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Dharmesh Sisodiya, Kamlesh Dashora
Institute of Pharmacy, Vikram University, Ujjain (M.P)-456001,India

Poornima Pandey
Mahakal Institute of Pharmaceutical Studies, Ujjain (M.P)-456001,India

R. K. Agrawal
Pharmaceutical Chemistry Lab, Department of Pharmaceutical Sciences, Dr. Hari Singh Gour Vishwavidyalaya, Sagar (M.P.) 470 003 India

Correspondence:
Dharmesh sisodiya
Institute of Pharmacy Vikram University, Ujjain (M.P)-456001,India
E mail : dsresearch@rediffmail.com

A Review on Chronic Obstructive Pulmonary Disease

Dharmesh Sisodiya, Poornima Pandey, Kamlesh Dashora, R. K. Agrawal

ABSTRACT

Chronic obstructive pulmonary is a chronic lung disease caused due to the narrowing and blockage of the airways or alveoli. Chronic obstructive pulmonary disease (COPD) encompasses a group of lung conditions that cause narrowing of the airways, leading to the shortness of breath and difficulty in breathing. It is a progressive disease in which symptoms worsen with time. Chronic bronchitis and emphysema are the most common forms of COPD. In chronic bronchitis, the lining of the airways is thickened as a result of constant irritation, which leads to an excess secretion of mucous. In case of emphysema, the elasticity of mucous lining is reduced, resulting in the obstruction of airflow. Majority of the cases of chronic obstructive pulmonary disease are caused due to long-term smoking. Inhalation of lung irritants such as pollens, air pollutants, dust, smoke and other chemicals may also contribute to developing COPD. The early signs of COPD are chronic cough and coughing up mucous secretions. Other symptoms of COPD may include breathing difficulty, chest tightness or discomfort, wheezing and other respiratory symptoms. A patient with COPD is more susceptible to constant chest infections than a healthy person. COPD is one of the leading causes of illness and death in many countries. END Pulmonary Fibrosis 95% Success Rate, Dissolve Scar Tissue By 60% within 6 Months. Provocholine, Methacholine Chloride Powder Inhalation Diagnostic for Asthma

Keywords: Chronic obstructive pulmonary disease (COPD), Acute exacerbations of COPD (AECOPD) ,Chronic bronchitis emphysema, Asthma and Inflammation.

1. INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a lung disease that makes it difficult to breathe; often seeming like one is short of breath. COPD affects many aspects of a person's health. COPD is a preventable and treatable disease. Its pulmonary component is characterized by airflow limitation and the inability to blow out air hard and fast which is not fully reversible. While cigarette smoking is the number one risk factor in developing COPD, other environmental and genetic risk factors can also play a significant role. Generally, COPD is the result of a complex interaction between environmental exposure such as smoking or breathing in fumes or chemicals, and genetic factors. The interactions between these two risk factors however are not well understood. There is currently no cure for COPD though medications are available to reduce symptoms. Getting treatment for symptoms can slow down the disease process and increase quality of life. Avoiding exposures to risk factors that worsen COPD (such as cigarette smoke) are frequently employed to help manage the disease.

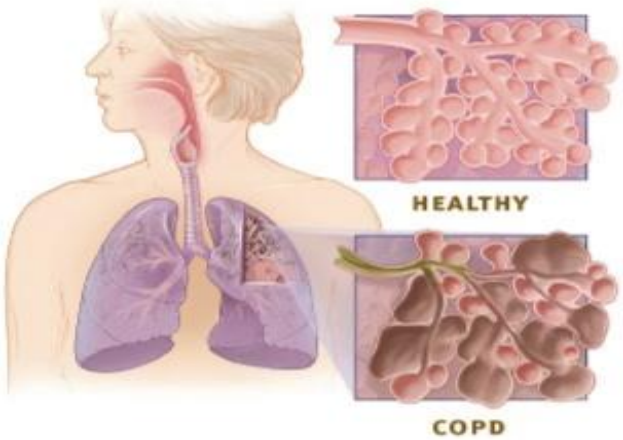
Chronic obstructive pulmonary disease (COPD) has an extensive, adverse effect on both patients and the healthcare system.

- With respect to patients, COPD causes physical impairment, debility, reduced quality of life, and death. It is the fourth-ranked cause of death in the United States, killing more than 120,000 individuals each year.

