"STUDY OF RISK FACTORS FOR EXACERBATIONS AND HOSPITALISATIONS DUE TO CHRONIC OBSTRUCTIVE PULMONARY DISEASE"

By

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IN

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Under the Guidance of

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ABSTRACT

STUDY OF RISK FACTORS FOR EXACERBATIONS AND HOSPITALISATIONS DUE TO CHRONIC OBSTRUCTIVE PULMONARY DISEASE

BACKGROUND AND OBJECTIVES:

Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death world over. COPD has been defined by Global initiative for chronic obstructive pulmonary disease as a disease state characterized by airflow limitation that is not fully reversible. Spirometric tests, (FEV1 less than 80% of the expected value and FEV1/FVC ratio less than 70%) are the diagnostic criteria for COPD.

1. To identify the risk factors for exacerbations and hospitalizations due COPD.
2. To assign an overall risk score to individual patients based on risk factors identified and spirometry to predict future hospital admission

MATERIALS AND METHODS:

In the present study 60 cases were selected on the basis of simple random sampling method from the Medical Wards, Sri R. L. Jalappa Hospital and Research Center, attached to Sri Devaraj Urs Medical College, Kolar. Informed consent from the patient or the relatives will be taken prior to inclusion in the study. Spirometry along with a few questions are directed to the patient. Exacerbation and hospitalization risk score were calculated based on questionnaire directed to the patient and spirometry.

RESULTS: A total number of 60 cases were collected**.** Majority of the patients were in the age group of 61 - 70yrs i.e. 38.3%, followed by 30% between 51 to 60 yrs and 26.7% above 70yrs. In the present study mean age is 66.47±10.36. Majority were males i.e 58(96.7%) and all were smokers and 2(3.3%) were females and were exposed to smoke of fuel. cough with expectoration was present in all the patients. 20% of subjects presented with fever. Cyanosis has been observed in 20 patients.

27(45%)patients were found to have low BMI below 18.5kg/mt^2. 49(81.7%) have percentage of predicted FEV1 less than 50%. 25 (41.7%) patients have an elevated leucocyte count which indicates infection.

CONCLUSION:

. Computerized spirometry is a very useful investigation in the diagnosis of chronic obstructive pulmonary disease. COPD is a disease of late adulthood predominantly seen in males. There was significant positive correlation (p value – 0.038) between Exacerbation score and Total Leucocyte Count and significant negative correlation (p value- 0.035) between Exacerbation score and Lymphocyte count. The main risk factors in predicting the AECOPD hospitalizations are Age, percentage of predicted FEV1, smoking and duration of Smoking, BMI.

LIST OF ABBREVIATIONS

AFB	: Acid-fast Bacilli
AT	: Anti- trypsin
ATS	: American Thoracic Society
BTS	: British Thoracic society
COPD	: Chronic Obstructive Pulmonary Disease
CO2	: Carbon dioxide
DLCO	: Diffusing capacity of the lung for carbon monoxide
DPI	: Dry Powder Inhaler
ECG	: Electrocardiogram
ERS	: European Respiratory Society
ERV	: Expiratory Reserve Volume
FEV1	: Forced Expiratory Volume in first second
FEV1/ FVC	: Ratio of Forced Expiratory Volume in first second to Forced Vital Capacity
FVC	: Forced Vital Capacity
FRC	: Functional Residual capacity
GOLD	: Global Initiative for Chronic Obstructive Lung Disease
HRCT	: High Resolution Computed Tomogram
IC	: Inspiratory Capacity
IL 8	: Interleukin- 8
IRV	: Inspiratory Reserve Volume
Kpa	: Kilo Pascal
LT-B4	: Leukotriene B4
LVRS	: Lung Volume Reduction Surgery

MDI	: Metered Dose Inhaler
MVV	: Minute Volume Ventilation
O2	: Oxygen
Pao2	: Partial pressure of oxygen
Paco2	: Partial pressure of carbon dioxide
PEF	: Peak Expiratory Flow
PI	: Protease Inhibitor
RBBB	: Right Bundle Branch Block
RV	: Residual Volume
RVH	: Right Ventricular Hypertrophy
SA node	: Sino Atrial node
Sao2	: Saturation of arterial oxygen
TLC	: Total Lung Capacity
TNF α	: Tumor Necrosis Factor alpha
Ta Wave	: Atrial repolarisation wave
UK	: United Kingdom
US	: United States of America
VC	: Vital Capacity
VT	: Tidal Volume
WHO	: World Health Organization
AECOPD	: acute exacerbation of chronic obstructive pulmonary disease

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INTRODUCTION

Chronic obstructive pulmonary disease is a common and preventable disease, which has great implications on global health. It is the fourth leading cause of death world over, exceeded only by myocardial infarction, malignancy and stroke.[1]

Chronic obstructive pulmonary disease is usually related to history of tobacco smoking. The free radicals in the tobacco smoke and the free radicals produced by metabolism of other components may be responsible for the tissue damage seen in chronic obstructive pulmonary disease. Since the airway obstruction associated with chronic obstructive pulmonary disease is not amenable to treatment, the best approach to COPD is prevention. [2]

Exacerbations of COPD are morbid and costly events. Exacerbations seriously impair quality of life and may also cause permanent loss of lung function. [3, 4]

Hospitalizations due to COPD exacerbations account for a major portion of the economic costs for this disease. Hence, the prevention of COPD exacerbations is recognized as an important management goal. [5, 6]

REVIEW OF LITERATURE

The history of the term COPD

In European medical history chronic bronchitis and emphysema are known from the early 19th century. The classical description of emphysema was made by Laennec in 1827 [Laennec], and the term bronchitis is known from the beginning of the 19th century and Great Britain [Badham, 1808]. However, not until the fog catastrophe in London in 1952 was there an increased awareness of the concept chronic bronchitis. It was estimated that among those suffering from chronic respiratory and cardiac diseases, over 4000 subjects more than expected died during one week in December. Research performed later in this area suggest that the figures might have been considerably higher than 4000. The London Fog catastrophe provided motivation for the British Medical Research Council (BMRC) to guide and support the research in the field of chronic bronchitis during the following years. There was a confusion concerning the diagnosis of obstructive pulmonary diseases regarding the conditions emphysema and chronic bronchitis, where the former was understood to cause severe airflow obstruction and the latter to represent a clinical diagnosis. Further, there was a geographical difference, the clinical term emphysema in North America was used for the condition labeled chronic bronchitis in Great Britain. .

HISTORICAL ASPECTS

Arteams(260 AD) had given many clinical descriptions of pulmonary disease of which ‘pneumodes’ might be the same as chronic bronchitis emphysema or bronchial asthma leading to cardiac failure.

In 1960, Benjamin Burrow and Richard H. Earle studied 200 patients and found out that mild chronic dyspnea had developed usually at an FEV1 between 1.5 to 2.0 liters, one would expect progression to more disability when FEV1becomes below 1.0 liter in about 10 additional years.

In 1967 to 1990, Margaret J. Thompson, studied spirogram of 143 men who died of COPD and 143 controls, they noticed that low FEV1 and mid expiratory flow rates as were powerful predictors of mortality in COPD.

In 2002, G C Donaldson et al studied Relationship between exacerbation frequency and lung function decline in chronic obstructive pulmonary concluded that the frequency of exacerbations contributes to long term decline in lung function of patients with moderate to severe COPD.

ANATOMY:

The lungs are well protected within the thoracic cage, the bifurcation of trachea corresponds in front with the lower border of the Manubrium sternum that is with the angle of Louis.

Air Passages

While passing through the nasal passages and pharynx, the air is warmed and takes up water vapour. The inspired air passes down the trachea and through the bronchioles, respiratory bronchioles and alveolar ducts to the alveoli.

Between the trachea and the alveolar sacs, the airway divides 23 times. The first 16 generations of passages form the conducting zone of the airways made up of bronchi, bronchioles and terminal bronchioles. The remaining seven generations form the transitional and respiratory zones where gas exchange occur and are made up of

respiratory bronchioles, alveolar ducts and alveoli. These multiple divisions greatly increase the total cross sectional area of the airways, from 2.5 cm^2 in the trachea to 11,800 cm^2 in the alveoli.

The alveoli are surrounded by pulmonary capillaries and in most areas the structures between the air and capillary blood across which O_2 and CO_2 diffuse are exceedingly thin. There are 300 million alveoli in humans, and the total area of the alveolar walls in contact with capillaries in both lungs is about 70 m^2.

The alveoli are lined by two types of epithelial cells. Type 1 cells are flat cells with large cytoplasmic extension and are the primary lining cells. Type II cells (granular pneumocyte) are thicker and contain numerous lamellar inclusion bodies, these cells secrete surfactant. [7]

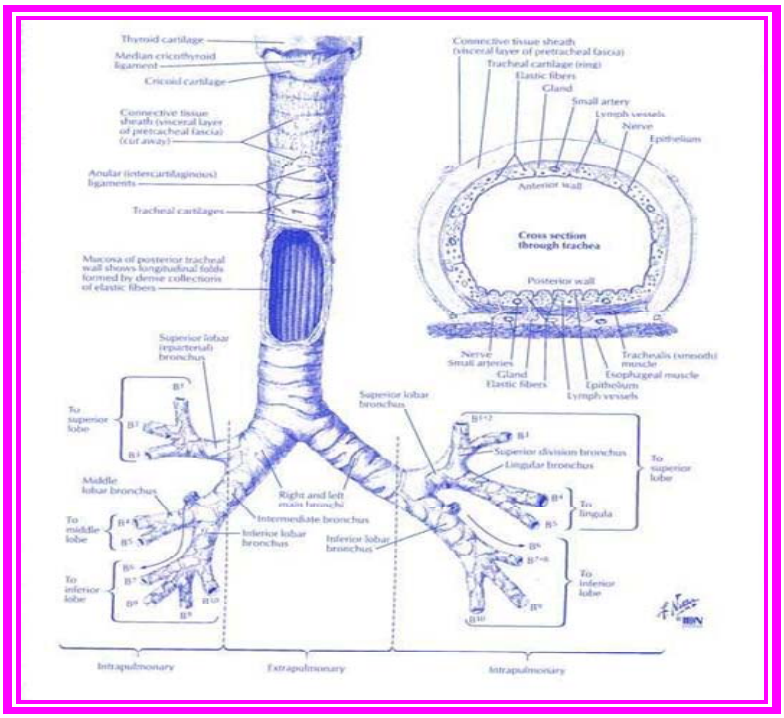


Figure 1: Anatomy of the larynx, trachea, lobar and segmental bronchi (anterior aspect)

