

Systematic Review of Early Diagnosis and Treatment of Chronic Obstructive Pulmonary Disease (COPD) in Family Practice

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Abstract: Background: COPD has very significant impacts patients through reduced lung function and reduced quality of life (QoL). The reduction in lung function is progressive and leads to exercise intolerance, a consequent reduction in activity as patients avoid the discomfort of breathing difficulties, and continued physical decline
Objective: aim to addresses the issues surrounding the diagnosis and misdiagnosis of COPD, their consequences, and how COPD can be better managed and diagnosed within primary care.

Methodology: We conducted a systematic review study by searching with no date limitations for all relevant articles using PubMed, a bibliographic database providing access to citations for biomedical articles from MEDLINE through July 2016, and life science journals. We used relevant MeSH headings and individual key words and/or phrases were used to search all available search fields: *chronic obstructive pulmonary disease or COPD* in association with the following search terms: *diagnosis, differential diagnosis, diagnostic techniques, family practice, and primary care*. Primary outcome data were extracted from each included paper using a prospectively designed data extraction tool.

Conclusion: The depth of the pessimism about the outcome of COPD treatment was disappointing. Primary care physicians often report cases of patients diagnosed with COPD whom the physician was unable to “help” except with terminal illness planning.

Keywords: Chronic Obstructive Pulmonary Disease (COPD).

1. INTRODUCTION

Chronic obstructive pulmonary disease (COPD), which is characterized by partially reversible airflow obstruction, is primarily caused by exposure to cigarette smoke and other occupational and environmental pollutants;¹ the widely used definitions of COPD are shown in (Table 1)^{2,3,4,5,6}. COPD is characterized by alveolar destruction, loss of alveolar attachments, loss of elastic recoil and increased airway resistance. This leads to limitations in expiratory flow and inadequate lung emptying upon expiration, resulting in lung hyperinflation⁷. Static hyperinflation occurs at rest and dynamic hyperinflation occurs with increased ventilation, such as during exercise⁸. COPD affects more than 200 million people worldwide. It is the third leading cause of mortality in the USA¹⁷, and is predicted to become the third most common cause of death worldwide by 2030¹⁸.

COPD further impacts patients through reduced lung function and reduced quality of life (QoL)^{9,10,11}. The reduction in lung function is progressive and leads to exercise intolerance, a consequent reduction in activity as patients avoid the discomfort of breathing difficulties, and continued physical decline¹². As the disease advances, symptoms worsen, exacerbations increase in frequency and severity, and lung function is further compromised, causing a downward spiral of events until death eventually occurs. The patient’s QoL, rate of decline, frequency of exacerbations, and emergency hospitalizations can all be influenced and improved by lifestyle interventions and pharmacologic treatment^{3,4,13,14,15}.

Unfortunately, lack of awareness and knowledge about COPD are major reasons why primary care practitioners (PCPs) and other health care providers may delay or incorrectly diagnose COPD. Results from a survey of American family

physicians, nurse practitioners (NPs), and physician’s assistants (PAs) (n = 284) indicated that fewer than 50% of this test group reported knowledge or use of COPD diagnosis and treatment guidelines ¹⁶

Table 1: Definitions of chronic obstructive pulmonary disease

Organization	Definition
American Thoracic Society/European Respiratory Society (ATS/ERS) ²	Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease state, characterized by airflow limitation 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, primarily caused by cigarette smoking. Although COPD affects the lungs, it also produces significant systemic consequences.
Canadian Thoracic Society (CTS) ³	Chronic obstructive pulmonary disease (COPD) is a respiratory disorder largely caused by smoking, and is characterized by progressive, partially reversible airway obstruction and lung hyperinflation, systemic manifestations, and increasing frequency and severity of exacerbations.
Global Initiative for Chronic Obstructive Lung Disease (GOLD) ⁴	COPD is a preventable and treatable disease with some significant extrapulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases.
National Institute for Health and Clinical Excellence (NICE) ⁵	COPD is characterized by airflow obstruction. The airflow obstruction is usually progressive, not fully reversible and does not change markedly over several months. The disease is predominantly caused by smoking.
World Health Organization (WHO) ⁶	Chronic obstructive pulmonary disease (COPD) is a lung disease characterized by chronic obstruction of lung airflow that interferes with normal breathing and is not fully reversible.

Objectives:

This review aim to addresses the issues surrounding the diagnosis and misdiagnosis of COPD, their consequences, and how COPD can be better managed and diagnosed within primary care.

2. METHODOLOGY

Study Design:

We developed systematic review study using the Preferred reporting items for systematic reviews (PRISMA) guidelines.

