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A REVIEW ON : CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Abstract

Chronic obstructive pulmonary disease is a growing healthcare problem that is expected to worsen as the population ages and the worldwide use of tobacco products increases. Smoking cessation is the only effective means of prevention. Employers are in a unique position to help employees stop smoking. During the long asymptomatic phase, lung function nevertheless continues to decline; therefore, many patients seek medical attention only when they are at an advanced stage or when they have experienced an acute exacerbation. To help preserve patients' quality of life and reduce healthcare costs related to this chronic disease, clinicians need to accurately diagnose the condition and appropriately manage patients through the long course of their illness. Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality across the globe. According to World Health Organization estimates, 65 million people have moderate to severe COPD. More than 3 million people died of COPD in 2005 corresponding to 5% of all deaths globally and it is estimated to be the third leading cause of death by 2030. Most of the information available on COPD prevalence, morbidity and mortality comes from high-income countries. Even in those

countries, accurate epidemiologic data on COPD are difficult and expensive to collect. However, it is known that low- and middle-income countries already shoulder much of the burden of COPD with almost 90% of COPD deaths taking place in these countries. In this issue of Lung India, the joint ICS/NCCP consensus guidelines for the diagnosis and management of COPD have been published to facilitate the Indian practitioner in burden reduction, diagnosis and management of COPD.

1.INTRODUCTION:

Chronic obstructive pulmonary disease, usually referred to as COPD (Chronic obstructive pulmonary disease), is a group of progressive lung diseases. The most common are emphysema and chronic bronchitis [1]. Many people with COPD have both of these conditions. Emphysema slowly destroys air sacs in the lungs, which interferes with outward air flow while, Bronchitis causes inflammation and narrowing of the bronchial tubes, which allows mucus to build up. Both the condition cause obstruction of air flow in the respiratory system and develops respiratory problems [2]. COPD is a preventable and treatable respiratory disorder largely caused by smoking and long term exposure to chemical irritants. It is characterized by progressive, partially reversible airflow obstruction and lung hyperinflation with significant extra pulmonary (systemic) manifestations and comorbid conditions all of which may contribute to the severity of the disease in individual patients [3]. The co-morbid conditions associated with COPD include ischemic heart disease; osteopenia, osteoporosis and bone fractures; cachexia and malnutrition; normochromic normocytic anemia; skeletal muscle wasting and peripheral muscle dysfunction; diabetes mellitus; sleep disorders; cataracts and glaucoma; lung cancer; and anxiety and depression both of which increase in incidence with disease severity[1]. It is a disease that usually takes a long time to develop. It is estimated that about 30 million people in the United States have COPD. As many as half are unaware that they have it. COPD is the major cause of chronic morbidity and will rank seventh of global burden of diseases in 2030. The estimated prevalence of COPD are 4-20% worldwide in adults over 40 years of age and 6.3% in Asian population [4]. Furthermore, it is the fourth most common causes of hospitalization and most economic burden among chronic diseases in old age patients [5]. Exacerbation of COPD is “an acute event characterized by a worsening of the patient’s respiratory symptoms that is beyond normal day-to-day variations and leads to a change in medication [6]. COPD statistics Globally, it is expected that about 65 million people have moderate to severe COPD. About 12 million adults in the United States have a diagnosis of COPD. It is estimated that million more have the disease, but don’t know it yet. Most people with COPD are 40 years of age or older. The majority of people with COPD are smokers or former smokers. Smoking is the most important risk factor that can be changed. Between 20 and 30% of chronic smokers develop COPD that shows symptoms and signs. Between 10 and 20% of people with COPD have never smoked [7]. An account of up to 5% of people with COPD, found that their cause is a genetic disorder involving a deficiency of a protein called alpha-1-antitrypsin. COPD is more prevalent and cause of hospitalizations in industrialized countries. In the year 2000, it was noted that there were over 700,000 hospital admissions and approximately 1.5 million emergency visited hospital in United States. Among people with lung cancer, between 40 and 70% also have COPD. About 120,000 people die from COPD each year in the United States. It is the third leading cause of death in the United States. It is estimated that the number of patients diagnosed with COPD will increase by more than 150% from 2010 to 2030. Much of that can be attributed to an aging population [8]. It has been also observed that the case of COPD has been also increase in India each year