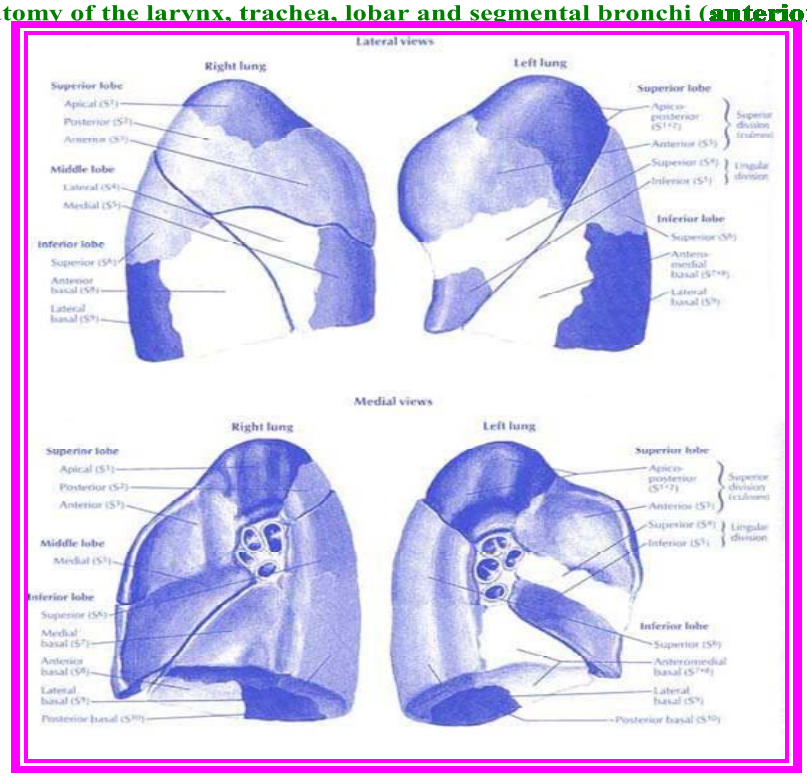


Fig 2: The Bronchi and their Innervations

The trachea and bronchi have cartilage in their walls but relatively little smooth muscle. They are lined by a ciliated epithelium that contains mucus and serous glands. Cilia are present as far as the respiratory bronchioles, but glands are absent from the epithelium of the bronchioles and terminal bronchioles and their walls do not contain cartilage. However, their walls contain more smooth muscle, of which the largest amount relative to the thickness of the wall is present in the terminal bronchioles. The walls of the bronchi and bronchioles are innervated by the autonomic nervous system. There are abundant muscarinic receptors, and cholinergic discharge causes bronchoconstriction. There are β1 and β2 adrenergic receptors in the bronchial epithelium and smooth muscle and in mast cells. Many are not innervated. Some may be located on cholinergic endings and ganglia, where they inhibit acetylcholine release. In humans, the β2 receptors predominate and inhaled or injected β agonists such as isoproterenol cause bronchodilation and decreased bronchial secretion.

Pulmonary Circulation

Almost all the blood in the body passes via the pulmonary artery to the pulmonary capillary bed, where it is oxygenated and returned to the left atrium via the pulmonary veins. The separate and much smaller bronchial arteries come from systemic arteries. They form capillaries, which drain into bronchial vein or anastomose with pulmonary capillaries or veins.

The bronchial veins drain into the azygous vein. The bronchial circulation nourishes the bronchi and pleura. Lymphatic channels are more abundant in the lungs than in any other organ.[8]

PHYSIOLOGY

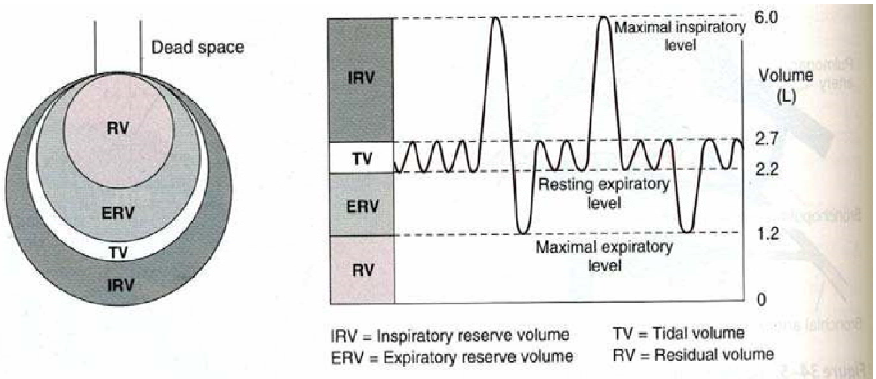
Lung volumes [9]

Tidal volume: The amount of air that moves into the lungs with each inspiration (or the amount that moves out with each expiration) is called the tidal volume.

Inspiratory reserve volume: The air inspired with a maximal inspiratory effort in excess of the tidal volume.

Expiratory reserve volume: The volume expelled by an active expiratory effort after passive expiration is the expiratory reserve volume.

Residual volume: The air left in the lungs after a maximal expiratory effort. The vital capacity: The largest amount of air that can be expired after a maximal inspiratory effort is frequently measured clinically as an index of pulmonary function.



IRV = Inspiratory reserve volume
ERV = Expiratory reserve volume
TV = Tidal volume
RV = Residual volume

		Volume (L)		
		Men	Women	
Vital capacity	IRV	3.3	1.9	Inspiratory capacity
	TV	0.5	0.5	
	ERV	1.0	0.7	Functional residual capacity
	RV	1.2	1.1	
Total lung capacity		6.0	4.2	

Respiratory minute volume (rest): 6 L/min
Alveolar ventilation (rest): 4.2 L/min
Maximal voluntary ventilation (BTPS): 125–170 L/min

Timed vital capacity: 83% of total in 1 s; 97% in 3 s
Work of quiet breathing: 0.5 kg-m/min
Maximal work of breathing: 10 kg-m/breath

Lung volumes and some measurements related to the mechanics of breathing. The diagram at the upper right represents the excursions of a spirometer plotted against time.

Maximal Voluntary Ventilation

It is the largest volume of gas that can be moved into and out of the lungs in one minute by voluntary effort. The normal MVV is 125-170 L/min.

Three measurements are commonly made from a recording of forced exhaled volume versus time, i.e. a spirogram.

FEV1 (forced expired volume in one second): The volume of air expired in the first second of maximal expiration after a maximal inspiration. This is a measure of how quickly the lungs can be emptied.

FVC (forced vital capacity): maximum volume of air that can be exhaled during a Forced maneuver.

FEV1/FVC: FEV1 expressed as a percentage of the FVC, gives a clinically useful Index of airflow limitation. [10, 11, 12]

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

DEFINITION

COPD has been defined by GOLD 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 anoxious particles or gases. [13]

COPD includes chronic bronchitis and emphysema.

Chronic bronchitis is defined as "the presence of a chronic productive cough on most days for three months, in each of two consecutive years."

Emphysema is defined as abnormal, permanent enlargement of the distal air spaces, distal to the terminal bronchioles, accompanied by destruction of their walls and without obvious fibrosis.

COPD is present only if chronic airflow obstruction occurs; chronic bronchitis without chronic airflow obstruction is not included within COPD. [14]

Epidemiology

Most of the information available on COPD prevalence, morbidity and mortality comes from developed countries. Even in these countries, accurate epidemiological data on COPD are difficult and expensive to collect. Prevalence and morbidity data greatly underestimate the total burden of COPD because the disease is usually not diagnosed until it is clinically apparent and moderately advanced. [15]

Prevalence

In the Global Burden of Disease study conducted under the auspices of the WHO and the World Bank, the worldwide prevalence of COPD in 1990 was

estimated to be 9.34/1000 in men and 7.33/1000 in women. However, these estimates include all ages and underestimate the true prevalence of COPD in older adults. [16] Overall, the prevalence is greater in males which is due to higher prevalence of smoking in this gender. The disease is mostly seen in the middle aged or elderly subjects, and is rare before the age of 35 years.

It has been reported from the studies in Northern India that the prevalence of chronic bronchitis may be as high as 15% in subjects above the age of 40 years in rural areas. Further the prevalence of disease is somewhat greater in Northern India as compared to South India. The regional difference has been attributed to climatic conditions, particularly the severe winter in North Indian states. [17]

The marked preponderance of males in urban areas is less striking in the rural areas of the country; this has been attributed to greater prevalence of smoking amongst women in rural India. It may also be attributed the marked indoor air pollution in rural households resulting from combustion of traditional fuels such as cow dung cakes, firewood and fossil fuels, etc. Initiation of smoking at an early age, and prolonged exposure to indoor air pollution is responsible for remarkably high prevalence of COPD in certain parts of the world, e.g. Nepal.[18]

COPD is the fourth leading cause of death and affects > 16 million persons in the United States. GOLD estimates suggest that COPD will rise from the sixth to the third most common cause of death worldwide by 2020.

In prospective study involving 40,000 medical practitioners in Britain, it was found that the death rate from chronic bronchitis was higher in cigarette smokers and increased with amount smoked. It was also observed that in those who stopped smoking, the mortality after ten years was much lower than those who continued to smoke. [19]

The mortality among physicians decreased by 24% between the year 1953-57 and 1961-65. While in other groups it only declined by 4%. Another study as female British Doctors gave similar results. [20]

Vishwanathan [21] in an analysis of hospital admission (1958-59) in Delhi found prevalence of COPD to be 1.42% of all admissions. There was male preponderance and highest prevalence was in the age group 30-49 years. On comparison of prevalence with other cities of India, It was found that Agra and Lucknow had the highest prevalence. He also assumed prevalence in industrial workers (textile mill workers) and found it to be higher (14.86%).

Bhattacharya et al. [22] studied chronic bronchitis in rural population aged more than 30 years and found prevalence of chronic bronchitis to be 57/1000. There was male preponderance, which was higher with increasing age. Smoking had direct relation to prevalence of chronic bronchitis. The prevalence was highest among those whose duration of smoking was more than 15 years. They also found that prevalence was higher among Hukka smokers (85/1000) as compared to beedi smokers (31.06/1000) and chilam smokers (17.59/1000).

D Gothi et al.[23] Studied (2001-2002) 268 consecutive patients of chronic air flow limitation in chest clinic, T.N medical college, BYL Nair hospital, Mumbai, India. All the cases of COPD were above 40 years of age, mean age 54 years, age range 40 to 75 years and male: female ratio of 45:1. 45(98%) patients of COPD were smokers, (38 smoked beedis and 7 smoked cigarettes) while only one patient had exposure to biomass fuel while cooking.