Search Strategy:

We conducted a systematic review study by searching with no date limitations for all relevant articles using PubMed, a bibliographic database providing access to citations for biomedical articles from MEDLINE through July 2016, and life science journals. We used relevant MeSH headings and individual key words and/or phrases were used to search all available search fields: *chronic obstructive pulmonary disease or COPD* in association with the following search terms: *diagnosis, differential diagnosis, diagnostic techniques, family practice, and primary care*. Primary outcome data were extracted from each included paper using a prospectively designed data extraction tool. Publication details (title, contact author, journal name, and country of research), study population (number of COPD participants, demographics, severity of respiratory impairment), and activity outcomes (activity type, duration, and frequency) were extracted verbatim.

Abbreviations:

GOLD, Global Initiative for Chronic Obstructive Lung Disease; COPD, chronic obstructive pulmonary disease; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; CRF, chronic respiratory failure; PFT, pulmonary function test; SAB, short-acting bronchodilator.

3. RESULTS

Despite existing tools to support diagnosis, underdiagnosis and misdiagnosis of COPD continue to be a major problem in general practice,^{37,39} with differential diagnosis between asthma and COPD being a particular challenge^{38,33}. Key areas for improvement include better case identification of patients and improved use of spirometry for diagnosis by trained, evaluated staff using appropriate spirometers^{39,40}. but primary care physicians should also be proactive in asking patients about their symptoms.

Several guidelines have been developed and published related to COPD management. These include combined North American and European guidelines²⁵, as well as the most widely distributed international COPD guidelines: Global Initiative for Chronic Obstructive Lung Disease (GOLD)²⁵. These guidelines are based primarily on the new 2011 version of GOLD but do not alter the basic recommendations for diagnosing COPD.

Firstly COPD must be suspected or included in the differential diagnosis. Symptoms and signs such as chronic/recurrent cough, sputum production, progressive dyspnea or functional decline due to 'breathing' problems or recurrent respiratory infections in individuals with exposure to noxious gases such as tobacco smoke should be considered as possibly due to COPD²⁵. The diagnosis of COPD is based on post-bronchodilator spirometry testing with a forced expiratory volume in 1 second/forced vital capacity (FEV₁/FVC) ratio of less than 0.70 and an FEV₁ less than 80% of predicted for the height, sex and race of the individual. Most people with symptomatic COPD, those who are candidates for therapy other than smoking cessation, usually have a FEV₁ less than 70% of predicted²⁵.

Lung function testing with Spirometry as diagnostic Tool for COPD that could be used by family physicians:

Lung function test (PFT) is indispensable to demonstrate the largely irreversible loss of lung function that is typical for COPD. Primary care spirometry not only increases rates of COPD diagnosis, but also leads to improvements in COPD management^{32,33}. All clinical COPD guidelines consider spirometry to be the standard to establish the presence (or absence) of airways obstruction. When available in primary care, spirometry is a valuable tool in the evaluation of patients with respiratory symptoms, allowing the GP to exclude or diagnose COPD, and to correctly stage its severity³⁴. We identifying several studies from different countries introducing their guidelines of easy fast diagnosis of COPD showed that the Spirometry is essential for the diagnosis of COPD. It can be easily performed in a clinic setting or as part of a formal pulmonary function testing (PFT) in a laboratory. When performed in a clinic setting, care should be taken to use a validated machine. These machines need to be calibrated as per the manufacturer's specification and the procedure should be performed according to the published standards¹⁹. As spirometry is effort related, the best of at least three trials is selected. Airflow limitation in COPD is defined as a post-bronchodilator FEV₁/forced vital capacity (FVC) of less than 70%. In the right clinical context and exposure to risk factors, the presence of airflow limitation is diagnostic of COPD. The use of the FEV₁/forced expiratory volumes in 6 s (FEV₆) ratio of less than 0.7 is promising. However, no consensus has yet been reached about this test **Table.2**²⁰. These measurements can be performed with handheld spirometry as a screening tool. If abnormal, the patient should be referred for formal spirometry to confirm the diagnosis.

When spirometry shows the FEV₁/FVC ratio of less than 70%, it is suggested to check the response to short-acting bronchodilators to assess reversibility using a short-acting b₂-adrenoceptor agonist, such as salbutamol, or an anticholinergic, such as ipratropium bromide^{21,22}. The drugs should be administered as two separate doses (100 mg/dose for salbutamol and 40 mg/dose for ipratropium bromide) using a spacer device. In addition, it is recommended that spirometry be performed 15 min following salbutamol administration or 30 min following ipratropium bromide administration. Reversibility is defined as an FEV₁ improvement from the pre-dose value by at least 12% and an absolute improvement of FEV₁ of more than 200 ml. Although it used to be commonly believed that patients with COPD have largely irreversible airflow obstruction, evidence now suggests that a considerable proportion of patients exhibit clinically significant bronchodilator reversibility. The usefulness of acute reversibility to short-acting bronchodilators in predicting a patient's long-term response to bronchodilator maintenance therapy is unclear. Most studies suggest that a lack of response to short-acting bronchodilators does not preclude a beneficial long-term response to maintenance bronchodilator treatment^{23,24}.