2.DEFINATION:

COPD comprises a diverse group of clinical syndromes that share the common feature of limitation of expiratory airflow.[10] The American Thoracic Society defines COPD in terms of chronic bronchitis and emphysema.[11] Chronic bronchitis is characterized by the clinical symptoms of excessive cough and sputum production; emphysema refers to chronic dyspnea, resulting from enlarged air spaces and destruction of lung tissue. The GOLD initiative defines COPD as "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."[12] Asthma is also characterized by airflow obstruction and inflammation, but in addition it involves hyperresponsiveness of the airways to stimulus; therefore, the reversibility of functional deficits in asthma differentiates it from COPD[11]

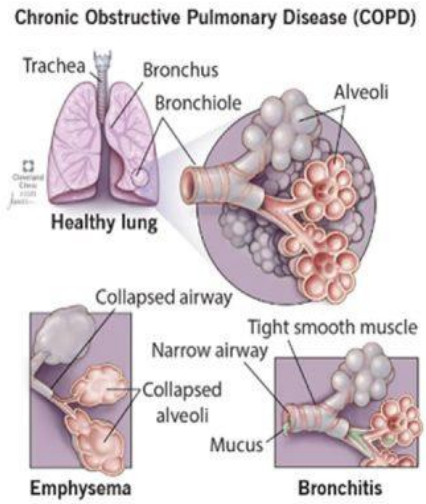

fig.no 1.chronic obstructive pulmonary disease

3.PATHOPHYSIOLOGY:

COPD is an inflammatory condition involving the airways, lung parenchyma, and pulmonary vasculature. The process is thought to involve oxidative stress and protease-antiprotease imbalances. Emphysema describes one of the structural changes seen in COPD where there is destruction of the alveolar air sacs (gas-exchanging surfaces of the lungs) leading to obstructive physiology. In emphysema, an irritant (e.g., smoking) causes an inflammatory response. Neutrophils and macrophages are recruited and release multiple inflammatory mediators. Oxidants and excess proteases leading to the destruction of the air sacs. The protease-mediated destruction of elastin leads to a loss of elastic recoil and results in airway collapse during exhalation. [13][15] Alpha-1 antitrypsin deficiency is a rare cause of emphysema which involves a lack of antiproteases and the imbalance leaves the lung parenchyma at risk for protease-mediated damage. AATD is caused by misfolding of the mutated protein which can accumulate in the liver. AATD should be suspected in COPD patients who present with liver damage. As opposed to smoking-related emphysema, AATD primarily involves the lower lobes. [13]The inflammatory response and obstruction of the airways cause a decrease in the forced expiratory volume (FEV1) and tissue destruction leads to airflow limitation and impaired gas exchange. Hyperinflation of the lungs is often seen on imaging studies and occurs due to air trapping from airway collapse during exhalation. The inability to fully exhale also causes elevations in carbon dioxide (CO_2) levels. As the disease progresses, impairment of gas exchange is often seen. The reduction in ventilation or increase in physiologic dead space leads to CO_2 retention. Pulmonary hypertension may occur due to diffuse vasoconstriction from hypoxemia. [13][15]Acute exacerbations of COPD are common and usually occur due to a trigger (e.g., bacterial or viral pneumonia, environmental irritants). There is an increase in inflammation and air trapping often requiring corticosteroid and bronchodilator treatment. [13][16]

***4**.EPIDEMIOLOGY OF COPD* **:**

In the US, about 24 million people have airflow limitation, of whom about 16 million have a diagnosis of COPD. COPD is a leading cause of death, resulting in more than 150,000 deaths each year in the US (1). Prevalence, incidence, and mortality rates increase with age. Prevalence is higher in women, but total mortality is similar in both sexes. COPD seems to aggregate in families independent of alpha-1 antitrypsin deficiency (alpha-1 antiprotease inhibitor deficiency).COPD is increasing worldwide because of increases in smoking and reduction in mortality due to infectious diseases. In some regions, the widespread use of biomass fuels, such as wood, grasses, or other organic materials, also contributes to COPD prevalence. COPD mortality rates may be higher in medically underserved nations than in nations where medical care is more easily accessed. COPD accounted for 3.23 million deaths globally in 2019 and is the third leading cause of death.The COVID-19 pandemic has posed a particular risk to patients with COPD. The mortality rate for patients with COPD and COVID-19 was 15% versus 4% in those without COPD [18]. Hospitalization rates were twice as great for COPD patients with COVID-19 compared to those without COPD. Overall, however, COVID-19 has been associated with world-wide reduction in COPD hospitalizations [19]. The reasons for this are unclear but are thought to reflect the reduction in exposure to other viral infections as a result of increased respiratory infection precautions [19]. In addition, it is speculated that hospitalizations were reduced during the pandemic because patients with medical emergencies, such as an acute exacerbation of COPD, avoided the emergency department out of fear of contracting COVID-19 [20].