RISK FACTORS [25, 26]

Cigarette Smoking: By 1964, the Advisory Committee to the Surgeon General of the United States concluded that cigarette smoking was a major risk factor for mortality from chronic bronchitis and emphysema. Subsequent longitudinal studies have shown accelerated decline in the volume of air exhale to the intensity of cigarette smoking, which is typically expressed as pack-years. Only 15% of the variability in FEV1 is explained by pack years, suggests additional environmental and/or genetic factors contribute to the impact of smoking on the development of airflow obstruction.

Airway Responsiveness:

The considerable overlap between persons with asthma and those with COPD on airway responsiveness, airflow obstruction and pulmonary symptoms is leading to the formulation of Dutch hypothesis. This suggests that asthma, chronic bronchitis and emphysema are variation of the same basic disease, which is modulated by environmental and genetic factors. Alternative British hypothesis contends that asthma and COPD are fundamentally different disease. Asthma viewed as largely an allergic phenomenon, while COPD results from smoking related inflammation and damage. Longitudinal studies that compared airway responsiveness at the beginning of the study to subsequent decline in pulmonary function have demonstrated that increased airway responsiveness is clearly a significant predictor of subsequent decline in pulmonary function. Thus, airway hyper-responsiveness is a risk factor for COPD.

Respiratory Infections:

Childhood respiratory infections have been assessed as potential predisposing factor for the eventual development of COPD.

Occupational Exposures:

Increased respiratory symptoms and airflow obstruction have been suggested resulting from general exposure to dust at work. Several specific occupational exposures, including coal mining, gold mining and cotton textile dust, have been suggested as risk factors for chronic airflow obstruction. However, although non-smokers in these occupations developed some reductions in FEV1 the importance of dust exposure as risk factor for COPD, independent of cigarette smoking, is not certain. Among workers exposed to cadmium (a specific chemical fume), FEV1, FEV1/FVC and DLCO, were significantly reduced, consistent with airflow obstruction and emphysema.

Ambient Air Pollution: There will be increased respiratory symptoms in those living in urban compared to rural areas, which may relate to increased pollution in the urban settings. With high rates of COPD reported in non-smoking women in many developing countries, indoor air pollution, usually associated with cooking, has been suggested as a potential contributor. [20]

Passive or Second hand, Smoking Exposure: Exposure of fetus/children to maternal smoking results in significantly reduced lung growth. In utero tobacco smoke exposure also contributes to significant reductions in postnatal pulmonary function. [15] Alpha-1 Antitrypsin Deficiency α 1 AT or α 1 protease inhibitors (α 1 Pi) is a polymorphic glycoprotein responsible for the majority of the anti-protease activity

in the serum. The commonly recognized alleles are designated by capital letters relating to their electrophoretic properties, which gave rise to the Pi nomenclature, e.g. Piz. The commonest allele in all populations is PiM and the most common genotype is PiMM, which occurs in around 86% in UK population.

PiMZ and PiMS are the next two most common genotypes and are associated with Pi levels of 50-75% of the mean levels of PiMM subjects. The homozygous Pizz deficiency, in which serum levels are 10-20% of the average normal value, is the strongest genetic risk factors for the development of emphysema and the associated airflow obstruction and forms the basis of the proteolytic theory of pathogenesis of emphysema.

The incidence of α -Pi deficiency in a population study of patients presenting with C0PD was 1-2%, but rises to greater than 50% in patients with severe disease who are less than 40 years of age. Life expectancy of subjects with α -Pi deficiency is significantly reduced, especially if they smoke. The onset of dyspnoea and death occurs in a younger age in smokers with α Pi deficiency.[27]

Subjects with α -Pi associated COPD who reach an older age exhibits a more indolent clinical course than younger affected individuals. Possible related in part to differences in tobacco exposure. This finding supports current guidelines that recommend screening of all patients with COPD for α –Pi deficiency, regardless of their age and prior smoking history.[28]

PATHOGENESIS

COPD is characterized by chronic inflammation throughout the airways, parenchyma, and pulmonary vasculature. Macrophages, T lymphocytes (predominantly CD8+), and neutrophils are increased in various parts of the lung.

Activated inflammatory cells release a variety of mediators - including leukotriene B4 (LTB4), interleukin 8 (IL-8), tumor necrosis factor a (TNF-α), and others capable of damaging lung structures and/or sustaining neutrophilic inflammation. In addition to inflammation, two other processes thought to be important in the pathogenesis of COPD are an imbalance of proteinases and anti-proteinases in the lung, and oxidative stress.

Inflammation of the lungs is caused by exposure to inhaled noxious particles and gases. Cigarette smoke can induce inflammation and directly damage the lungs.

Although fewer data are available, it is likely that other COPD risk factors initiate a similar inflammatory process. It is believed that this inflammation can then lead to COPD. [29]

PATHOLOGY

Pathological changes characteristic of COPD are found in the central airways, peripheral airways, lung parenchyma, and pulmonary vasculature.

In the central airways - the trachea, bronchi, and bronchioles greater than 2-4 mm in internal diameter - inflammatory cells infiltrate the surface epithelium.

Enlarged mucus secreting glands and an increase in the number of goblet cells are associated with mucus hyper secretion. In the peripheral airways - small bronchi and bronchioles that have an internal diameter of less than 2 mm - chronic inflammation leads to repeated cycles of injury and repair of the airway wall. The repair process results in a structural remodeling of the airway wall, with increasing collagen content and scar tissue formation that narrows the lumen and produces fixed airways obstruction.

Destruction of the lung parenchyma in COPD patients typically occurs as centrilobular emphysema. This involves dilatation and destruction of the respiratory bronchioles. These lesions occur more frequently in the upper lung regions in milder cases, but in advanced disease they may appear diffusely throughout the entire lung and also involve destruction of the pulmonary capillary bed. An imbalance of endogenous proteinases and anti-proteinases in the lung - due to genetic factors or the action of inflammatory cells and mediators - is thought to be a major mechanism behind emphysematous lung destruction. Oxidative stress, another consequence of inflammation, may also contribute.

Pulmonary vascular changes in COPD are characterized by a thickening of the vessel wall that begins early in the natural history of the disease. Thickening of the intima is the first structural change, followed by an increase in smooth muscle and the infiltration of the vessel wall by inflammatory cells. As COPD worsens, greater amounts of smooth muscle, proteoglycans, and collagen further thicken the vessel wall. [29]

PATHOPHYSIOLOGY [30]

Pathological changes in the lungs lead to corresponding physiological changes characteristic of the disease, including mucus hyper secretion, ciliary dysfunction, airflow limitation, pulmonary hyperinflation, gas exchange abnormalities, pulmonary hypertension and corpulmonale. They usually develop in this order over the course of the disease.

Mucus hyper secretion and ciliary dysfunction lead to chronic cough and sputum production. These symptoms can be present for many years before other symptoms or physiological abnormalities develop.

Expiratory airflow limitation, best measured through spirometry, is the hallmark physiological change of COPD and the key to diagnosis of the disease. It is primarily due to fixed airways obstruction and the consequent increase in airways resistance. Destruction of alveolar attachments, which inhibits the ability of the small airways to maintain patency, plays a smaller role.

In advanced COPD, peripheral airways obstruction, parenchymal destruction, and pulmonary vascular abnormalities reduce the lung's capacity for gas exchange, producing hypoxemia and later on hypercapnia. Pulmonary hypertension, which develops late in the course of COPD, is the major cardiovascular complication of COPD and is associated with the development of Cor pulmonale and a poor prognosis. Patients with COPD have been divided on clinical grounds and blood gas abnormalities into two extreme presentations. Type A patients or "pink puffers" have severe dyspnea, a normal or low Paco2, only a mild decrease in PaO_2 at rest, and a low DLCO. These patients are hypoxemic only at a late stage in the disease and therefore do not develop pulmonary hypertension, Cor pulmonale and consequently fluid retention and secondary polycythemia. In contrast, "blue bloaters" or type B patients presents with cough and sputum production and are likely to develop hypoxemia and hypercapnia earlier in the disease course and hence Cor pulmonale, fluid retention and polycythemia.[16] The pink puffers were thought to have predominantly emphysema and the blue bloaters were the bronchitic type. Blue bloaters have almost the double the mortality rate of pink puffers with similar degrees of airflow obstruction.

CLINICAL FEATURES AND DIAGNOSIS

The common mode of presentation of chronic obstructive pulmonary disease is a period of totally asymptomatic phase.

Symptoms: symptoms commonly associated with COPD includes, dyspnoea, cough with or without sputum expectoration and wheezing. The severity of dyspnoea is reported by patients seems parallel to severity of lung function. The threshold for discernible exercise limitation occurs with forced expiratory volume (FEV1) value about 1.5 liters. Dyspnoea is usually gradual in onset and is present for many years. Chronic productive cough is frequently associated with dyspnoea.

Hallmark of chronic bronchitis is cough with sputum production which develop insidiously, occurring initially only in the morning and volume rarely exceeds 60 ml of mucoid sputum. During acute exacerbation there is an increase in cough, purulent sputum, wheezing, dyspnoea and occasionally fever which is intermittent and of mild degree. As the disease gets progressive the period between the acute attacks becomes shorter.[14]

As the disease progresses from chronic bronchitis to emphysema, the shortness of breath increases and there is scanty sputum production. In this stage patients develop physical stigmata of COPD like muscle wasting, weight loss, weakness and fatigue. At this stage any acute exacerbation gives rise to erythrocytosis and patients develop polycythemia. They all start retaining carbon dioxide (hypercapnia) which usually presents with a morning headache and drowsiness due to lack of sleep at night. Patients with COPD tend to develop sleep apnea and are associated with sudden desaturation of oxygen, giving rise to sudden death. As the disease progresses patients develop corpulmonale with right heart failure and edema.

Physical Examination

In the initial stages of disease, examination of the chest may reveal only slowed expiration and wheezing as forced expiration.

Signs: As the obstruction progresses, hyperinflation becomes evident by the increased antero-posterior diameter of the chest (barrel shaped chest). This leads to hyper resonance of the chest wall to percussion, diminished vocal fremitus, widening of the subcostal margin and flattening of the diaphragm with decreased motion. Breath sounds at this stage are decreased, expiration is prolonged, and heart sound often become soft, coarse crackles may be heard at the lung bases.

Due to elevation of the sternum, there is marked reduction in the length of the trachea (from cricoid cartilage to the suprasternal notch, normally 3-4 finger breadth), while the patient lying down supine with neck extended.[31] There is generalized restriction of the movement of the chest. The typical barrel shaped or square chest with increased antero-posterior diameter relative to transverse diameter may be seen in later stages on emphysema.