- With respect to the healthcare system, COPD causes high resource utilization, which includes frequent clinician office visits, frequent hospitalizations due to acute exacerbations and chronic therapy (e.g., long-term oxygen therapy, medication). This is a consequence of the high prevalence and chronicity of COPD

It is important to recognize and diagnose COPD early because appropriate management can prevent and decrease symptoms (especially dyspnea), reduce the frequency and severity of exacerbations, improve health status, improve exercise capacity, and prolong survival. Despite this, COPD is under diagnosed Only 15 to 20 percent of smokers are ever diagnosed with COPD, although the majority develop airflow obstruction Despite the fact that COPD is now prevalent in both developed and developing countries as the result of tobacco epidemic, precise figures on its prevalence is surprisingly scanty in many parts of the world. There is now a consensus that COPD is characterized by airway obstruction with lung function levels of FEV1/FVC < 70% and presence of a post-bronchodilator FEV1<80% of the predicted value that is not fully reversible. However, population-based estimates of COPD prevalence by region has been problematic since the disease is progressive, measurement tools and definitions still vary among studies, and implementation of spirometry is often no t feasible in developing regions.

In such circumstances, the observed incidence and prevalence become highly dependent on factors other than the true occurrence of disease. For example,prevalence based on self-reported symptoms (chronic cough, sputum, etc.) Most likely overestimates true COPD prevalence due to misclassification of other possible respiratory diseases. In fact, it is suggested that only half of patients with symptoms of chronic bronchitis have actual COPD.



Chronic obstructive pulmonary disease (COPD) is a disorder that causes a huge degree of human suffering. Chronic bronchitis is defined clinically as the presence of a chronic productive cough for 3 months during each of 2 consecutive years (other causes of cough being excluded). Emphysema, on the other hand, is defined pathologically as an abnormal, permanent enlargement of the air spaces distal to the terminal bronchioles, accompanied by destruction of their walls and without obvious fibrosis. Airflow limitation in emphysema is due to loss of elastic recoil and decrease in airway tethering, whereas chronic bronchitis leads to narrowing of airway caliber and increase in airway resistance. Although some patients predominantly display signs of one or the other, most fall somewhere in the middle of the spectrum.The past definitions of COPD have been pessimistic at best, suggesting that the disease process is irreversible with little therapy to offer. More recently, however, a more optimistic definition has become widely accepted. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines define COPD as a disease state characterized by airflow limitation that is not fully reversible, is usually progressive, and is associated with an abnormal inflammatory response of the lungs to inhaled noxious particles or gases. This definition shifts the paradigm of the disease, suggesting that it is both treatable and preventable.

2. SYMPTOMS

Cough

Cough may be intermittent (early morning) at the beginning, progressively becoming present throughout the day, but is seldom entirely nocturnal [4]. Chronic cough is usually productive and is very often discounted as it is considered an expected consequence of smoking. Cough syncope or cough rib fractures may occur.

Sputum

Sputum initially occurs in the morning but later will be present all day long. It is usually tenacious and mucoid and in small quantities. Production of sputum for 3 months in 2 consecutive years is the epidemiological definition of chronic bronchitis. A change in sputum colour (purulent) or volume suggests an infectious exacerbation.

Dyspnoea

It is usually progressive and over time it becomes persistent. At the onset it occurs during exercise (climbing up

