occupational dusts and chemicals, and indoor and outdoor atmospheric pollutants. [9]

Smoking cessation is the single most effective intervention to reduce the risk of further development of COPD.

The table below indicates which interventions are likely to be beneficial and are currently recommended, and so may be expected to be reported, in different conditions

Drug Interventions

Treatment	Effect
Inhaled anticholinergics	improved exacerbation rate, symptoms, and FEV_1
Inhaled anticholinergics plus $beta_2$ agonists	Improved FEV_1 compared with either drug alone
Inhaled corticosteroids plus long acting $beta_2$ agonists	improved exacerbation rate, symptoms, quality of life, FEV_1 Discontinue if no benefit after 4 weeks
Antibiotics	Possibly overprescribed but indicated if there is purulent sputum and an increase in respiratory symptoms with systemic upset.
Long term domiciliary oxygen	beneficial in people with severe hypoxaemia provided the $_pCO_2$ does not rise unacceptably

Non – drug Interventions

Psychosocial plus pharmacological interventions for smoking cessation	
Pulmonary rehabilitation	
General physical activity	
Inspiratory muscle training	
Peripheral muscle training	

Pulmonary Rehabilitation

Definition

A multidisciplinary programme of care for patients with chronic respiratory impairment that is individually tailored and designed to optimise each patient's physical and social performance and autonomy.

COPD patients with breathlessness often avoid exercise and become unfit and de-motivated. They become anxious, depressed and socially isolated. Pulmonary rehabilitation (PR) addresses all these issues.

The general indication is any patient who considers him or herself to be functionally disabled by COPD (usually modified MRC dyspnoea scale 2 or greater [Appx. B]) irrespective of lung function.
It is not suitable for patients unable to exercise.

Those who lack motivation need encouragement.

Pulmonary rehabilitation is effective in improving:
- quality of life
- exercise capacity
- dyspnoea

There is some evidence of reduced bed days and healthcare consumption. There is strong evidence that it is cost-effective.
Despite its proven benefits, it is estimated that it is only available to a minority of suitable patients.

The components of Pulmonary rehabilitation are:

Exercise

- Individually tailored and increased during the programme
- Involves supervised exercises preferably twice weekly, although once weekly can be effective
- upper- and lower-limb exercises
- usually in a group with an exercise regime to be followed at home

Education - main topics include:

- Relaxation
- Breathing control
- Pathophysiology
- Drug treatment
- Self-management
- Benefits, social services

Setting

In the past PR was mainly hospital based, but increasingly it is performed in the community. This has advantages for patients in terms of access, but it is important that location and the
programme are risk-assessed. Most programmes comprise 2 or 3 sessions per week and last for 6 – 12 weeks.

Assessment

It is important that formal assessment of health status and exercise capacity is measured before and after pulmonary rehabilitation.
Widely used are:

- The Incremental Shuttle Walking Test [10]
- "Guyatt's" Chronic Respiratory Questionnaire (CRQ) [11]
- St. Georges Respiratory Questionnaire (SGRQ) [12]
- Clinical COPD Questionnaire (CCQ) [13]

Other useful questionnaires include

- London Chest Activity of Daily Living Scale (LCADL)
- Hospital anxiety Depression Score (HAD) [14]
- Lung Information Needs Questionnaire (LINQ). [Appx. B]

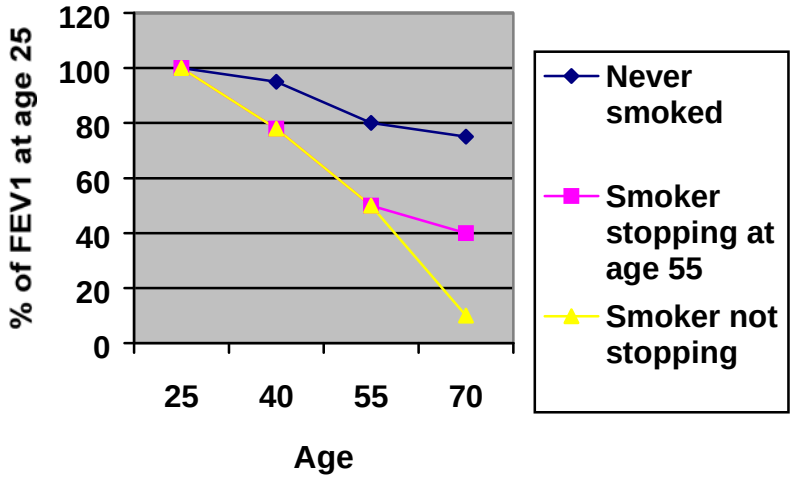
Follow-up

It is important to offer a means of continuing the exercise programme.
Some have regular follow-up sessions, some refer to exercise on prescription Schemes, and some to the local patient support group, e.g. Breathe Easy. [5]

Prognosis

The prognosis is profoundly influenced by smoking habit. Continuation of smoking in COPD leads to a continuous steady decline in lung function.