5.CAUSES **:**

COPD develops gradually over time, often resulting from a combination of risk factors
1) Tobacco exposure from active smoking or passive exposure to second-hand smoke; Occupational exposure to dusts, fumes or chemicals

2) Indoor air pollution: biomass fuel (wood, animal dung, crop residue) or coal is frequently used for cooking and heating in low- and middleincome countries with high levels of smoke exposure

3) Early life events such as poor growth in utero, prematurity, and frequent or severe respiratory infections in childhood that prevent maximum lung growth
4) in childhood; and A rare genetic condition called alpha-1 antitrypsin deficiency, which can cause COPD at a young age.
Smoking tobacco causes up to 90% of COPD cases. Other causes include:

- Alpha-1 antitrypsin (AAT) deficiency, a genetic disorder.
- Secondhand smoke.
- Air pollution.
- Workplace dust and fumes.

Smoking-

Tobacco smoke irritates airways, triggering inflammation (irritation and swelling) that narrows the airways. Smoke also damages cilia so they can't do their job of removing mucus and trapped particles from the airways.

AAT deficiency-

AAT (alpha-1 antitrypsin deficiency) is an uncommon, inherited disorder that can lead to emphysema. Alpha-1 antitrypsin is an enzyme that helps protect your lungs from the damaging effects of inflammation. When you have AAT deficiency, you don't produce enough of alpha-1 antitrypsin. Your lungs are more likely to become damaged from exposure to irritating substances like smoke and dust. It's not possible to distinguish COPD related to alpha-1 antitrypsin deficiency from common COPD. Therefore, all people with COPD should get screened for AAT deficiency with a blood test.

Causes of airway obstruction:

Causes of airway obstruction include:

1) Emphysema - This lung disease causes destruction of the fragile walls and elastic fibers of the alveoli. Small airways collapse when you exhale, impairing airflow out of your lungs.

Etiology- Emphysema is caused by chronic and significant exposure to noxious gases, of which cigarette smoking remains the most common cause, and 80% to 90% of patients with COPD are cigarette smokers identified, with 10% to 15% of smokers developing COPD. However, in smokers, the symptoms also depend on the intensity of smoking, years of exposure, and baseline lung function. Symptoms usually begin after at least 20 packs per year of tobacco exposure.[21][22]

Biomass fuels and other environmental pollutants such as sulfur dioxide and particulate matter are recognized as important causes in developing countries affecting women and children greatly. A rare hereditary autosomal recessive disease, alpha one antitrypsin deficiency, can also lead to emphysema and liver abnormalities. However, it only contributes to 1% to 2% of cases of COPD. It is a proven risk factor and can present with pan-acinar bibasilar emphysema early in life.
Other etiological factors are passive smoking, lung infections, and allergies. Moreover, low birth weight as a newborn makes one more prone to develop COPD later in life

