

Tobacco Smoking and COPD: Agony of 21st Century

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Abstract

According to the World Health Organization (WHO), there are more than one billion smokers in the world, more than 3 million people died of COPD and it ranked as the third-leading cause of death in 2012. If remains unchecked, tobacco-related deaths will increase to more than eight million a year by 2030. Study on the COPD affected patients reveal that it is often associated with a history of cigarette smoking and is characterized by shortness of breath, coughing that produces large amounts of mucous, wheezing, high blood pressure, diabetes mellitus, muscle wasting, osteoporosis, lung cancer, anxiety disorder and depression. Here I have put up an instance of a patient suffering from COPD which gradually became worse over time. I have studied his symptoms, sufferings and medications over long years. Inhaled bronchodilators are used for primary medication and long term antibiotics are sometimes used for reducing the frequency of exacerbations. The only measures that have been shown to reduce mortality are smoking cessation and supplemental oxygen. Lung transplantation is sometimes performed for severe COPD. Prevention of COPD by cessation of tobacco smoking rather than the cure should be a more important aspect that should be dealt with in the present era.

Keywords: Chronic Obstructive Pulmonary disease, tobacco, smoking, shortness of breath

1. Introduction

Tobacco smoking is the practice of burning tobacco and inhaling the smoke released from it consisting of particle and gaseous phases. This practice is believed to be prevalent from as early as 5000 – 3000 BC¹. Tobacco was introduced to Eurasia in the late 17th century where it followed common trade routes. Smoking is the most common method of consuming tobacco and tobacco is the most common substance smoked.

Tobacco is an agricultural product processed from the fresh leaves of plants in the Genus *Nicotiana*. The active substance in tobacco specially cigarettes are administered by burning the leaves and inhaling the resulting vaporized gas. These compounds enter the bloodstream by absorption through the alveoli in the lungs. The inhaled nicotine mimics nicotinic acetylcholine which when bound to nicotinic acetylcholine receptors prevents the reuptake of acetylcholine thereby increasing that neurotransmitter in those areas of the body². The nicotinic acetylcholine receptors are located in the central nervous system and at muscle junction of skeletal muscle, whose activity increases heart rate, alertness and faster reaction times^{3,4}.

Cigarette smoking is the leading cause of preventable death and a major public health concern. Regular use of tobacco leads to various diseases affecting the heart and lungs. Smoking often results in heart attacks, strokes, COPD, emphysema and cancer of lung, larynx, mouth, oesophagus and pancreas.

COPD is a progressive disease that makes it hard to breathe and gets worse over time. Cigarette smoking is the leading cause of COPD. Most people who suffer from COPD shows a long history of smoking. The most common symptoms of COPD are shortness of breath, cough and sputum production which worsens over time with age.

2. COPD – The Disease

Bonnet (1679) first gave a description of “voluminous lungs”⁵. Badham (1814) first used the word catarrh to refer to the chronic cough and mucous hypersecretion that are cardinal symptoms⁶. Laennec (1821), the inventor of stethoscope, first described emphysema component of the disease. He observed that emphysema lungs were hyper inflated and did not empty well⁷. In this era smoking was rare but emphysema may occur in non-smokers, particularly with a familial predisposition or from other environmental provoking factors.

Now in 21st century COPD is known to be a detrimental progressive disease that makes it hard to breathe and gets worse over time. According to World Health Organization (WHO) there are more than one billion smokers in the world and more than 3 million people died of COPD in 2012. It is ranked as the third leading cause of death which is equal to 6% of all deaths globally. Out of this more than 90% of COPD deaths occur in low and middle income countries.

3. COPD – A Case Study

A COPD patient in Kolkata, Late Siddharta Mukherjee (original name not revealed) suffered from the disease for over a period of 30years. He started smoking at the age of 16 years and used to smoke 30-40 cigarettes/day at the age of 25 years. At around the age of 35 years he started showing symptoms of chronic cough and frequent respiratory infections. At the age of around 40 years he started showing shortness of breath while doing everyday activities which included office works. Acute exacerbation occurred at frequent intervals mostly at the time of season change with increased shortness of breath, chest tightness, increased sputum

production, a change in the colour of sputum from clear to yellow and increase in cough. During this exacerbation phase there were signs of increased work of breathing such as fast breathing, a fast heart rate, sweating, active use of muscles in the neck and a combating behavior. These all symptoms were associated with signs of anxiety disorder and depression which ultimately led to a poor quality of life. He had to retire from his job at an early age of 52 years and had to lead a very restricted life. Ultimately he expired at the age of 67 years suffering from acute breathing problems. In COPD, less air flows in and out of the lungs because the airways and air sacs lose their elastic quality, the walls between many of the air sacs are destroyed, the walls of the airways become thick and inflamed and the airways make more mucous than usual which can ultimately clog them. Figure 1 shows the X-ray of Late Siddharta Mukherjee which shows how the lungs are being affected in COPD.