With the cessation of smoking the decline in lung function reverts to its normal gradient within a relatively short time.



Graph of decline of lung function with age and smoking with COPD.

Pulmonary rehabilitation can lead to significantly improved effort tolerance in COPD patients, even though lung function tests are not improved. [15] [16]

Severely dyspnoeic patients benefit less from rehabilitation than moderately dyspnoeic patients. [17]

Main Disabling Effects

The primary disablement from COPD is due to reduced exercise tolerance.

Initially there is minimal disablement, which may only be apparent when running.

As the disease progresses there is limitation in walking quickly and climbing flights of stairs.

This progresses to limitation in walking at a normal pace and in climbing a flight of stairs.

Later the effort of mild exertion limits activities, such as dressing and undressing,

washing, rising from sitting and walking even a few steps.

Eventually even minimal effort is not tolerated and there will be breathlessness at rest.

The gold standard for diagnosis of COPD is by spirometry. The diagnosis requires a post-bronchodilator FEV_1 of less than 80% of the predicted value accompanied by an FEV_1 / FVC ratio of less than 70%.
However, functional activity limitation (disability) does not directly correlate with FEV_1 measured/FEV_1 predicted (impairment) due to other factors such as body mass index, general level of fitness, and psychological factors.

Cardiopulmonary exercise testing is a better guide of disability although this is rarely performed except in experimental work. [8]

Clinical examination findings do not correlate well with functional ability and the assessment of claimants is best made from the evidence of:

1. The History of Activities of Daily Living (Typical Day) taking variation into account.
2. Informal Observation of the client's activities at examination.
3. Medication taken and attendance at Chest Clinic.

Some scales of pulmonary disability assessment are detailed in Appendix B.

Appendix A - Differential Diagnoses

Breathlessness due to respiratory centre stimulation by hypoxia or excess CO_2

Common causes	***Uncommon causes***
Pulmonary oedema	Acidosis
Pulmonary embolus	Pregnancy
Pneumothorax	Cyanotic congenital heart disease
Pneumonia	High altitude
Lobar collapse	Arteriovenous fistula
Pulmonary fibrosis	
Anaemia	

Breathlessness associated with an increased work of breathing (Obstructive ventilatory defects)

Commoner causes	***Uncommon causes***
Asthma	Upper airways obstruction
Bronchiectasis	Byssinosis
Cystic fibrosis	

Other Common causes	***Other Uncommon causes***
Sarcoidosis	Large tumours
Fibrosing alveolitis	Large hiatus hernia
Extrinsic allergic alveolitis	Lymphangitis carcinomatosa
Pneumoconioses	Connective tissue diseases
Large pleural effusion	Aspiration pneumonitis
Extensive lung resection	Infections
Chest wall deformity. Scoliosis etc.	
Pulmonary oedema	
Left ventricular dysfunction	

Conditions associated with decreased neuromuscular power (these are all relatively uncommon)

More common causes	***Uncommon causes***
Myasthenia gravis	Poliomyelitis
Polyneuritis	Motor neurone disease
	Muscular dystrophies

Appendix B - Some scales used in assessment for other purposes

Scales used as guidance for assessment of pulmonary dysfunction in IISB.
Table A

Symptoms and signs	Lung Function Impairment (Severity Category)
Not breathless on exercise	Nil
Breathless on prolonged or heavy exertion	Mild
Breathless on walking uphill or climbing stairs or hurrying on level ground	Mild
Breathless at normal pace for age on level ground	Mild
Breathless on walking 100 metres or climbing one flight of stairs at a normal pace	Moderate
Breathless on walking 100 metres at a slow pace or climbing one flight of stairs without stopping	Moderate
Breathlessness prevents walking 100 metres at a slow pace without stopping or climbing one flight of stairs without stopping	Moderate
Breathlessness prevents activity outside the home without assistance or supervision	Severe
Breathlessness limits activities to within the home	Severe
Able to walk only a few steps because of breathlessness	Severe
Bed and chair bound, totally dependent on carers because of breathlessness	Total

Table B

FEV_1 as a percentage of the predicted value (use post-bronchodilator value if available)	Lung Function Impairment (Severity Category)
>80	Nil
60-80	Mild
40-59	Moderate
<40 *	Severe
<40 *	Total

- **Note that there is no exact correlation between FEV_1 value at any level and functional disability.** [8]

Medical Research Council dyspnoea scale for grading the degree of a patient's breathlessness

1. Not troubled by breathlessness except on strenuous exercise
2. Short of breath when hurrying or walking up a slight hill
3. Walks slower than contemporaries on the level because of breathlessness, or has to stop for breath when walking at own pace
4. Stops for breath after about 100 m or after a few minutes on the level
5. Too breathless to leave the house, or breathless when dressing or undressing

MRC: 22 April 2006

Note that this scale (used by thoracic surgeons and others) measures reported breathlessness as a response to standard questions. It is, again, a subjective assessment.