Airflow obstruction is detected by placing the chest piece of the stethoscope over the trachea and timing of a forced expiration. Normally it is possible to empty the lungs in 4-5 seconds, but a patient with airflow obstruction shows a prolonged expiratory time. Patients with end stage COPD may adopt positions that relieve dyspnoea, such as leaning forward with arms outstretched, weight supported on the palms and neck extended (Tripod sign). The accessory respiratory muscle of the neck and shoulder girdle are in full use to keep the airway open. Expiration often takes place through pursed lips. Paradoxical in drawing of the lower intercostal space is often evident (Hoover's sign), cyanosis may be present, clubbing is not associated

with COPD. If it present one should rule out bronchiectasis or lung carcinoma. An enlarged, tender liver indicates heart failure due to increased intrathoracic pressure. Asterixis may be seen with severe hypercapnia.[16]

LABORATORY FINDINGS AND DIAGNOSTIC TESTS

Chest X-ray

In among 21% to 50% of patients with chronic bronchitis, there's no abnormality in Chest radiographs. When radiological abnormalities have been detected in patients with chronic bronchitis, they have been seen described as over inflation, oligemia (sparse and attenuated lung vessels) thickening of bronchial walls (peribronchial cuffing) and accentuation of linear lung margins (dirty lung, increased markings, interstitial prominence, or inflammatory changes of cigarette smoking).[32]

Radiological manifestations in emphysema: Sometimes emphysematous spaces and bullae are visible, but the principle radiographic manifestations of emphysema are over inflation and alteration in lung vessels, signs of over inflation include height of the patients. Lung being greater than 29.9 cms, location of patients hemidiaphragms, enlargement of the retrosternal space, widening of the sternodiaphragmatic angles, narrowing of transverse diameter of the heart. Alterations in lung vessels include arterial depletion, reduction in caliber and number of peripheral vessels.[33, 34]

Simon's criteria for X-ray diagnosis of emphysema [35]

1. **Excess of air in the lung:**

   Low and flat diaphragm; below rib 6 1/2

   Large retrosternal trans-radiant area

2. **Cardiovascular changes:**

Narrow vertical heart; 11.5 cm or less

Sometimes prominent pulmonary trunk

Hilar vessels normal or large

Lung vessels over-all small (prove by marker vessels)

Sometimes local vessel loss

If demarcated: bulla

If not demarcated: bullous area

If vessels changes in more than four zones: widespread

If fewer: local.

Computed Tomography

Computed tomography (CT), especially high resolution computed tomography (HRCT), collimation of 1-2 mm has much greater sensitivity and specificity than standard chest radiography. Though it is used to identify the specific anatomic type of emphysema it rarely alters therapy, and hence has no place in patient's management. It is however the main imaging tool to predict the benefit of pulmonary resection for giant bullous disease and for diagnosing complicating bronchiectasis. [36]

Pulmonary Function Tests

The most important disturbance of respiratory function in COPD is obstruction to forced expiratory airflow. During the last three decades lung function tests have evolved from tools for physiological study to clinical tools widely used in assessing respiratory states. In addition to their use in clinical case management, they have become a part of routine health examinations in respiratory, occupational and sports

medicine and in public health screening. It is a common practice for the results of lung function tests to be interpreted in relation to reference values.

Computerized equipment adds a new dimension with preselected or means of reference values and interpretation algorithms. By the time most patients present clinically, conventional spirometry is abnormal and most useful and commonly employed test is the FEV1.[37, 38]

Spirometry: Spirometry is as important for the diagnosis of COPD, as blood pressure measurements are for the diagnosis of hypertension. Spirometry is the most robust test of airflow limitation in patients with COPD. A low FEV1 with an FEV1/FVC ratio below the normal range is a diagnostic criterion for COPD. The rate of decline of FEV1, can be used to assess susceptibility in cigarette smokers, progression of disease and reversibility of the airway obstruction.[39]

Spirometry is a simple test to measure the amount of air a person can breathe out, and the amount of time taken to do so.

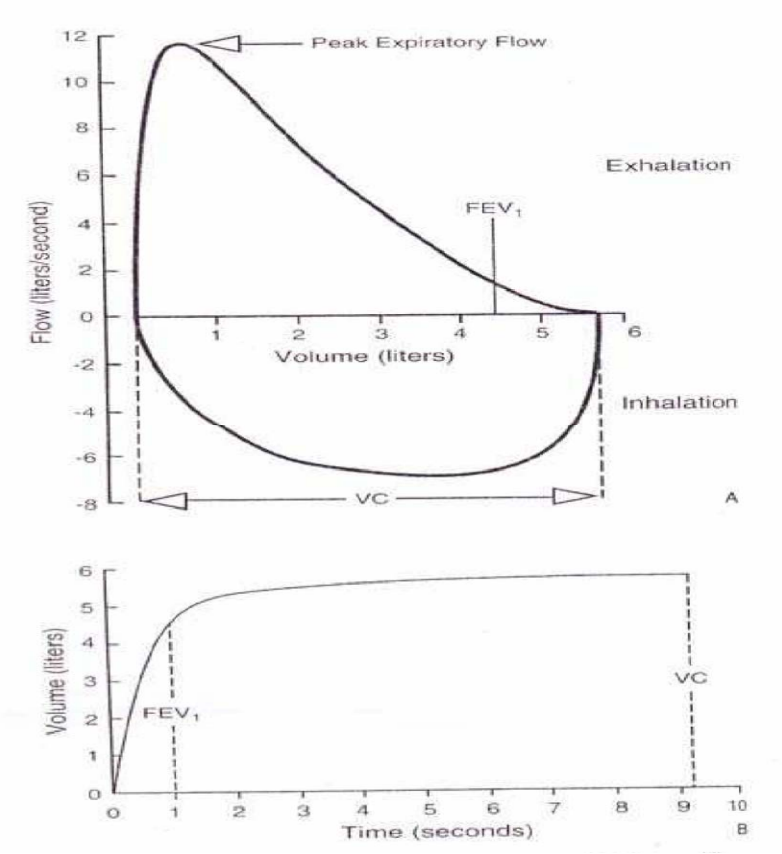


Fig 3: Normal spirogram and flow volume curve (top) Volume time curve (bottom)

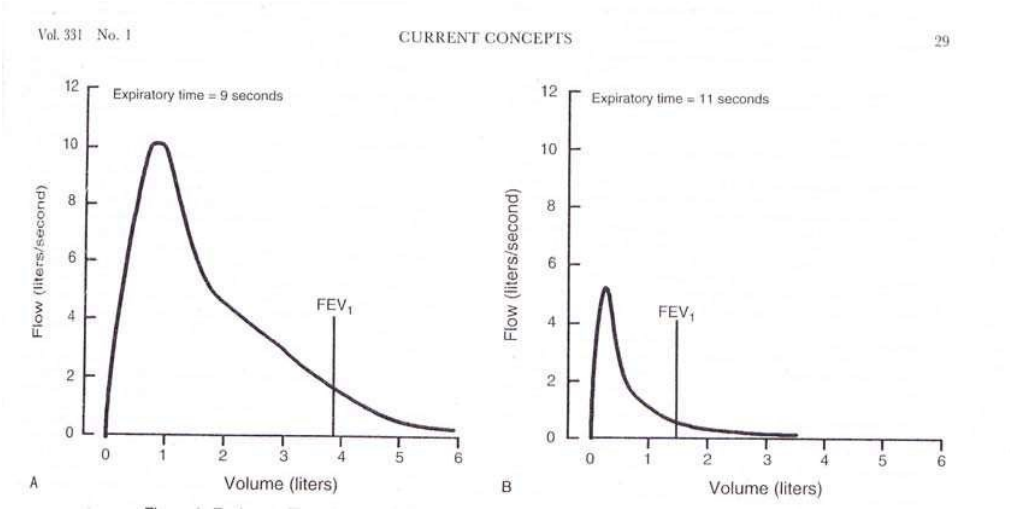


Fig 4: Spirogram typical of patients with moderate and severe COPD[37]

Spirometric parameters used for diagnosis of COPD include

- FEV1(forced expiratory volume in one second)
- FVC (forced vital capacity)
- FEV1/FVC ratio

FEV1 is influenced by the age, sex, height and ethnicity and is best considered as a percentage of the predicted normal value.

The degree of Spirometric abnormality generally reflects the severity of COPD.

The ratio FEV1/FVC is between 70% and 80% in normal adults; a value less than 70% indicates airflow limitation and the possibility of COPD.

As per Om Prakash et al who has studied Spirometric norms from Karnataka in which the value of FVC of 2.70 lit and FEV1of 2.14 lit and FEV1/FVC ratio of 80% above 55 years in males were taken as normal parameters.

In females FVC of 1.68 and FEV1 of 1.39 and FEV1/FVC 83% above 55 years were taken as normal.[12, 38, 39]

Performance of Spirometry

Spirometry is best performed with the patient seated. Patients may be anxious about performing the test properly, and should be reassured. Careful explanation of the test, accompanied by a demonstration, is very useful.

The patient should:

- Breathe in fully.
- Seal their lips around the mouth piece.
- Force the air out of the chest as hard and fast as they can until their lungs are completely "empty".
- Breathe in again and relax.

Exhalation must continue until no more air can be exhaled, must be atleast 6 seconds, and can take up to 15 seconds or more.

Like any test, Spirometry results will only be of value if the expirations are performed satisfactorily and consistently. Both FVC and FEV1 should be the largest value obtained from any of three technically satisfactory curves and FVC and FEV1 values in these three curves should vary by no more than 5% or 100 ml, whichever is greater, the FEV1/FVC is calculated using the maximum FEV1 and FVC from technically acceptable (not necessarily the same) curves. Those with chest pain or frequent cough may be unable to perform a satisfactory test and this should be noted. [14, 31, 42]

GOLD STAGE	**Severity**	**Symptoms**	**Spirometry**
0	At risk	Chronic cough, sputum production	Normal
I	Mild	With or without chronic cough or sputum production	FEV1/FVC <0.7 and FEV1> 80% predicted
II	Moderate	With or without chronic cough or sputum production	FEV1/FVC < 0.7 and 50%≤FEV1<80% predicted
III	Severe	With or without chronic cough or sputum production	FEV1/FVC < 0.7 and 30% ≤ FEV1<50% predicted
IV	Very severe	With or without chronic cough or sputum production	FEV1 /FVC < 0.7 and FEV1 < 30% predicted or FEV1 < 50% predicted with respiratory failure or signs of right heart failure

Table: 1 GOLD Criteria for COPD Severity[14]

Flow-Volume Loops

Expiratory flow at 75% or 50% of VC has been used as a measure of airflow limitation and provides complementary information to the usual volume time plot. There are problems with reproducibility of the measurement.

