COPD: Clinical Significance of Early Diagnosis

RICHARD D. LEFF, PharmD, FCCP

ABSTRACT

OBJECTIVE: To explain the differential diagnosis of chronic obstructive pulmonary disease (COPD) and how COPD can be distinguished in patients who present with complaints of dyspnea, (shortness of breath on exertion), with the goal of improving earlier diagnosis.

SUMMARY: It is important to differentiate COPD from other diagnoses when adult patients present with dyspnea. There are several key diagnostic indicators for COPD, including, most notably, a history of smoking and objective lung-function measurements. COPD remains an underdiagnosed disease, chiefly in its milder and more treatable form. The Global Initiative for Chronic Obstructive Lung Disease (GOLD)-defined standards for COPD management consist of 4 components: (1) assess and monitor disease, (2) reduce risk factors, (3) manage stable COPD through education and nonpharmacologic and pharmacologic means, and (4) manage exacerbations.

CONCLUSION: Updated standards for diagnosis and treatment-targeted pharmacologic agents have provided physicians and health care workers with more specific and targeted treatment modalities for early detection and treatment of this progressive disease. Early detection and more accurate diagnosis are key in improving outcomes and altering the progression of the disease.

KEYWORDS: Chronic obstructive pulmonary disease (COPD); Lung diseases, obstructive; Bronchodilators; Tiotropium; Fluticasone; Salmeterol; Corticosteroid

J Manag Care Pharm. 2005;11(6)(suppl S-a):S8-S11

Chronic obstructive pulmonary disease (COPD), a disease encompassing emphysema and chronic bronchitis, presents with various symptoms. Many of the features of asthma and COPD may be similar in patients, but it is important to differentiate COPD from asthma in adult patients who present with dyspnea (shortness of breath on exertion). The objective of this article is to discuss how COPD is distinguished from asthma. To accomplish this, we will review COPD, its typical presentations, diagnostic tools, and an approach to management.

COPD: A Picture of the Disease

An Underdiagnosed Disease

Over the past 30 years, epidemiological data indicate that COPD in the United States is largely underdiagnosed and misdiagnosed. An estimated 10 million adults in this country reported a physician diagnosis of COPD in 2000, and data from the Third National Health and Nutrition Examination Survey (NHANES III) suggest that nearly 24 million U.S. adults have evidence of some type of impaired lung function. During 2000, COPD was responsible for 8 million physician office and hospital outpatient visits, 1.5 million emergency department visits, 726,000 hospitalizations, and 119,000 deaths. Moreover, the Centers for Disease Control and Prevention conclude that “despite its ease of diagnosis, COPD remains an underdiagnosed disease, chiefly in its milder and more treatable form.”

Definition and Differentiation of COPD

Global Initiative for Chronic Obstructive Lung Disease (GOLD)

In 2001, the National Heart, Lung, and Blood Institute/World Health Organization (NHLBI/WHO) GOLD workshop set forth standards for diagnosing and managing COPD, which characterize the disease as marked by airflow limitation that is not fully reversible. This airflow limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases such as cigarette smoke or environmental pollutants. Characteristic symptoms of COPD are cough, with and without sputum production, and dyspnea on exertion and often at rest. The patient may present with a chronic cough and sputum, which often precedes airflow limitation by many years.

Spectrum and Differentiation of COPD

Asthma symptoms overlap with COPD symptoms in some patients, and patients can present with a mixed disease that combines features of both disorders. However, it is important to understand the similarities and differences between their diagnosis and treatment. The NHLBI/WHO GOLD workshop set forth standards for the differential diagnosis of COPD (Table 1). Because the symptoms of each disorder are sometimes difficult to distinguish, medical history can be very helpful. For example, asthma often presents in childhood and is characterized by reversible airway reactivity with notable triggers and varying daily...
symptoms. Patients with asthma may have a history of allergies, rhinitis, and eczema. Most cases of asthma respond reasonably well to inhaled corticosteroids. COPD patients often have a history of smoking and/or exposure to pollutants. In comparison with patients with asthma, those with COPD have a largely irreversible airflow limitation and may or may not respond to inhaled or oral corticosteroids; they also present with exertional dyspnea.