Lung Information Needs Questionnaire (LINQ)

LINQ is a self-complete questionnaire that has measures the information needs of patients with chronic obstructive pulmonary disease (COPD). LINQ can also be used for patients with some other chronic lung diseases. **It is not suitable for patients with asthma.**
It has been found particularly use to be used before and after pulmonary rehabilitation to assess effectiveness

LINQ
Lung Information Needs Questionnaire

LINQ

1 Do you know the name of your lung disease?

YES ☐

NO ☐

2 Has a health professional (e.g., doctor, nurse, physiotherapist) told you how this disease affects your lungs?

YES ☐

NO ☐

3 Has a health professional (e.g., doctor, nurse, physiotherapist) told you what is likely to happen in the future?

YES ☐

NO ☐

4 Which of the following statements best describes what will happen to you over the next few years? **TICK ONE ONLY**

I will get worse ☐

Now that my disease is being treated, I will probably stay the same ☐

Now that my disease is being treated, I will probably get better ☐

I have no idea ☐

LINQ
Lung Information Needs Questionnaire

5 Has a health professional (e.g., doctor, nurse, physiotherapist) explained the **reason** for taking your inhalers or medicines?

YES ☐

NO ☐

6 Do you ***try*** to take your inhalers or medicines ***exactly*** as you have been instructed by a health professional (e.g., doctor, nurse, physiotherapist)?

YES ☐

NO ☐

7 Are you satisfied with the information health professionals have given you about your inhalers or medicines? **TICK ONE ONLY**

I understand everything I need to know ☐

I understand what I have been told but I would like to know more ☐

I am slightly confused about my medicines ☐

I am very confused about my medicines ☐

8 What sentence best describes what you have been told to do if your breathing gets worse (e.g., take two puffs instead of one)? **TICK ONE ONLY**

I have been told what to do and the doctor/nurse has given me written instructions ☐

I have been told but it is not written on paper ☐

I haven't been told but I know what to do ☐

I haven't been told and I don't know what to do ☐

LINQ
Lung Information Needs Questionnaire

9 Have you been told when you should call an **ambulance** if your breathing worsens? **TICK ONE ONLY**

- I have been told what to do and the doctor/nurse has given me written instructions ☐
- I have been told but it isn't written on paper ☐
- I haven't been told but I know what to do ☐
- I haven't been told and I am uncertain when an ambulance should be called ☐

10 What best describes you? **TICK ONE ONLY**

- Never smoked (go to question 13) ☐
- Used to smoke but don't now (go to question 13) ☐
- Still smoking (go to question 11) ☐

11 Has a health professional (e.g., doctor, nurse, physiotherapist) advised you to give up smoking?

- YES ☐
- NO ☐

12 Has a health professional (e.g., doctor, nurse, physiotherapist) offered to help you to give up smoking (e.g., given you nicotine gum or patches or referral to a Smoking Cessation clinic)?

- YES ☐
- NO ☐

LINQ
Lung Information Needs Questionnaire

13 Have you been told by a health professional (e.g., doctor, nurse, physiotherapist) to try to do some physical activity (e.g., walking, brisk walking and other forms of exercise)?

YES ☐

NO ☐

14 Has a health professional (e.g., doctor, nurse, physiotherapist) told you ***how much*** physical activity (e.g., walking, brisk walking and other forms of exercise) you should do?

Yes and I know what to do ☐

Yes but I am unsure what to do ☐

Yes but I am unable to do it ☐

No ☐

15 How much physical activity do you do?

I push myself as much as I can ☐

I make an effort ☐

As little as possible ☐

16 What have health professional (e.g., doctor, nurse, physiotherapist) told you about your diet or eating?
(please tick ***all*** that apply)

Eat several small meals per day
"(e.g., 6 small meals per day instead of 3 large ones)" ☐

Lose or gain weight ☐

Eat healthy food ☐

Nothing ☐

LINQ
Lung Information Needs Questionnaire

17 Have you any questions or comments about your lung disease?
If so, write them in the space below.

18 Sex (tick one) Male ☐
Female ☐

19 In which year were you born? 19 _ _

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