Fig 1: X-ray of Siddharta Mukherjee (Original name changed) showing increased translucency in bilateral lungs suggesting COPD.

4. Treatment of COPD : past, present and future

In the early part of 20th century, the only therapies for COPD were antibiotics for pneumonia. Potassium iodide was used as a mucous thinner and combination product containing ephedrine, a small amount of theophylline and a minor amount of sedative was used to deal with the side effects of ephedrine⁸.

Inhaled isoproterenol began to be used in the early 1960s. The systematic use of bronchoactive drugs i.e. bronchodilators and corticosteroids began to gain popularity in the 1990s. Inhaled bronchodilators are the primary medications used. β_2 agonists and anticholinergics are the two major types of bronchodilators used. They reduce the shortness of breath and exercise limitation resulting in an improved quality of life⁹. Salbutamol and terbutaline are two β_2 agonists used which provide relief of symptoms for four to six hours. Salmeterol and formoterol are long-acting β_2 agonists used for maintenance therapy. Ipratropium and tiotropium are the two main anticholinergics used in COPD but they can cause dry mouth and urinary tract symptoms¹⁰. Corticosteroids are usually used in inhaled

form but may also be used as tablets to treat and prevent acute exacerbations but long term treatment with steroid tablets is associated with significant side effects.

Long term antibiotics reduce the frequency of exacerbations specially in those who have two or more a year but there can be problems of antibiotic resistance and hearing problems^{11,12}. Mucolytics may be useful in those patients who have very thick mucous but cough medicines are generally not recommended.

The importance of smoking cessation also became a feature of treatment in the 1990s. Long term oxygen therapy has also proved to provide relief to COPD patients¹³. Supplemental oxygen is recommended in those with low oxygen levels at rest (oxygen saturation of less than 88%). In this group of people it decreases the risk of heart attack and death if used 15 hours per day. The use of high concentrations of oxygen without taking into consideration a person's oxygen saturations may lead to increased levels of carbon dioxide and worse outcomes.

In case of severe COPD surgery is sometimes helpful and may include lung volume reduction surgery or lung transplantation. Lung volume reduction surgery involves removing the parts of the lung severely damaged and allowing the remaining, relatively good lung to expand and work better. In younger individuals lung transplantation is sometimes performed for very severe COPD but has been established in very few numbers of patients due to the lack of organ availability¹⁴.

The noxious gas in cigarette smoke and environment results in the inflammatory damage of the conducting airways and vascular damage of the alveolar surface of the lung. The inflammation in the airways results in mucous gland hyperplasia and hypersecretion. Immune responsive cells like macrophages and CD8 cells are the prime cellular mediators which include leukotriene B₄, interleukin – 8 and tumour necrosis factor (TNF)¹⁵.

5. Summary

COPD is a partially reversible, progressive airflow obstructive process associated with underlying pulmonary as well as systemic inflammation. At one time, COPD was more common in men, but with time cigarette smoking is now popular among women too. So the disease now equally threatens both men and women. In 2004 only 64 million people were being affected but in 2010, this number was raised to 329 million people. In some countries the mortality has decreased in men but has increased in women¹⁶. According to the report presented by WHO, more than 90% of COPD deaths occur in low and middle income countries where effective strategies for prevention, control and treatment are not always accessible or can be implemented.

In 2010, COPD was estimated to result in economic costs of \$2.1 trillion, half of which occurred in the developing world. Out of this amount, \$1.9 trillion was for medical care while \$0.2 trillion was related to indirect costs such as missed work.

Unfortunately, the research progress in this field has been slow but because of the enormous public health burden imposed by COPD, there is urgent need of research progress. Some new, long-acting agents in COPD are under development¹⁰. Treatment of COPD with stem cells is under study¹⁷.

Recent curtain raising development is that WHO has put up an overall effort to prevent and control non-communicable diseases which includes COPD. Their work aims at raising awareness about the global epidemic of non-communicable diseases, creating more healthy environments, decreasing risk factors of non-communicable disease such as tobacco smoking, unhealthy diet and physical inactivity and preventing premature deaths and avoidable disabilities from these diseases. The WHO Framework Convention on Tobacco Control was developed in response to the globalization of the tobacco epidemic to protect billions of people from harmful exposure to tobacco and it is the first global health treaty, negotiated by WHO that has been ratified by 180 countries. With a controlled use of tobacco and a more healthier environment, it can be expected that occurrence of COPD can also be controlled.

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