Table.2: Spirometry determined GOLD COPD

stage/asthma state	FEV	FEV ₁ /FVC	FEV	FEV ₁ /FVC
Mild/intermittent	≥80%	<0.70	>80%	Normal
Moderate/mild persistent	50%–79%	<0.70	>80%	Normal
Severe/moderate persistent	30%–49%	<0.70	60%–79%	Reduction ≤5% of normal
Very severe/severe persistent	<30% or <50% with CRF	<0.70	<60%	Reduction >5% of normal
Response to bronchodilators	Variable, PFT does not normalize but may show improvement		Rapid response and PFT may greatly improve eg, FEV ₁ improves >0.4 L after SAB	

Differentiating COPD from asthma:

It is essential to differentiate COPD from asthma to ensure correct treatment choices and optimal patient outcomes;²⁷ this can be facilitated by a good understanding of the differences between COPD and asthma. Both COPD and asthma are associated with inflammation and a reduced rate of pulmonary airflow, but they can be distinguished by their differing causes and inflammatory mechanisms. In COPD, irritants, such as smoke, activate lung epithelial cells to release chemotactic factors, which in turn activate pathways that cause elastin degradation, emphysema, mucus hypersecretion, and small airway fibrosis²⁸. In asthma, triggers cause immunoglobulin activation of mast cells and pathways leading to bronchoconstriction and inflammation²⁸.

COPD and asthma can be differentiated by pre- and postbronchodilator spirometry because airway obstruction is only partially reversible in COPD, while it is fully reversible in asthma^{29,30}. There may also be differences between the symptoms and medical histories of patients with COPD and asthma. Often, patients with COPD are older than 35 years, have a history of smoking, and may suffer from a persistent, worsening, productive cough. In contrast, asthma can occur at any age but often starts in childhood or adolescence and is characterized by an intermittent dry cough and wheezing. The distinctions between COPD and asthma diagnosis and treatment are summarized in **Tables 3**.^{3,4,31}

Table.3: Differential diagnosis of chronic obstructive pulmonary disease and asthma

Diagnostic features	COPD	Asthma
Onset age	Usually >35 years	Typically during childhood/adolescence, but can be any age
Allergic hypersensitivity	Family/Personal history rarely a factor	Usually family/personal history
Smoking history	Often >20 pack-years [*]	Possible but not necessarily
Symptom occurrence	Chronic and persistent	Intermittent; usually symptom free
Cough	Persistent and productive	Intermittent and nonproductive
Breathlessness	Progressive and persistent	Intermittent and variable
Disease course	Progressive worsening (with exacerbations)	Stable (with exacerbations)
Nocturnal symptoms	Uncommon unless severe disease state	Common
Cause of exacerbations	Bacterial/viral respiratory tract infection	Allergens, cold air, or exercise

^{*}**Notes:** Total number of pack-years is calculated = (number of cigarettes smoked per day/20) × number of years smoking (O'Donnell et al, 2008³);

Abbreviations: GOLD, Global Initiative for Chronic Obstructive Lung Disease; COPD, chronic obstructive pulmonary disease; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; CRF, chronic respiratory failure; PFT, pulmonary function test; SAB, short-acting bronchodilator.

Management of COPD in Primary care:

The goals for COPD patient management are to delay the process of disease progression and alleviate its manifestations. A substantial number of clinical guidelines to support (evidence-based) health care for patients with COPD have been published in the past few years³⁴. Some of these guidelines have specifically been developed for use in primary care,^{35,36} others do or do not address the role of primary care in diagnosing and managing COPD. In some cases, Family physicians have been involved in the development of the guideline. Current COPD guidelines generally cover diagnosis and severity classification, non-pharmacologic treatment options (including smoking cessation), avoidance of risk factors, patient education, pharmacological therapy and use of oxygen supplementation, management of acute exacerbations, the role of pulmonary rehabilitation, and monitoring and ongoing care³⁴.

These treatments are effective ways of meeting the goals of COPD management. A beneficial addition to pharmacotherapy is participation by the patient in pulmonary rehabilitation, which is recommended for all patients with COPD^{3,4,14}. A pulmonary rehabilitation program can benefit patients with COPD by providing education and support to change behaviors, such as smoking cessation, improvement in nutrition, and adherence to the prescribed medication regimen.

4. CONCLUSION

The depth of the pessimism about the outcome of COPD treatment was disappointing. Primary care physicians often report cases of patients diagnosed with COPD whom the physician was unable to “help” except with terminal illness planning. Although some pessimism may be appropriate, it was surprising and inconsistent with reported data, that over 84% of health care professionals reported that they felt pharmacotherapy had no effect on COPD symptom reduction or reduction of exacerbations

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