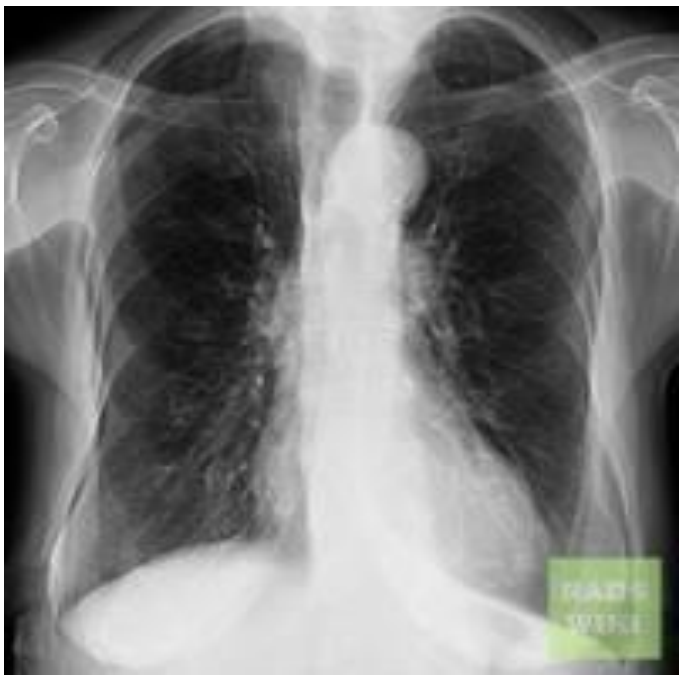
stairs, walking up hills) and may by avoided entirely by appropriate behavioural changes (*e.g.* using an elevator). However, as the disease progresses, dyspnoea is elicited even during minimal exertion or at rest. A quantification of dyspnoea using the Modified Medical Research Council scale (see Definition, diagnosis and staging) is indicated since it predicts quality of life and survival.
COPD can cause a variety of symptoms, including:

- Chronic, persistent cough
- Increased mucus
- Shortness of breath, especially during physical activity
- Wheezing
- A tight feeling in the chest

Usually, people with COPD first notice problems with coughing or phlegm and then breathlessness (shortness of breath) during activities, such as stair-climbing and walking uphill. Symptoms sometimes creep up on people. Without realizing it, people may also cut back or stop doing some activities to prevent problems with breathlessness.

3. RESPIRATORY SIGNS

Inspection: check for barrel chest deformity, pursed-lips breathing, chest/abdominal wall paradoxical movements and use of accessory respiratory muscles. All these are signs of severe airflow limitation, hyperinflation and impairment of the mechanics of breathing.



Percussion: check for decreased motion of the diaphragm and tympanic sounds due to hyperinflation or bullae; in addition the liver becomes easily palpable.

Auscultation: adventitious rhonchi and wheezing may help differentiate COPD from congestive heart failure or pulmonary fibrosis, which are often associated with crackles.

Auscultation of the heart: may show a sign of cor pulmonale, such as split of second sound (pulmonic), murmurs of pulmonary or tricuspid insufficiency.

4. CAUSES OF COPD

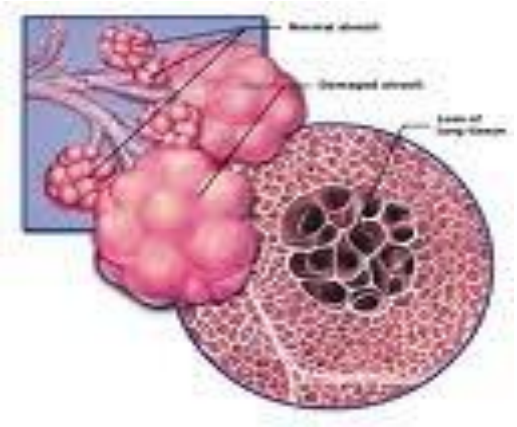
There are several causes of COPD:

- Smoking (and less often other inhalational exposures)
- Genetic factors

Inhalational exposure

Of all inhalational exposures, cigarette smoking is the primary risk factor in most countries, although only about 15% of smokers develop clinically apparent COPD; an exposure history of 40 or more pack-years is especially predictive. Smoke from burning biomass fuels for indoor cooking and heating is an important contributing factor in developing countries. Smokers with preexisting airway reactivity (defined by increased sensitivity to inhaled Methacholine), even in the absence of clinical asthma, are at greater risk of developing COPD than are those without.

Low body weight, childhood respiratory disorders, and exposure to passive cigarette smoke, air pollution, and occupational dust (e.g., mineral dust, cotton dust) or inhaled chemicals (e.g., cadmium) contribute to the risk of COPD but are of minor importance compared with cigarette smoking.



Genetic factors

The best-defined causative genetic disorder is α_1-antitrypsin deficiency), which is an important cause of emphysema in nonsmokers and influences susceptibility to disease in smokers. Polymorphisms in microsomal epoxide hydrolase, vitamin D–binding protein, IL-1β, IL-1 receptor antagonist, phospholipase A_2, matrix metalloproteinase 9, and *ADAM-33* genes are all associated with rapid decline in forced expiratory volume in 1 sec (FEV_1) in selected populations.

