



FIGURE 314-3 Hypothetical tracking curves of forced expiratory volume in 1 s (FEV_1) for individuals throughout their life spans.

The normal pattern of growth and decline with age is shown by curve A. Significantly reduced FEV_1 (<65% of predicted value at age 20) can develop from a normal rate of decline after a reduced pulmonary function growth phase (curve C), early initiation of pulmonary function decline after normal growth (curve B), or accelerated decline after normal growth (curve D). (From B Rijcken: Doctoral dissertation, p 133, University of Groningen, 1991; with permission.)

growth during childhood and adolescence, followed by a gradual decline with aging. Individuals appear to track in their quantile of pulmonary function based on environmental and genetic factors that put them on different tracks. The risk of eventual mortality from COPD is closely associated with reduced levels of FEV_1 . A graphic depiction of the natural history of COPD is shown as a function of the influences on tracking curves of FEV_1 in Fig. 314-3. Death or disability from COPD can result from a normal rate of decline after a reduced growth phase (curve C), an early initiation of pulmonary function decline after normal growth (curve B), or an accelerated decline after normal growth (curve D). The rate of decline in pulmonary function can be modified by changing environmental exposures (i.e., quitting smoking), with smoking cessation at an earlier age providing a more beneficial effect than smoking cessation after marked reductions in pulmonary function have already developed. Genetic factors likely contribute to the level of pulmonary function achieved during growth and to the rate of decline in response to smoking and potentially to other environmental factors as well.

CLINICAL PRESENTATION

HISTORY

The three most common symptoms in COPD are cough, sputum production, and exertional dyspnea. Many patients have such symptoms for months or years before seeking medical attention. Although the development of airflow obstruction is a gradual process, many patients date the onset of their disease to an acute illness or exacerbation. A careful history, however, usually reveals the presence of symptoms prior to the acute exacerbation. The development of exertional dyspnea, often described as increased effort to breathe, heaviness, air hunger, or gasping, can be insidious. It is best elicited by a careful history focused on typical physical activities and how the patient's ability to perform them has changed. Activities involving significant arm work, particularly at or above shoulder level, are particularly difficult for patients with COPD. Conversely, activities that allow the patient to brace the arms and use accessory muscles of respiration are better tolerated. Examples of such activities include pushing a shopping cart or walking on a treadmill. As COPD advances, the principal feature is worsening dyspnea on exertion with increasing intrusion on the ability to perform vocational or avocational activities. In the most advanced stages, patients are breathless doing simple activities of daily living.

Accompanying worsening airflow obstruction is an increased frequency of exacerbations (described below). Patients may also develop resting hypoxemia and require institution of supplemental oxygen.

PHYSICAL FINDINGS

In the early stages of COPD, patients usually have an entirely normal physical examination. Current smokers may have signs of active smoking, including an odor of smoke or nicotine staining of fingernails. In patients with more severe disease, the physical examination is notable for a prolonged expiratory phase and may include expiratory wheezing. In addition, signs of hyperinflation include a barrel chest and enlarged lung volumes with poor diaphragmatic excursion as assessed by percussion. Patients with severe airflow obstruction may also exhibit use of accessory muscles of respiration, sitting in the characteristic "tripod" position to facilitate the actions of the sternocleidomastoid, scalene, and intercostal muscles. Patients may develop cyanosis, visible in the lips and nail beds.

Although traditional teaching is that patients with predominant emphysema, termed "pink puffers," are thin and noncyanotic at rest and have prominent use of accessory muscles, and patients with chronic bronchitis are more likely to be heavy and cyanotic ("blue bloaters"), current evidence demonstrates that most patients have elements of both bronchitis and emphysema and that the physical examination does not reliably differentiate the two entities.

Advanced disease may be accompanied by cachexia, with significant weight loss, bitemporal wasting, and diffuse loss of subcutaneous adipose tissue. This syndrome has been associated with both inadequate oral intake and elevated levels of inflammatory cytokines (TNF- α). Such wasting is an independent poor prognostic factor in COPD. Some patients with advanced disease have paradoxical inward movement of the rib cage with inspiration (Hoover's sign), the result of alteration of the vector of diaphragmatic contraction on the rib cage as a result of chronic hyperinflation.

Signs of overt right heart failure, termed *cor pulmonale*, are relatively infrequent since the advent of supplemental oxygen therapy.

Clubbing of the digits is not a sign of COPD, and its presence should alert the clinician to initiate an investigation for causes of clubbing. In this population, the development of lung cancer is the most likely explanation for newly developed clubbing.

LABORATORY FINDINGS

The hallmark of COPD is airflow obstruction (discussed above). Pulmonary function testing shows airflow obstruction with a reduction in FEV_1 and FEV_1/FVC (Chap. 306e). With worsening disease severity, lung volumes may increase, resulting in an increase in total lung capacity, functional residual capacity, and residual volume. In patients with emphysema, the diffusing capacity may be reduced, reflecting the lung parenchymal destruction characteristic of the disease. The degree of airflow obstruction is an important prognostic factor in COPD and is the basis for the Global Initiative for Lung Disease (GOLD) severity classification (Table 314-1). More recently it has been shown that a multifactorial index incorporating airflow obstruction, exercise performance, dyspnea, and body mass index is a better predictor of mortality rate than pulmonary function alone. In 2011, the GOLD added an additional classification system incorporating symptoms and exacerbation history; the utility of this system remains to be defined.

Arterial blood gases and oximetry may demonstrate resting or exertional hypoxemia. Arterial blood gases provide additional information

TABLE 314-1 GOLD CRITERIA FOR SEVERITY OF AIRFLOW OBSTRUCTION IN COPD

GOLD Stage	Severity	Spirometry
I	Mild	$FEV_1/FVC < 0.7$ and $FEV_1 \geq 80\%$ predicted
II	Moderate	$FEV_1/FVC < 0.7$ and $FEV_1 \geq 50\%$ but $< 80\%$ predicted
III	Severe	$FEV_1/FVC < 0.7$ and $FEV_1 \geq 30\%$ but $< 50\%$ predicted
IV	Very severe	$FEV_1/FVC < 0.7$ and $FEV_1 < 30\%$ predicted

Abbreviations: COPD, chronic obstructive pulmonary disease; GOLD, Global Initiative for Lung Disease.

Source: From the Global Strategy for Diagnosis, Management and Prevention of COPD 2014, © Global Initiative for Chronic Obstructive Lung Disease (GOLD), all rights reserved. Available from <http://www.goldcopd.org>.