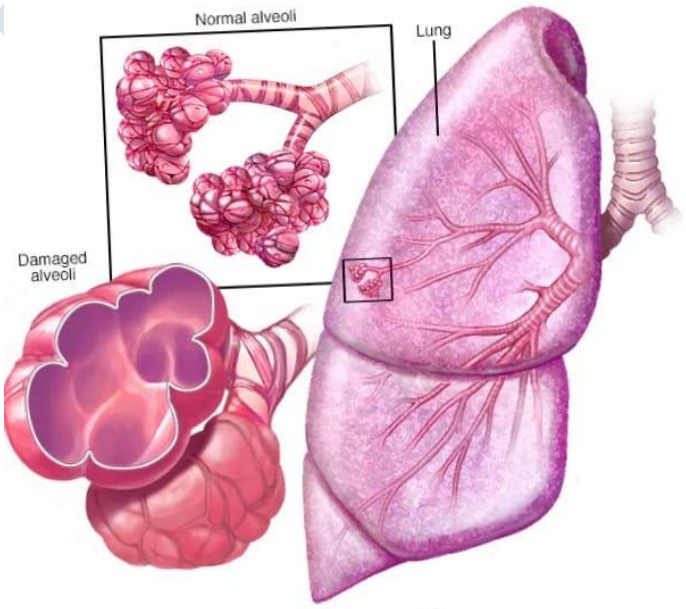

Fig no.2. Emphysema

2) Chronic bronchitis - Chronic bronchitis can be defined as a chronic productive cough lasting more than 3 months and occurring within a span of 2 years. There is a strong causal association with smoking, and it is very often secondary to chronic obstructive pulmonary disease (COPD). [23]

ETIOLOGY: There are many known causes of chronic bronchitis, but the most important causative factor is exposure to cigarette smoke, either due to active smoking or passive inhalation. Many inhaled irritants to the respiratory tract, such as smog, industrial pollutants, and toxic chemicals, can cause chronic bronchitis. Although bacterial and viral infections usually cause acute bronchitis, repeated exposure to infections can cause chronic bronchitis. The predominant viruses that are causative are Influenza types A and B, and the dominant bacterial agents are Staphylococcus, Streptococcus, and Mycoplasma pneumonia. People who have an associated background in respiratory diseases such as asthma, cystic fibrosis, or bronchiectasis have a higher predisposition to develop chronic bronchitis. People who have repeated exposure to environmental pollutants such as dust or airborne chemicals such as ammonia and sulfur dioxide have a higher risk of developing chronic bronchitis. Chronic gastroesophageal reflux is a well-documented but less frequent cause of chronic bronchitis. [23]

EPIDEMILOGY: The occurrence of Chronic bronchitis in the general population has been documented to vary between 3% to 7% of healthy adults. However, it is estimated to be as high as 74% among those diagnosed to have COPD. Many among those in the general population experiencing symptoms of chronic bronchitis may not have a definitive respiratory diagnosis. It has been documented that subjects under the age of 50 years who are otherwise healthy and have chronic bronchitis are at a higher risk of morbidity and mortality when compared to healthy subjects. The increasing prevalence of chronic bronchitis is thought to be associated with increasing age, tobacco smoking, occupational exposure, and socioeconomic status.[24]

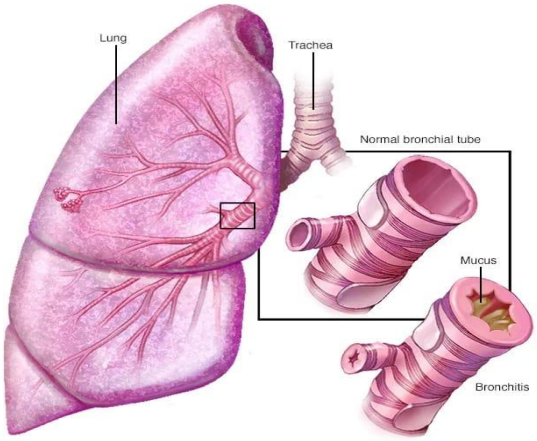

Fig.no.3. Chronic bronchitis

6.PATHOGENESIS:

Cigarette smoking or exposure to noxious agents induces an inflammatory process in the lungs and airways of the bronchial tree that leads to small airway disease and parenchymal destruction[25[26] Loss of elasticity of the alveolar attachments, or their destruction, is a hallmark of emphysema. The inability of the lungs to empty results in air trapping and hyperinflation, manifested as dyspnea on exertion. Over time, this can cause the diaphragm to flatten and the rib cage to enlarge. In the late stages of COPD, hypoxemia develops. Pulmonary hypertension is a consequence of thickening of the intima and vascular smooth muscle and indicates a poor prognosis.The net result of the pathophysiologic processes of COPD is increased resistance to airflow and decreased expiratory flow rate. Removing the inflammatory stimulus (eg, stopping smoking) does not diminish the inflammatory process. The inflammatory process in asthma is markedly different from that in COPD, but since approximately 10% of COPD patients also have asthma, some of the pathologic features may overlap[26]