Peak Expiratory Flow (PEF)

Peak expiratory flow can either be measured directly from the flow volume or with a hand held peak flow meter. However, in COPD there is little daily change in PEF and many variations are often within the measurement, so that PEF is an inferior measurement of airway obstruction in COPD. [31]

Lung Volumes

Measurements of static lung volumes as TLC, RV and FRC, are used in patients with COPD to assess the degree over inflation and gas trapping that results from loss of elastic recoil and collapse of the airways.

The standard methods to measure static lung volume are using the helium dilution technique and body plethysmograph.

Reversibility to bronchodilators

The American, European and British Thoracic Societies (ATS, ERS and BTS) recognize that assessment of reversibility to bronchodilators is an essential part of investigation arid management of patients with COPD.

Reversibility tests are important in COPD for several reasons to help, to distinguish those patients with marked reversibility who have underlying asthma because the FEV1 after bronchodilator is the best predictor of survival.

The GOLD guidelines recommend an increase in FEV1that is both greater than 200ml and 12% above the pre-bronchodilator FEV1 is considered significant. [41]

Reversibility to Corticosteroids

According to the recommendation of the BTS guidelines, administration of 30 mg of prednisolone for a period of two weeks. Those patients who have previously shown a response to nebulized bronchodilators are more likely to show a response to steroids. [42]

Arterial blood gases

Measurement of arterial blood gases is essential in patients with COPD to confirm the degree of hypoxaemia and hypercapnia and in acute exacerbation particularly to determine the hydrogen ion concentration. It is recommended in patients with an FEV1 <40% of their predicted volume.

Non - Physiogical assessments

In patients with severe COPD, identifying polycythemia is important since it predisposes to vascular events, and there is some evidence that venesection may improve exercise tolerance. Polycythemia should be suspected when the haematocrit is greater that 47% in women and > 52% in men and/or the hemoglobin is > 16g/dl in women and > 18g/dl in men, provided other causes of spurious polycythemia, such as decreased plasma volume due to dehydration can be excluded. The levels and phenotype of α_1 – AT should be measured in all patients under the age of 40 years and in those with a family history of emphysema at an early age. [14]

ELECTROCARDIOGRAPHIC CHANGES THAT OCCUR IN COPD AND THE POSSIBLE MECHANISMS FOR SUCH CHANGES

Pulmonary arterial hypertension and Cor pulmonale in COPD

Chronic obstructive pulmonary disease is the most common cause of pulmonary hypertension and Cor pulmonale in patients with intrinsic pulmonary disease. Even though chronic bronchitis and emphysema generally co-exist, the predominant cause of pulmonary hypertension is alveolar hypoxia resulting from chronic bronchitis. Emphysema plays only a minor role, presumably by restricting the extent of pulmonary vascular bed.

Pathogenesis of pulmonary hypertension or Cor pulmonale in COPD. [43, 44]

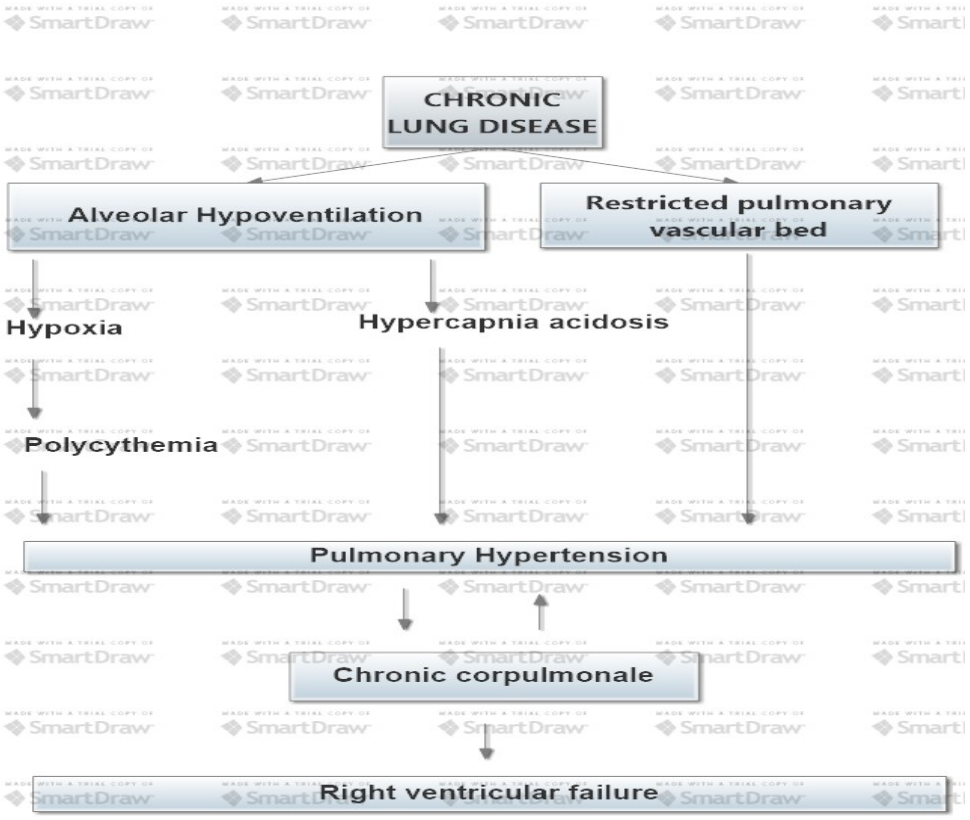


Fig 5: Pathogenesis of pulmonary hypertension or corpulmonale in COPD

The indiscriminate use of the designation of COPD, without differentiating from predominant emphysema, tends to cloud the natural history of this spectrum of obstruction airway disease. In essence pulmonary hypertension generally culminating in corpulmonale is encountered in two settings, episodically in "pink puffer" who becomes hypoxemic during an acute respiratory infection and chronically in "blue bloater" with whom unremitting hypoxia is aggravated during an acute respiratory infection. In the blue bloater, the course of pulmonary hypertension is inexorably progressive.

Hypoxia is likely the causative factor in the development of pulmonary artery hypertension and RV hypertrophy in patients with COPD. Longitudinal studies show that resting pulmonary artery pressure increases slowly in patients with emphysema or chronic bronchitis who have mild or moderate arterial hypoxemia one large study found that extent of pulmonary arterial hypertension correlated most closely with resting arterial oxygen saturation, measured while patients are awake. FEV1and diffusing capacity may correlate more closely with the degree of pulmonary hypertension than arterial blood gases at rest, in case of pure emphysema.

Chronic hypoxaemia causes proliferation of endothelial cells and thickening of intima of small pulmonary arterioles. Abnormalities in endothelium dependent vasodilatation caused by nitric oxide also contribute to pulmonary arterial hypertension.

Cor pulmonale in COPD is related to severity of lung dysfunction, and pulmonary hypertension is a manifestation of advanced disease. Exercise limitation in COPD is usually due to limitation of ventilatory capacity, not cardiac reserve. No single test of lung function is highly predictive of cor pulmonale.

Acute cor pulmonale is manifested by RV dilation whereas chronic cor pulmonale is presented with right ventricular hypertrophy. Left ventricular dysfunction due to RVH is rare and most commonly associated with coexisting ischemic heart disease. [44, 45]

MANAGEMENT:

The goals of COPD management include:

- Prevent disease progression
- Relieve symptoms
- Improve exercise tolerance
- Improve health status
- Prevent and treat complications
- Prevent and treat exacerbations
- Reduce mortality
- Prevent or minimize side effects from treatment.

Cessation of cigarette smoking should be included as a goal throughout the management program.

These GOALS can be achieved through implementation of a COPD management programs with four components.

- Assessment and monitoring of disease
- Reduction of risk factors
- Management of stable COPD
- Management of exacerbations

1. Assessments and Monitoring of Disease

- Past medical history, including asthma, allergy, sinusitis or nasal polyps, respiratory infections, and other respiratory disease.
- Family history of COPD or other chronic respiratory disease.
- Pattern of symptom development.
- History of exacerbations or previous hospitalizations for respiratory disorder.
- Presence of comorbidities, such as heart disease and rheumatic disease, which may also contribute to restriction of activity.
- Appropriateness of current medical treatments.
- Impact of disease on patient's life, including limitation of activity; mixed work and economic impact; effect on family routines; and feelings of depression or anxiety.
- Social and family support available to the patient.
- Possibilities for reducing risk factors, especially smoking cessation.

In addition to spirometry, the following other tests should be undertaken for the assessment of a patient with moderate, severe and very severe COPD. Bronchodilator reversibility testing: To rule out a diagnosis of asthma and guide initial treatment decisions.

Chest X-ray: Seldom diagnostic in COPD but valuable to exclude alternative diagnosis, e.g. pulmonary tuberculosis.

Arterial blood gas measurement: Perform in patients with FEV1< 40% predicted or with clinical signs suggestive of respiratory failure or right heart failure. The major clinical sign of respiratory failure is cyanosis. Clinical signs of right heart failure include ankle edema and an increase in the jugular venous pressure.

- Respiratory failure is indicated by PaCO2 < 8.0 KPa (60 mmHg), with or without PaCO2 > 6.7 KPa (50 mmHg) while breathing air at sea level.[14]
- α-1 antitrypsin deficiency screening: Perform when COPD develops in patients under 45 years, or in patients with a strong family history of COPD.

2. Reduction of Risk Factors

Smoking cessation is the single most effective and cost effective intervention to reduce the risk of developing COPD and slow its progression.

- Even a brief, 3-minute period of counselling to urge a smoker to quit can be effective, and at a minimum this should be done for every smoker at every visit.
- Pharmacotherapy (nicotine replacement and/or bupropion) is recommended when counselling is not sufficient to help patients stop smoking. Special consideration should be given before using pharmacotherapy in people smoking fewer than ten cigarettes per day, pregnant women, adolescents and those with medical contraindications (unstable coronary artery disease, untreated peptic ulcer, and recent myocardial infarction or stroke for nicotine replacement; and history of seizures for bupropion).

Smoking prevention: Encourage comprehensive tobacco-control policies and programs with clear, consistent, and repeated non-smoking messages. Legislation to establish smoke-free schools, public facilities, and work environments should be encouraged.

Occupational exposures: Emphasize primary prevention, which is best achieved by elimination or reduction of exposures to various substances in the work place.