5. NATURAL HISTORY

COPD has a variable natural history and not all individuals follow the same course. The often-quoted statistic that only 15-20% of smokers develop clinically significant COPD is misleading and greatly underestimates the toll of COPD. It is increasingly apparent that COPD often has its roots decades before the onset of symptom. Impaired growth of lung function during childhood and adolescence, caused by recurrent infections or tobacco smoking, may lead to lower maximally attained lung function in early adulthood. This abnormal growth will, often combined with a shortened plateau phase in teenage smokers, increase the risk of COPD. The normal course of forced expiratory volume in one second (FEV1) over time is compared with the result of impaired growth of lung function, an accelerated decline and a shortened plateau phase all three abnormalities can be combined.

An accelerated decline in lung function is nevertheless still the single most important feature of COPD. COPD is generally a progressive disease, especially if the patient's exposure to noxious substances, most often tobacco smoking, continues. If exposure is stopped, the disease may still progress, mainly due to the decline in lung function that normally occurs with ageing. Nevertheless, stopping exposure to noxious agents, even after significant airflow limitation is present, can result in some improvement in function and will slow or even hold the progression of the disease.

Acute exacerbations of COPD (AECOPD) are a significant contributor to mortality. For example, in the SUPPORT study of patients with AECOPD admitted to the hospital, of 1016 inpatients admitted with hypercapnic respiratory failure, 89% survived the acute hospitalization, but only 51% were alive at 2 years. Patient characteristics associated with mortality at 6 months included increased severity of illness, lower body mass index, older age, poor prior functional status, lower cur (inspired fraction of oxygen), and lower serum albumin. However, congestive heart failure and cur pulmonale were associated with longer survival time at 6 months, and this was attributed to the effective therapy available for the management of these conditions. The overall severity of illness on the third day of hospitalization, as measured by the Apache III score, was the most important independent predictor of survival at 6 months.

Notably, in another study of patients with AECOPD, the development of hypercapnia during an acute exacerbation of COPD appeared not to affect the risk of death with AECOPD. Specifically, in a prospective study involving 85 patients admitted with acute exacerbation and followed for 5 years, the mortality rate was not significantly different between hypercapnic and eucapnic persons. In contrast, patients with chronic hypercapnia demonstrated a much poorer outcome, with only an 11% 5-year survival rate. Notwithstanding these insights, well-designed studies and controlled trials are necessary to improve our ability to predict the outcomes for patients with this disease.

6. MEDICAL HISTORY OF COPD

The most common cause of chronic obstructive pulmonary disease (COPD) is cigarette smoking, although only about 20% of smokers develop lung disease. Other elements that may lead to the development of COPD are:

- Work-related dusts and chemicals (vapors, irritants, and fumes) and things in the environment, such as coal dust or silica
- Indoor air pollution from fuels used for cooking and heating in poorly ventilated homes
- Second-hand smoke may add to breathing problems and COPD
- Some patients who develop COPD have an inherited disorder called alpha1-antitrypsin deficiency; this disorder can be detected by a blood test. Childhood respiratory infections may be linked with decreased lung function and an increased breathing problem in adulthood Clinical assessment is based on medical history and physical examination. Although a complete examination is indicated for all patients, these two components are specifically important for patients with suspected COPD.

Asthmatic bronchitis, chronic bronchitis, and emphysema develop as a result of one or more of these factors. Cigarette smoking, Family susceptibility, or Inhaling large amounts of dust at work or at home.

7. PATHOPHYSIOLOGY OF COPD

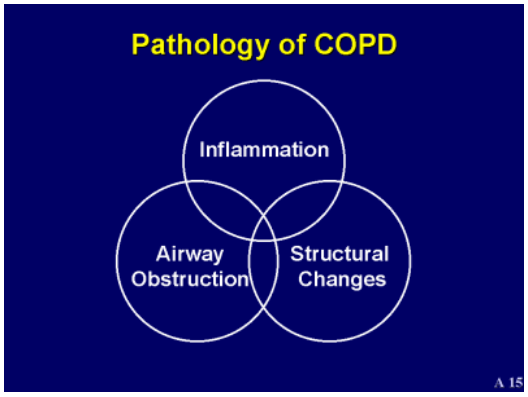
The pathophysiology of COPD is very complex and is not clearly identified as yet. A resistance to the airflow can be attributed to many factors such as mucociliary disorders, inflammatory responses and structural changes. In short, the