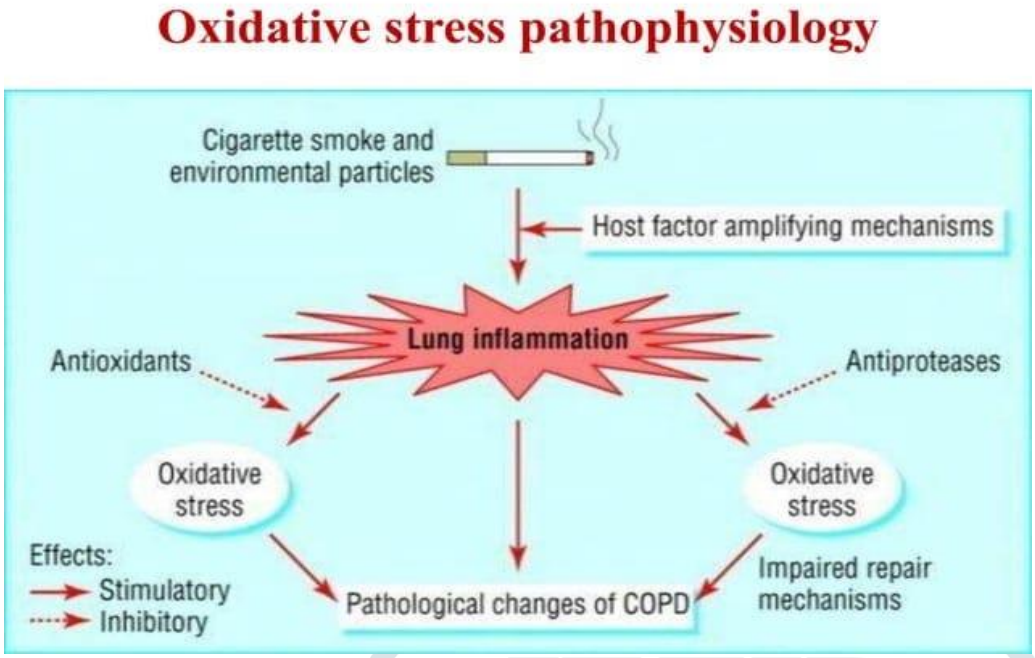

Fig.no.4. Pathophysiology

7.RISK FACTORS FOR COPD INCLUDE:

1) Exposure to tobacco smoke - The most significant risk factor for COPD is long-term cigarette smoking. The more years you smoke and the more packs you smoke, the greater your risk. Pipe smokers, cigar smokers and marijuana smokers also may be at risk, as well as people exposed to large amounts of second hand smoke.

2) People with asthma - Asthma, a chronic inflammatory airway disease, may be a risk factor for developing COPD. The combination of asthma and smoking increases the risk of COPD even more.

3) Exposure to fumes from burning fuel - In the developing world, people exposed to fumes from burning fuel for cooking and heating in poorly ventilated homes are at higher risk of developing COPD

4) Genetics-The uncommon genetic disorder alpha-1-antitrypsin deficiency is the cause of some cases of COPD. Other genetic factors likely make certain smokers more susceptible to the disease].27]

Fig. no.5 Risk factor

8. CONCLUSION

In summary, COPD is a global disease, with increasing prevalence and health-related impact. The loss of FEV1 may be slowing down, but what is really needed is an intervention that improves it in the long-term. It is important to identify patients with the frequent-exacerbation phenotype using clinical predictors such as chronic bronchitis, GERD and history of previous exacerbations. Performing a CT scan should not be done routinely, but can be useful in patients with severe disease. The findings may include bronchiectasis or an enlarged pulmonary artery, both clinically useful in identifying those at risk of recurrent exacerbations. COPD exacerbations are a major cause of mortality and morbidity, and it is important to recognize that they are inflammatory events primarily driven by infections, so antibiotic treatment according to a stratified approach is the right way to go as they are helpful in eradicating the bacteria and reducing the relapse rate. COPD is preventable, something that was always known, but physicians have to change our attitude in treating this disease. Relief of symptoms, reduction of exacerbations and improvement in quality of life should be our primary aim when approaching COPD patients. Out of the pipelines, tremendous ongoing research is being done to obtain new bronchodilators and anti-inflammatory therapies for COPD, with a lot of focus and promise in finding the magic bullet for this chronic and debilitating disease.

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