Natural History of COPD

Clinical course of COPD

The progressive nature of chronic obstructive pulmonary disease (COPD) is so fundamental that it is included in the definition adopted in the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines. According to GOLD, COPD is a disease state ‘characterized by airflow limitation that is not fully reversible. The airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases’.1

The characteristic symptoms of COPD are chronic and progressive cough, increased sputum production and dyspnoea (breathlessness) on exertion.2 Dyspnoea leads to reduced activity, deconditioning of the muscles and further inactivity.1 As the symptoms worsen, the patient’s quality of life (QoL) and functional health will also deteriorate: patients may feel increasingly isolated as they may become unable to carry out everyday activities. This can result in patients suffering from anxiety and depression. Exacerbations (the acute onset of sustained worsening of symptoms requiring additional medical attention), become more likely as the disease progresses.3

Chronic cough and sputum production precede the development of airflow limitation by many years. This pattern offers a unique window of opportunity to identify smokers and others at risk of COPD, and intervene when the disease is not yet a major health problem. The progression of COPD has historically been assessed using changes in airflow obstruction, especially FEV1.

Natural history of COPD: Fletcher & Peto Curve 1977

Concepts relating to the natural history of chronic obstructive pulmonary disease (COPD) arise most importantly from the classic study of Fletcher, Peto and colleagues which remains the landmark reference for the natural history of COPD.4 They performed an eight-year prospective study of working men in London and developed the much reproduced diagram, frequently termed the “Fletcher-Peto curve” (Figure 1). This schematic diagram continues to form the basis for understanding the progression of this disorder.

Figure 1 illustrates the relationship between long-term cigarette smoking, decline in lung function (FEV1) and life expectancy, and suggests slower decline in lung function during the earlier stages of the disease.4 However, not all patients will follow the same clinical course outlined in the Fletcher-Peto curve, and clinical factors other than airflow limitation that are relevant to COPD natural history (e.g. cough, dyspnoea and QoL measures) remain undefined within the curve.

Natural history of COPD: current evidence

Recent studies have suggested that FEV1 decline may in fact be greater during earlier rather than later stages of disease.5–7 This is reflected in the more recently published modified curve (Figure 2),8 which includes data from the Framingham study (healthy non-smokers aged 3-80 years followed for 26 years with standardised spirometry)10 and various large trials where there was a faster decline in GOLD stage I-II than stage III-IV groups (susceptible smokers).5–7 The implication of this new data is that early detection is critical to preserve lung function by interventions such as smoking cessation. Earlier detection allows treatment of symptoms by pharmacological interventions and improving outcomes with pulmonary rehabilitation.

Figure 2. Modified Fletcher-Peto curve redrawn by Jones & Østrem to incorporate findings of recent advances in the natural history of COPD including FEV1 decline data from the UPLIFT study demonstrating greater annual rate of FEV1 decline during early stages of disease (Adapted with permission of the editors, Primary Care Respiratory Journal)8
Clinical implications of early lung decline in COPD

Patients with early lung decline may be missed as most COPD patients remain undiagnosed or are diagnosed in a late stage of the disease, even though they are smokers or have a smoking history (Table 1). Under-diagnosis or misdiagnosis of COPD can mean that patients remain untreated, or that they receive inappropriate or suboptimal treatment, leading to poor outcomes.\(^\text{10,11}\)

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Potential solutions</th>
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<tr>
<td><strong>Underdiagnosis</strong></td>
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<tr>
<td>Physician lack of symptom awareness and risk factors for COPD</td>
<td>Consider screening for COPD (spirometry) in at risk patients</td>
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<tr>
<td>Perception that COPD is self inflicted</td>
<td>Increase education of physicians</td>
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<tr>
<td>Underuse of spirometry as diagnostic tool</td>
<td>Increase availability and training in spirometry use</td>
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<tr>
<td>Patients lack of symptom awareness and risk factors</td>
<td>Consider asking questions about symptoms and general QoL</td>
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<tr>
<td>Smokers perception of cough as ‘normal’</td>
<td>Encourage documentation of smoking status and consider spirometry screening</td>
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<tr>
<td>Inaccurate use of spirometry</td>
<td>Increase staff training on spirometry use</td>
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<tr>
<td>Confusion between COPD and asthma</td>
<td>Consider differences in presentation and symptoms between COPD and asthma and perform spirometry</td>
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<tr>
<th>Severity of airflow obstruction</th>
<th>FEV(_1) (% predicted)*</th>
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<tbody>
<tr>
<td>Mild</td>
<td>≥80%**</td>
</tr>
<tr>
<td>Moderate</td>
<td>50% – 79%</td>
</tr>
<tr>
<td>Severe</td>
<td>30% – 49%</td>
</tr>
<tr>
<td>Very severe</td>
<td>&lt;30% (or &lt;50% + respiratory failure)</td>
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* Where FEV\(_1\)/FVC <0.7
** If FEV\(_1\) ≥80% predicted, then the patient must be symptomatic