Pathophysiology of COPD

Micrographic and Radiologic Evidence

Alveolar destruction with emphysema is one of the signs of COPD. Scanning electron microscopic examination of emphysematous lung sections demonstrate characteristic destruction of tissue, loss and collapse of regularly shaped alveoli, and enlarged alveolar ducts. The lungs in these patients lose elasticity and undergo airway collapse. As a result, air remains trapped in the lung, which is a characteristic sign of COPD. A typical X-ray of a patient with COPD (Figure 1), shows hyperinflation and air trapping manifested as an enlarged heart diameter, low and flattened diaphragm (left panel), and increased anterior-posterior diameter and retrosternal space (right panel).

Diagnostic Features of COPD

History

A patient’s history is important in diagnosing COPD. COPD should be considered in any patient with a smoking history, particularly those with at least ≥10 pack-years (number of packs smoked daily multiplied by the number of years smoking) or a history of exposure to other risk factors, such as environmental pollutants. A diagnosis of COPD should also be considered in an adult patient complaining of dyspnea, a persistent or recurring respiratory infection, or chronic cough with or without sputum. Finally, patients with respiratory symptoms beginning in midlife might be suspected of having COPD.

Spirometry

Lung volume measurements are important diagnostic tools in COPD. Comparison of lung volumes in patients with COPD with normal individuals (Figure 2) reveals large decreases in inspirational capacity (IC), the maximum volume of air that can be inhaled from rest, and large increases in the functional residual capacity (FRC), the volume of air in the lungs at resting end-expiration. There is considerable air trapping in COPD. The tidal volume (VT), the volume of air inhaled and exhaled during each breath, is typically low and does not change dramatically in COPD. As a result, patients cannot expel the large amounts of trapped air in their lungs, and their capacity to bring in fresh air is reduced, resulting in bodily oxygen starvation. Expiratory airflow limitation is the notable physiological change characteristic of COPD.

Evidence indicates that history and physical examination are insufficient for diagnosing mild and moderate obstructive ventilatory impairment. Spirometry is the preferred assessment of lung function impairment for diagnosing COPD because it can produce adequate information in a cost-effective manner. The most important spirometric maneuver is the forced vital capacity (FVC), the air volume exhaled during a maximal forced expiration. Normal lungs generally can empty more than 80% of their residual volume in ≤6 seconds. The forced expiratory volume in 1 second (FEV1) is the volume of air exhaled in the first second of the FVC maneuver. The FEV1/FVC ratio is expressed as a percentage (e.g., FEV1 of 0.5 L divided by FVC of 2.0 L gives an FEV1/FVC ratio of 25%). COPD patients experience a progressive decline of these ratios as their disease progresses.

In the GOLD criteria for staging, Stage 0 includes patients who have normal spirometric measures; Stage I includes an FEV1/FVC at < 70% and FEV1 ≥ 80% predicted; Stage II is characterized by 50% ≤ FEV1 < 80% predicted; Stage III is severe COPD characterized by worsening airflow limitation (30% ≤ FEV1 < 50% predicted) and repeated exacerbations; Stage IV includes
patients with severe airflow restriction (FEV1 < 30% predicted).2 These differences are illustrated in Figure 3, showing the spirometry measurement of a normal individual and a patient with COPD.7 COPD is progressive and can be attributed to initial complex biochemical and cellular events in the small airways and surrounding alveoli.8 Structural damage leads to a loss of elastic recoil, the lungs begin to increase in size, and FVC increases. This results in early physiologic alterations that can be readily identified by simple spirometry.

An epidemiological study showed that FEV1 values are associated with a gradual age-related decline over the course of a nonsmoker’s life.9 In susceptible people, smoking causes irreversible obstructive changes and lost pulmonary function. However, at the time of smoking cessation, further FEV1 changes will revert to a more normal, age-related decline. Severe or fatal obstructive lung disease could thus be prevented only by smoking cessation.

Clinical and radiographic signs are not observed until COPD is in a moderate-to-advanced stage. Thus, early diagnosis is critical to prevent worsening disease progression.

**Patient Presentations**

**COPD Stereotypes**

Two stereotypes of patients with severe COPD have been used to define the extremes of the COPD spectrum. The “pink puffer,” which refers to one stricken with emphysema, typically is characterized as an asthenic, barrel-chested patient who exhibits pursed lips breathing with the use of respiratory muscles and has no cyanosis or edema.10 Usually, such a patient uses extrathoracic muscles to breathe, produces minimal sputum, and experiences little fluctuation in the day-to-day level of dyspnea. The barrel-shaped chest is nonspecific because older persons commonly have increased lung compliance and larger resting lung volumes.10 Conversely, the “blue bloater,” one who presents with chronic bronchitis, is typically overweight, cyanotic, edematous, and exhibits a chronic productive cough. Blue bloaters often have cor pulmonale, which rapidly leads to death if not treated appropriately.10 Actually, most patients have features of both stereotypes, and today, the refinement in diagnosis has led to a more accurate and complete picture of the disease. Several aspects of COPD are illustrated in the following case presentations.