Secondary prevention achieved through surveillance and early detection, is also important.

Indoor and Outdoor Air Pollution: Implement measures to reduce or avoid indoor air pollution from biomass fuel, burned for cooking and heating in poorly ventilated dwellings. Advice patients to monitor public announcement of air quality and depending on the severity of their disease, avoid vigorous exercise outdoors or stay indoors altogether during pollution episodes.

3. Management of Stable COPD

Patient education can help improve skills, ability to cope with illness, and health status. It is an effective way to accomplish smoking cessation.

Pharmacologic treatment can improve and prevent symptoms, reduce the frequency and severity of exacerbations, improve health status and improve exercise tolerance.

Bronchodilators: These medications are central to symptom management in COPD.

- Give as "needed" to relieve intermittent or worsening symptoms, and as a regular basis to prevent or reduce persistent symptoms.
- The choice between β2-agonists, anticholinergics, methylxanthines and combination therapy depends on the availability of medications and each patient's individual response in terms of both symptom relief and side effects.
- Regular treatment with long acting bronchodilators is more effective and convenient than treatment with short acting bronchodilators, but more expensive.
- Combining drugs with different mechanisms and durations of action may increase the degree of bronchodilation for equivalent or lessen side effects.

- Theophylline is effective in COPD, but due to its potential toxicity, inhaled bronchodilators are preferred when available.

Regular nebulized bronchodilator therapy for a stable patient is not appropriate unless it has been shown to be better than conventional doses by metered dose inhaler. Glucocorticosteroids: Regular treatment with inhaled glucocorticosteroids is only appropriate for patients with an FEV1<50% predicted and repeated exacerbations (for example, 3 in last three years). Prolonged treatment with inhaled glucocorticosteroids may relieve symptoms in this carefully selected group of patients but does not modify the long-term decline in FEV1. The dose response relationships and long-term safety of inhaled glucocorticosteroids in COPD are not known. Long term treatment with oral glucocorticosteroids is not recommended.

Table 2: Commonly used formulations of drugs in COPD

Drug	Inhaler (μg)	Solution for Nebulizer (mg/ml)	Oral	Vials for Injection (mg)	Duration of Action (hours)
β2-agonists					
Short-acting					
Fenoterol	1 00-200 (MDI)	1	0.05% (Syrup)		4-6
Salbutamol (albuterol)	100,200(MDI&DPI)	5	5mg (Pill) Syrup	0.1, 0.5	4-6
Terbutaline	400, 500 (DPI)	-	2.5, 5 (Pill)	0.2, 0.25	4-6
Long-acting					
Formoterol	4.5-12 (MDI & DPI)				12+
Salmeterol	25-50 (MDI & DPI)				12+
Anticholinergics					
Short-acting					
Ipratropium bromide	20, 40 (MDI)	0.25-0.5			6-8
Oxitropium bromide	100 (MDI)	1.5			7-9

Long-acting					
Tiotropium	18 (DPI)				24+
Combination short-acting p2-agonists plus anticholinergic in one inhaler					
Fenoterol/Ipratropium	200/80 (MDI)	1.25/0.5			6-8
Salbutamol/Ipratropium	75/15 (MDI)	0.75/4.5			6-8
Methylxanthines					
Aminophylline			200-600 mg (Pill)	240 mg	Variable, up to 24
Theophylline (SR)			100-600 mg (Pill)		Variable, up to 24
Inhaled glucocorticosteroids					
Beclomethasone	50-400 (MDI & DPI)	0.2-0.4			
Budesonide	100, 200, 400 (DPI)	0.20, 0.25, 0.5			
Fluticasone	50-500 (MDI & DPI)				
Triamcinolone	100 (MDI)	40		40	
Combination long-acting p2-agonists plus glucocorticosteroids in one inhaler					
Formoterol/Budesonide	4.5/160, 9/320 (DPI)				
Salmeterol/Fluticasone	50/100,250, 500 (DPI) 25/50, 125, 250				
Systemic glucocorticosteroids					
Prednisone			5-60 mg (Pill)		
Methyl-Prednisolone			4,8, 16 mg (Pill)		

MDI: Metered dose inhaler, DPI = Dry powder inhaler

Vaccines: Influenza vaccines reduce serious illness and death in COPD patients by 50%. Give once (in autumn) or twice (in autumn and winter) each year. There is no

evidence for recommending the general use of pneumococcal vaccine for COPD. Antibiotics: Not recommended except for treatment of infections and exacerbations.

Mucolytic (Mucokinetic, Mucoregulator) Agents: Patients with viscous sputum may benefit from mucolytics, but overall benefits are very small. Use is not recommended.

Anti-tussives: Regular use contraindicated in stable COPD.

Respiratory stimulants: Not recommended for regular use.

Non-pharmacologic treatment: includes rehabilitation, oxygen therapy and surgical interventions.

Rehabilitation programs should include at a minimum:

- Exercise training
- Nutrition counseling
- Education

Oxygen therapy: The long-term administration of oxygen (> 15 hours per day) to patients with chronic respiratory failure increases survival and has a beneficial impact on pulmonary arterial pressure, polycythemia (hematocrit > 55%), exercise capacity, lung mechanics and mental state.[63]

The goal of long-term oxygen therapy is to increase the baseline PaO2 at rest to at least 8.0 Kpa(60 mmHg) at sea level, and/or produce SaO_2 at least 90%, which will preserve vital organ function by ensuring an adequate delivery of oxygen.

Initiate oxygen therapy for patients with stage IV: very severe COPD if; Pa02 is at or below 7.3 KPa (55 mmHg) or SaO2 is at or below 88%, with or without hypercapnia; or $Pa0_2$ is between 7.3 KPa (55 mmHg) and 8.0 KPa (60 mmHg) or SaO_2 is 89%, if there is evidence of pulmonary hypertension, peripheral edema suggesting congestive heart failure or polycythemia.

Surgical Treatment: Bullectomy and lung transplantation may be considered in carefully selected patients with stage IV: very severe COPD. There is currently no sufficient evidence that would support the widespread use of lung volume reduction surgery (LVRS).

There is no convincing evidence that mechanical ventilator support has a role in the routine management of stable COPD.

A summary of characteristics and recommended treatment at each stage of COPD is shown in table 3.

<table>
<tr><td>0: At risk</td><td>I: Mild</td><td>II: moderate</td><td>III: Severe</td><td>IV: Very severe</td></tr>
<tr><td colspan="5">Avoidance of risk factor(s); influenza vaccination</td></tr>
<tr><td></td><td colspan="4">Add short acting bronchodilators when needed</td></tr>
<tr><td colspan="2"></td><td colspan="3">Add regular treatment with one or more long acting bronchodilators, add rehabilitation.</td></tr>
<tr><td colspan="3"></td><td colspan="2">Add inhaled glucocorticoids if repeated exacerbations</td></tr>
<tr><td colspan="4"></td><td>Add long term oxygen if chronic respiratory failure, consider surgical treatments.</td></tr>
</table>

Table 3: Therapy at each stage of COPD[14]

4. Management of Exacerbations

COPD is often associated with exacerbations of symptoms. Many exacerbations are caused by infection of the tracheobronchial tree or an increase in air pollution, but the cause of about one-third of severe exacerbations cannot be identified.

Home care or hospital care for end-stage COPD patients

The risk of dying from an exacerbation of COPD is closely related to the development of respiratory acidosis, the presence of serious comorbidities, and the need for ventilatory support. Patients lacking these features are not at high risk of dying, but those with severe underlying COPD often require hospitalization in any case.

Home Management

Bronchodilators: Increase dose and/or frequency of existing bronchodilator therapy. If not already used, add anti-cholinergic until symptoms improve.

Glucocorticosteroids: If baseline FEV1<50% predicted, add 40 mg oral prednisolone per day for ten days to the bronchodilator regimen. Nebulized budesonide may be an alternative to oral glucocorticosteroids in the treatment of non-acidotic exacerbations. [42]

Antibiotics: When symptoms of breathlessness and cough are increased and sputum is purulent and increased in volume, provide antibiotic coverage of the major bacterial pathogens involved in exacerbations, taking into account local patterns of antibiotic sensitivity.

Hospital Management:

Indications for referral and the management of exacerbations of COPD in the hospital depend on local resources and the facilities of the local hospital.

Patients with the following characteristics should be hospitalized.

- Indicating for hospital admission for exacerbations
- Marked increase in intensity of
  - ✓ Newly occurring arrhythmias
  - ✓ Diagnostic uncertainty development of resting dyspnoea
  - ✓ Older age
- Severe background COPD
- Insufficient home support.
- Onset of new physical signs (e.g.: cyanosis, peripheral edema)
- Failure of exacerbation to respond to initial medical management
- Significant comorbidities

METHODOLOGY

OBJECTIVES:

1. To identify the risk factors for exacerbations and hospitalizations due COPD.

2. To assign an overall risk score to individual patients based on risk factors identified and spirometry to predict future hospital admission

STUDY GROUP:

In the present study 60 cases were selected on the basis of simple random sampling method from the Medical Wards, Sri R. L. Jalappa Hospital and Research Center, attached to Sri Devaraj Urs Medical College, Kolar.

INCLUSION CRITERIA:

The patients who were aged above 40years and with smoking history admitted in the medical wards with symptoms suggestive of airway obstruction and in whom clinical diagnosis of chronic obstructive pulmonary disease was made. All these patients were subjected to spirometric test; the patients with forced expiratory volume in first second (FEV1) of less than 60% of the expected value and FVC less than 70%.

EXCLUSION CRITERIA:

- Clinical diagnosis of asthma
- Myocardial infarction within the prior 6 months
- Hospitalization for heart failure within the prior year
- Known moderate-to-severe renal impairment
- Current radiation or chemotherapy for a malignancy
- Inability to give informed consent

METHOD OF COLLECTION OF DATA:

A total number of 60 cases were collected. Spirometry along with a few questions are directed to the patient. Exacerbation and hospitalization risk score were calculated based on questionnaire directed to the patient and spirometry.