For those patients who are at risk and who have potentially early disease, the International Primary Care Respiratory Group (IPCRG) also recommends that people over 35 years old should be evaluated for their risk of developing or having COPD by taking a history or using validated screening questionnaires such as the IPCRG COPD risk evaluation questionnaire. Those who screen positive should then be further assessed by: \(^\text{12,13}\)

- Performing ‘case-identification’ spirometry to exclude those with normal FEV\(_1\) and so identify those who require more complete investigation for COPD. Those testing positive should then undergo clinical review and diagnostic standard spirometry
- Alternatively going directly to diagnostic spirometry to patients who have symptoms and risk factors, or a positive screening questionnaire, or whose screening FEV\(_1\) is outwith normal limits.

### Treatment

Current guidelines are in broad agreement that COPD treatment should follow a stepwise approach, depending on disease severity (Figure 3). \(^\text{1,2}\) However, active risk reduction (smoking cessation and influenza vaccination) should also be part of the overall treatment plan.

In early stages of COPD life style changes of smoking cessation and physical activity may affect outcome. Very often patients do not get this information until their disease is advanced and the best opportunities to help are lost. Pulmonary rehabilitation is usually reserved for people with MRC dyspnoea scale three or above, but may also be effective in people with less degrees of impairment.

Achieving earlier diagnosis in practice

NICE suggests that in order to identify early disease, post bronchodilator spirometry should be performed in patients who are over 35, current or ex-smokers, and have a chronic cough. \(^\text{3}\) The next step is to conduct a detailed assessment of symptoms through direct questioning and physical examination, with diagnosis being confirmed by spirometric measurements of airflow limitation (primarily FEV\(_1\) and FVC) (see TMT: ‘Diagnosis of COPD’ and ‘Is it COPD or something else?’) Traditionally the severity of disease has been equated with the degree of airflow limitation (see Table 2 below) but NICE recommends that there should be a multidimensional assessment of severity (using tools such as the BODE index (Body Mass Index, Obstruction (FEV\(_1\) % predicted), Dyspnoea (MRC score), Exercise (as measured by six-minute walking test) and the DOSE (Dyspnoea [MRC score], Obstruction [FEV % predicted; Smoking status, Exacerbation frequency] score. \(^\text{2}\)

<table>
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<th>Table 2. Severity of airflow obstruction (Reproduced with permission from National Clinical Guideline Centre 2010)</th>
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Summary
In conclusion, it is important for all healthcare professionals to aim to identify early-stage COPD patients and to initiate smoking cessation before too much damage is done. Earlier identification allows people with symptoms and exacerbations to receive drug treatment to relieve their distress and life style changes which can keep them healthier.

References
12. IPCRG Opinion Sheet No 5. Early diagnosis of COPD does help! Date: 17th November 2009

Related Ten Minute Tutorials
A basic guide to diagnosing COPD
COPD or something else?
Spirometry and lung function
Early diagnosis: Case finding or screening?
Managing the COPD patient

What you need to know
Symptoms of COPD such as chronic cough and sputum production precede the development of airflow limitation by many years

Patients with early lung decline may remain undiagnosed (and therefore untreated) leading to poor outcomes

Early identification of COPD can result in better long term outcomes as the decline in lung function is faster in early stages, thus late diagnosis means there is less to gain by smoking cessation.

Case identification can be used to identify patients at risk and/or those with early disease.

It is important to advocate lifestyle changes (such as smoking cessation and physical activity) in patients with early disease. Depending on assessment of symptoms and exacerbations, long-acting bronchodilator and inhaled steroids therapy should be used.

Think about...
• Are you aware of the implications of early decline in lung function?
• How would you identify those patients at risk of early stage disease?
• What lifestyle changes would you recommend?