**Three Case Studies**

**Case 1: Female Aged 47 Years**

This patient is a saleswoman who presented with a recent increase in morning cough and mild breathlessness when walking up stairs. Her own assessment was, “I might be allergic to something.” When assessing her history, we learn that she has a history of smoking which, along with her exertional dyspnea and morning cough, is strongly suggestive of COPD. Spirometry assessment confirmed that her airflow limitation was not fully reversible: FEV1 was 80% of normal and FEV1/FVC was 65% of normal. These tests and her history indicate Stage I (mild) COPD.
Case 2: Male Aged 53 Years
This middle-aged textile mill worker presented with moderate dyspnea and complained that he could not walk from his parked car to his worksite without experiencing shortness of breath. He also complained of a recent increase in morning cough. History revealed that he has been a smoker much of his life and works in a textile mill. Chronic symptoms beginning in midlife with this gentleman’s history are strongly suggestive of COPD. The patient’s postbronchodilator spirometry readings were: FEV₁ = 60% and FEV₁/FVC = 59%, leading to a diagnosis of Stage II (moderate) COPD.

Case 3: Female Aged 55 Years
This middle-aged professor had a history of smoking one pack a day, but gave up smoking 2 months ago. However, she has continued to cough and produce sputum daily. She complains of being “tired” all the time. She recently caught a cold that rapidly progressed to recurrent bronchitis. The physician noticed wheezing during quiet breathing. A chest X-ray shows hyperinflated but clear lungs, pointing to airflow limitation. Her postbronchodilator spirometry readings were: FEV₁ = 40% and FEV₁/FVC = 50%. The diagnosis was therefore Stage III (severe) COPD.

These 3 case histories illustrate 3 different stages of COPD with subtly different signs, symptoms, and histories.

Risk Factors for Developing COPD
The risk factors must be clearly identified while taking a patient’s history. Cigarette smoking is the most common preventable risk. Approximately 80% to 90% of patients with COPD have a smoking history of at least 10 to 20 pack-years. Occupational and environmental pollutant exposure, in which there is chronic exposure to fumes, chemical substances, and dust in the workplace, are important risk factors. Frequent bacterial or viral infections are also risk factors for COPD. A relatively rare genetic condition, α₁ antitrypsin (AAT) deficiency, is a potential risk factor for pulmonary diseases such as emphysema and COPD in children. Finally, protease enzyme production that may occur in some inflammatory reactions may enhance pulmonary tissue damage and predispose an individual to COPD.

GOLD Management Guidelines
The GOLD-defined standards for COPD management consist of 4 components: (1) assess and monitor disease, (2) reduce risk factors, (3) manage stable COPD, and (4) manage exacerbations. This management plan has several goals to achieve effective outcomes: prevent the progression of the disease, improve exercise tolerance and overall health, prevent and treat complications and exacerbations and relieve symptoms as they occur, and reduce the mortality and morbidity associated with the disease.

Conclusion
COPD is a disorder commonly diagnosed by clinicians. Yet, COPD remains underdiagnosed, largely in its milder and more treatable form. Increasing knowledge of this disease, key diagnostic features, and more familiarity with published standards for its diagnosis and medical management will help to improve its early detection and treatment. COPD should be considered in any patient who has (1) a smoking history of at least 10 to 20 pack-years and/or exposure to other risk factors, (2) chronic cough with or without sputum production, (3) dyspnea, (4) onset of respiratory symptoms after the age of 40, and (5) respiratory infection that persists or recurs. The hallmark diagnostic marker of COPD is expiratory airflow limitation. Patients with COPD experience decreases of FEV₁, FVC, and FEV₁/FVC. Spirometry is the “gold standard” for diagnosis, being reproducible, objective, and standardized.

DISCLOSURES
This article is based on the proceedings of an American College of Clinical Pharmacy symposium held on October 25, 2004, in Dallas, Texas, which was supported by an educational grant from Boehringer Ingelheim Pharmaceuticals, Inc. and Pfizer, Inc. The author received an honorarium from the Postgraduate Institute for Medicine for participation in the symposium upon which this article is based. He discloses that he is on the speaker’s bureau of Boehringer Ingelheim Pharmaceuticals, Inc.

REFERENCES