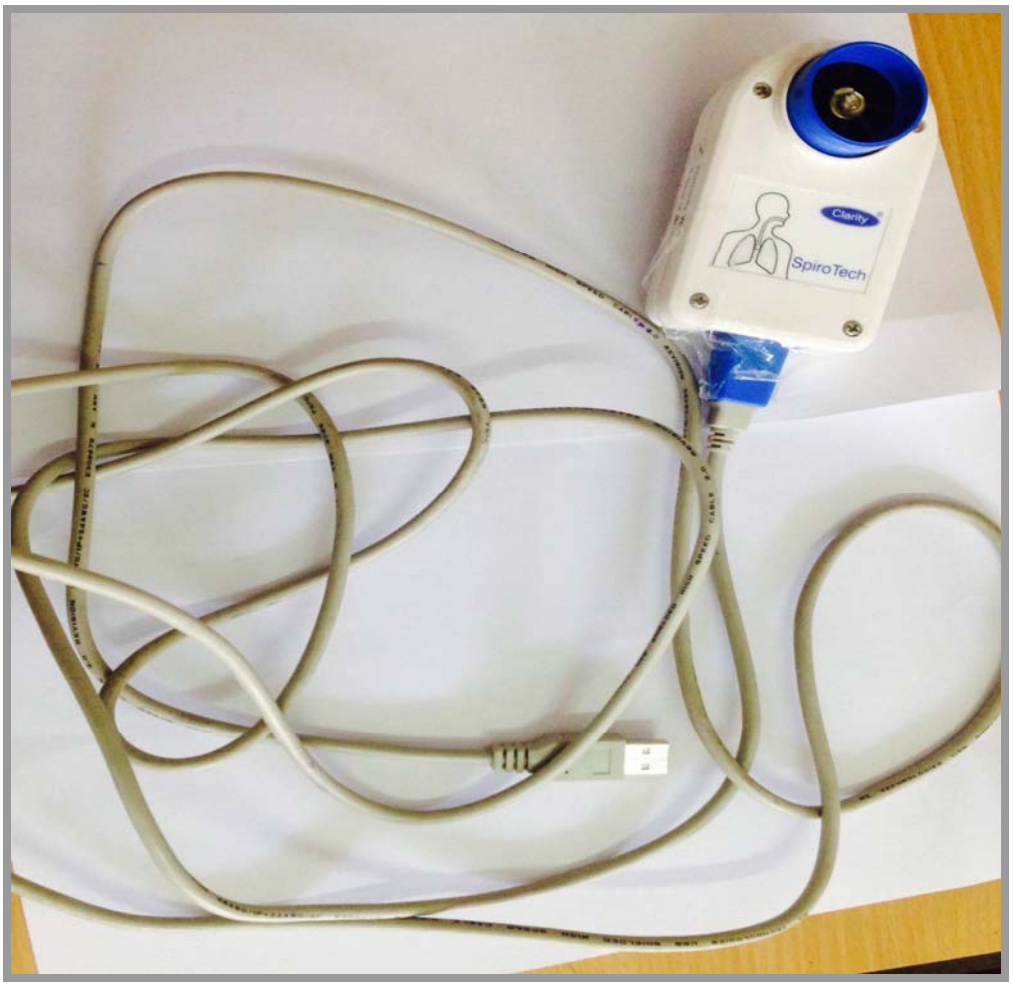
STATISTICAL ANALYSIS :

Data was entered in to Microsoft excel data sheet and was analyzed using EPI info 7 version software. Categorical data was presented in the form of frequencies and proportions. Bar charts and pie diagrams was used to represent graphically. Chi-square test was the test of significance. Continuous data was represented in the form of Mean and Standard deviation. Independent t test was the test of significance for continuous data. Multiple logistic regression to identify the independent predictors of hospitalization was done. p value <0.05 was considered as statistically significant.

INVESTIGATIONS:

Routine investigations along with special investigation spirometry(pulmonary function test) were performed for all patients who were included in the study.

Fig 6: SPIROMETER



QUESTIONNAIRE

1. AGE
2. CURRENT SMOKER
3. DURATION OF COPD DIAGNOSIS
4. PREDICTED FEV_1 AND FEV_1/FVC
5. BODY MASS INDEX
6. HOME OXYGEN USE
7. SHEDULED HOSPITAL VISITS FOR COPD IN THE PRIOR: 1/2/3/4 VISITS
8. UNSCHEDULED VISITS IN PRIOR YEAR : 1/2/3 OR MORE
9. COPD HOSPITALIZATION PRIOR YEAR: NO HOSPITALIZATION , 1 TIME , 2 TIME
10. ANTIBIOTICS FOR COPD PRIOR YEAR : NO COURSE, 1 COURSE, 2 COURSE
11. MEDICATIONS AT ENTRY
12. COMORBIDITIES

EXACERBATION RISK SCORE :

VARIABLES	**POSSIBLE POINTS**	**INDIVIDUAL AND TOTAL SCORES**	
AGE,YEAR			
<45	0		
45-54	20		
55-64	40		
65-74	60		
75-84	80		
>=85	100		
PERCENTAGE OF PREDICTED FEV1			
10-19	75		
20-29	66		
30-39	56		
40-49	47		
50-59	38		
60-69	28		
THEOPHYLLINE AT ENTRY	26		
PRODUCTIVE COUGH	31		
COPD DURATION, YEAR			
1	0		
2	5		
3	9		
4	14		
5	19		
6	23		
7	28		
8	33		
ONE OR MORE ANTIBIOTIC COURSES FOR COPD IN PRIOR YEAR	63		

SYSTEMATIC STEROID COURSES FOR COURSE IN PRIOR YEAR			
1	39		
2 OR MORE	70		
ONE OR MORE HOSPITAL	24		
ADMISSION FOR COPD IN PRIOR YEAR			
TOTAL			

HOSPITALIZATION RISK SCORE:

VARIABLE	**POSSIBLE POINTS**	**INDIVIDUAL AND TOTAL SCORE**
AGE, YEARS		
<70	0	
70-74	12	
75-79	23	
80-84	35	
>=85	46	
PERCENTAGE OF PREDICTED FEV1		
10-19	89	
20-29	78	
30-39	67	
40-49	56	
50-59	44	
60-69	33	
ORAL STEROIDS AT ENTRY	22	
ONE OR MORE CVS MORBIDITY	28	
UNSCHEDULED CLINICAL FOR		

ED VISITS FOR COPD PRIOR YEAR		
1	3	
2 OR MORE	24	
ONE OR MORE HOSPITAL ADMISSION FOR COPD PRIOR	40	
TOTAL		

RESULTS

General characteristics of COPD patients

1. AGE

Table 4: Age distribution of COPD subjects

		Frequency	Percent
Age	**<50 yrs**	3	5.0
	51 to 60 yrs	18	30.0
	61 to 70 yrs	23	38.3
	>70 yrs	16	26.7
	Total	60	100.0

In the study majority of COPD patients were in the age group of 61 to 70yrs i.e. 38.3%, followed by 30% in 51 to 60 yrs and >70yrs.

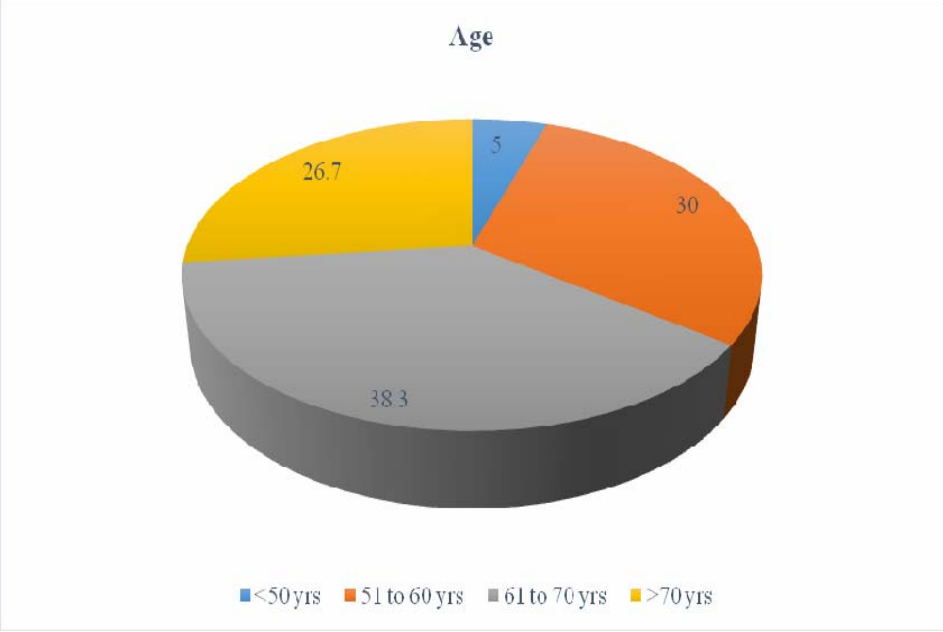


Figure 7: Pie diagram showing age distribution of COPD subjects

2. SEX:

Table 5: Sex distribution of COPD subjects

		Frequency	Percent
Sex	**Female**	2	3.3
	Male	58	96.7
	Total	60	100.0

In the study majority i.e. 96.7% were males and 3.3 were females.

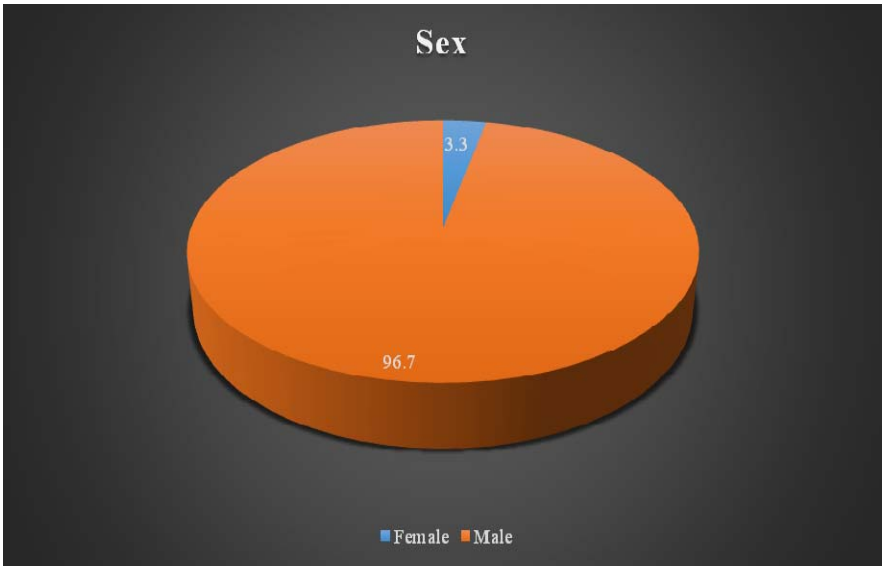


Figure 8: Pie diagram showing Sex distribution of Subjects

3. Symptoms in COPD subjects:

Table 6: Symptoms in COPD subjects

		Frequency	Percent
Cough	**Present**	60	100.0
Expectoration	**Present**	60	100.0
Breathlessness	**Present**	60	100.0
Fever	**Present**	12	20.0

In the study all the COPD subjects presented with cough with expectoration and breathlessness. 20% of subjects presented with fever.