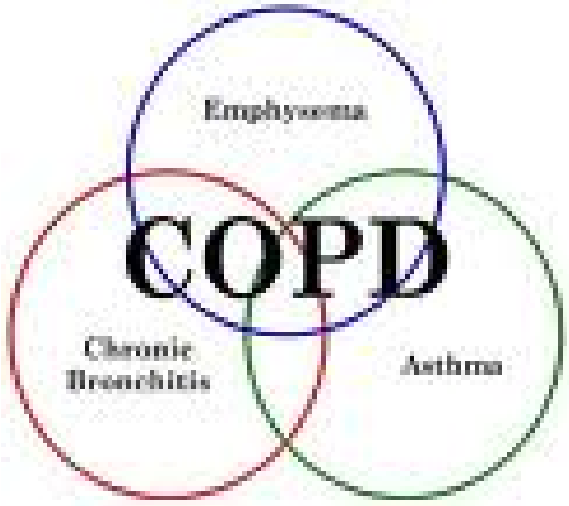
blockage and/or narrowing of the airways may be caused due to loss of elasticity of the airways, damage or inflammation in the walls of the airways, secretion of excess mucous in the airways and decrease in the surface area for the exchange of air. According to medical studies, it is revealed that chronic inflammatory responses of the airways are the major contributing factor to the development of COPD. It is stated that inflammatory responses resulted from COPD and those from asthma are different. COPD associated inflammation induces the production of neutrophils, macrophages and lymphocytes. These cells along with reactive oxygen and proteases enzymes are responsible for causing damage to the airways (alveoli). When smoking, the number of neutrophils is increased than the normal level. Gradually, the airways are thickened, excess smooth muscles and connective tissues are produced by the body, leading to fibrosis in the airways. All these inflammatory responses are caused due to prolonged cigarette smoking and at times, frequent exposure to lung irritants.

The pathophysiology of COPD thus includes the narrowing of the airways, damage to the lungs and other supportive tissues, hyperactivity of the lungs, dysfunction of the cilia in the airways and constant damage of the alveolar walls. As the COPD condition progresses, patients of COPD manifest wheezing, productive cough, difficulty in clearing alveoli and shortness of breath (dyspnea). As the pressure in the chest increases, the patient faces more difficulty during exhaling air, rather than inhalation.

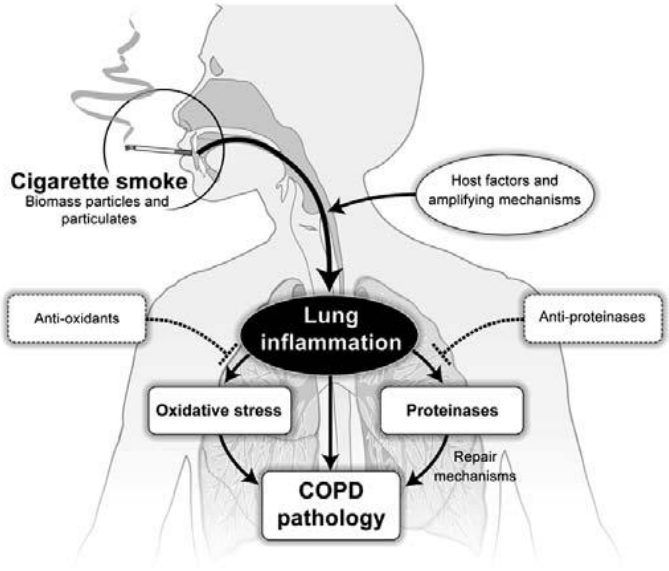
There is no cure for COPD, as damage in the airways cannot be reversed back. However, there are certain treatment options in order to manage the breathlessness symptoms. The effective treatment of COPD is to quit smoking; one can opt for nicotine replacement therapy to cope up the withdrawal symptoms. Other treatment options of COPD include oxygen therapy (if necessary) and medications such as corticosteroids and antibiotics (for chest infection).

Pathology





Chronic obstructive pulmonary disease (COPD) comprises pathological changes in four different compartments of the lungs (central airways, peripheral airways, lung parenchyma, pulmonary vasculature), which are variably present in individuals with the disease.



Pathogenesis

Tobacco smoking is the main risk factor for COPD, although other inhaled noxious particles and gases may contribute. This causes an inflammatory response in the lungs, which is exaggerated in some smokers, and leads to the characteristic pathological lesions of COPD. In addition to inflammation, an imbalance of proteinases and antiproteinases in the lungs and oxidative stress are also important in the pathogenesis of COPD.

Inflammation, proteinase, antiprotease imbalance and oxidative stress are also characterization of COPD.

The different pathogenic mechanisms produce the pathological changes which, in turn, give rise to the physiological abnormalities in COPD: mucous hypersecretion and cilliary dysfunction, airflow limitation and hyperinflation, gas exchange abnormalities, pulmonary hypertension, and systemic effects.

As indicated in the definition of emphysema, the pathologic hallmark is elastic breakdown with resultant loss of alveolar wall integrity. This process is triggered by the exposure of a susceptible person to noxious particles and gases. Cigarette smoke remains the main causative agent, involved in more than 90% of cases. However, other gases and particles have been shown to play a role in pathogenesis, which is a result of an inflammatory process. In contrast to the eosinophilic inflammation seen in asthma, the predominant inflammatory cell is the neutrophils. Macrophages and $CD8^+$ T lymphocytes are increased in the various parts of the lungs, and several mediators, including leukotriene B_4, interleukin 8, and tumor necrosis factor, contribute to the inflammatory process.

Oxidative stress is regarded as another important process in the pathogenesis of COPD, and altered protease-ant protease balance, at least in persons with severe deficiency of α_1-antitrypsin, has been shown to predispose to a panacinar form of emphysema. Persons with severe deficiency of α_1-antitrypsin can develop emphysema at an early age (e.g., by the fourth decade), in contrast to the "usual" emphysema, which typically begins in the sixth decade.

The pathologic hallmark of chronic bronchitis is an increase in goblet cell size and number that leads to excessive mucus secretion. Airflow obstruction and emphysematous change are common but not universal accompaniments. When COPD is complicated by hypoxemia, intimae and vascular smooth muscle thickening can cause pulmonary hypertension, which is a late and poor prognostic development in COPD.

8. CONCLUSION

Overall, COPD poses a common and significant clinical challenge for patients and clinicians alike. Clinicians' expert knowledge regarding diagnosis and management can enhance patients' longevity and quality of life. Results of emerging studies will likely lead to enhancements in current management and new paradigms in managing patients with COPD.

- COPD is emerging as a major cause of morbidity and mortality in the United States. COPD currently is the fourth leading cause of death among Americans.
- COPD is under-recognized overall, as is α_1-antitrypsin deficiency, a genetic predisposition to COPD.

So conclude that the available therapies for COPD, many can improve symptoms (e.g., bronchodilators, pulmonary rehabilitation). Three treatments—smoking cessation, supplemental oxygen used 24 hours a day, and lung volume reduction surgery—have been shown to prolong life in appropriately selected COPD patients COPD is a major health problem across the world and its medical, societal, and economic impacts continue to grow. There are several hypotheses regarding the pathogenesis of COPD, and important new information on airway inflammation, oxidative stress, and proteolysis in the lungs. Yet, there is still much to learn about the mechanisms by which cigarette smoke causes damage to the airways and lung parenchyma and about how these destructive processes can be controlled or stopped.

The differences in susceptibility to COPD among cigarette smokers and the common familial risk of developing disease point to important genetic influences. The identification of candidate gene loci and various gene polymorphisms have improved our understanding of the mechanisms by which genetic factors predispose for COPD.

There is a good understanding of the natural history of COPD, and the beneficial effects of smoking cessation in slowing the decline in lung function and the progression of disease are clearly established. Whether or not other factors, such as mucus hypersecretion, respiratory infections, and airway hyperreactivity, contribute to disease progression independent of cigarette smoking is still being debated. There is new interest in dietary strategies to prevent or control COPD and preliminary information suggesting the usefulness of diets favoring antioxidant-rich foods. On the other hand, several large, long-term, randomized, controlled clinical trials have failed to show a beneficial effect of either anticholinergics or corticosteroids in slowing the rate of decline in lung function in COPD. Corticosteroid treatment, however, appears to reduce the frequency of COPD exacerbations.

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