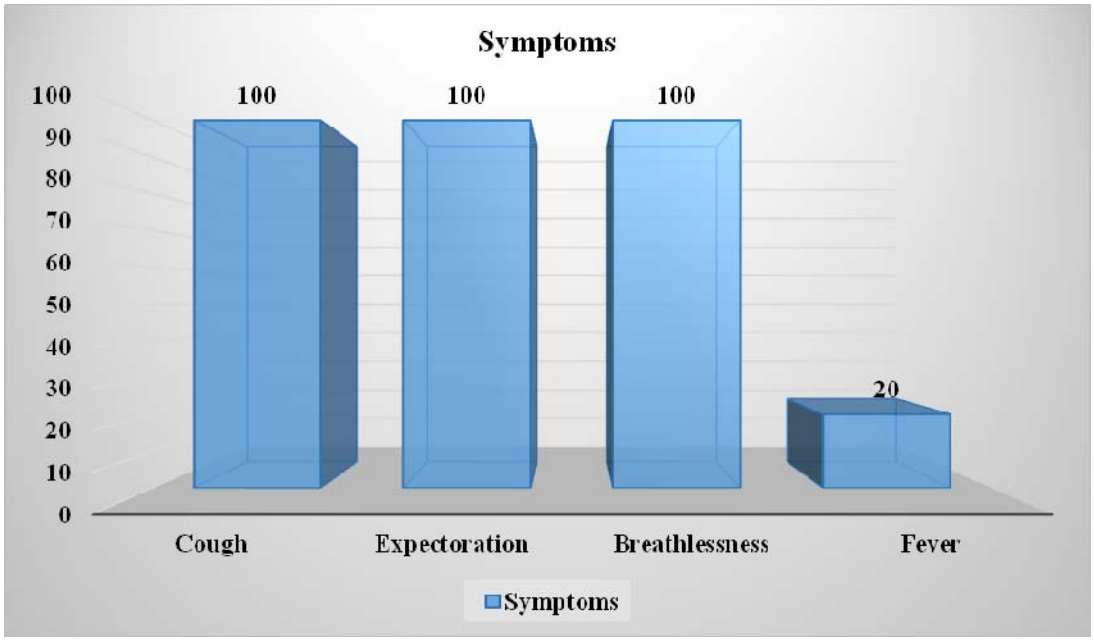


Figure 9: Bar diagram showing symptoms in COPD subjects

4.Smoking habits of COPD subjects

Table 7: Smoking habits of COPD subjects

		Frequency	Percent
Smoking habits	**Beedi**	45	75.0
	Cigarette	12	20.0
	Non smoker	2	3.3
	Both	1	1.7
	Total	60	100.0

In the study it was observed that 96.7% of COPD subjects were smokers and 3.3% of them were nonsmokers. Majority of patients i.e. 75% were using Beedi, 20% Cigarette and 1.7% both cigarette and Beedi.

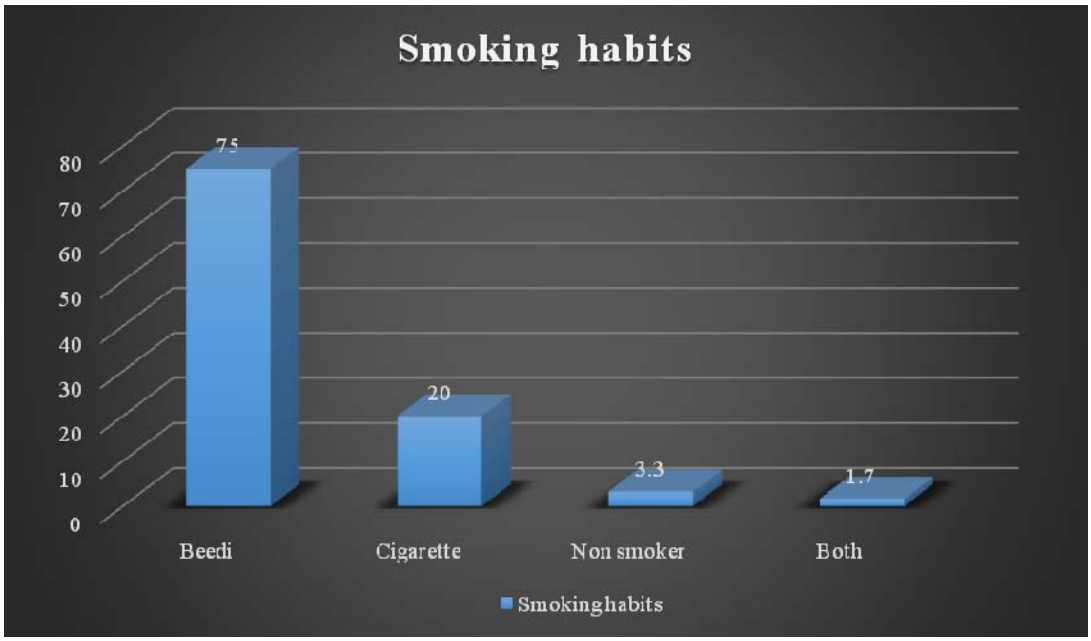


Figure 10: Bar diagram showing smoking habits among COPD subjects

5. Duration of Smoking among COPD subjects:

Table 8: Duration of Smoking among COPD subjects

		Frequency	Percent
Duration of smoking	**<10yr**	2	3.3
	11 to 20 yrs	4	6.7
	21 to 30 yrs	23	38.3
	31 to 40 yrs	31	51.7
	Total	60	100.0

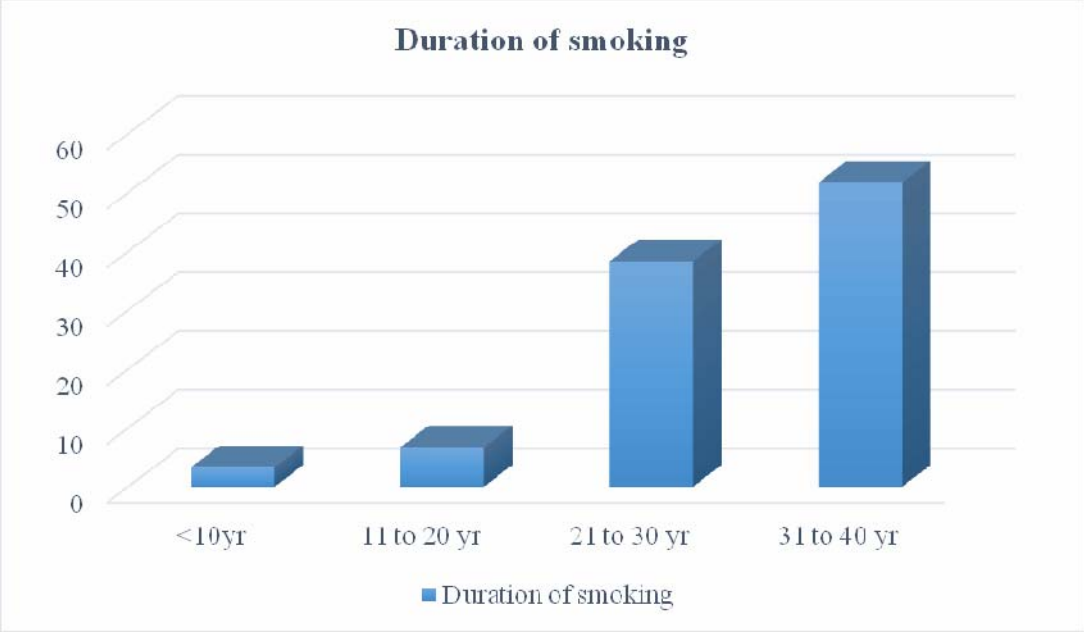


Figure 11: Bar diagram showing Duration of smoking

6.Use of Home oxygen among COPD subjects

Table 9: Use of Home oxygen among COPD subjects

		Frequency	Percent
Home oxygen	No	41	68.3
	Yes	19	31.7
	Total	60	100.0

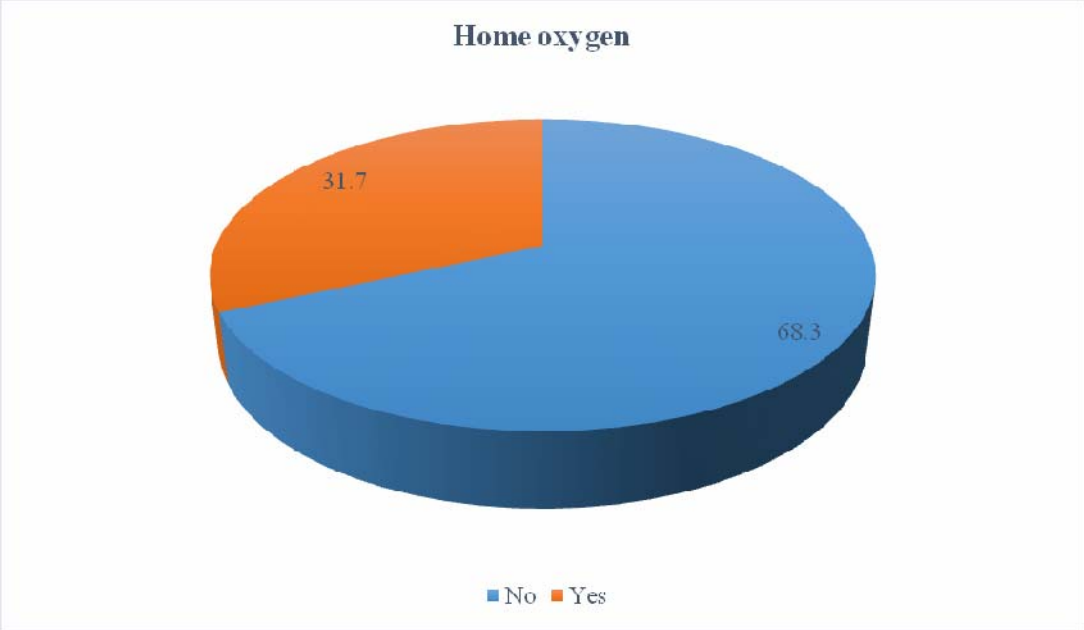


Figure 12: Pie diagram showing Home oxygen usage

7. Grade of COPD

Table 10: Grade of COPD

		Frequency	Percent
Grade of COPD	**2**	10	16.7
	3	32	53.3
	4	18	30.0
	Total	60	100.0

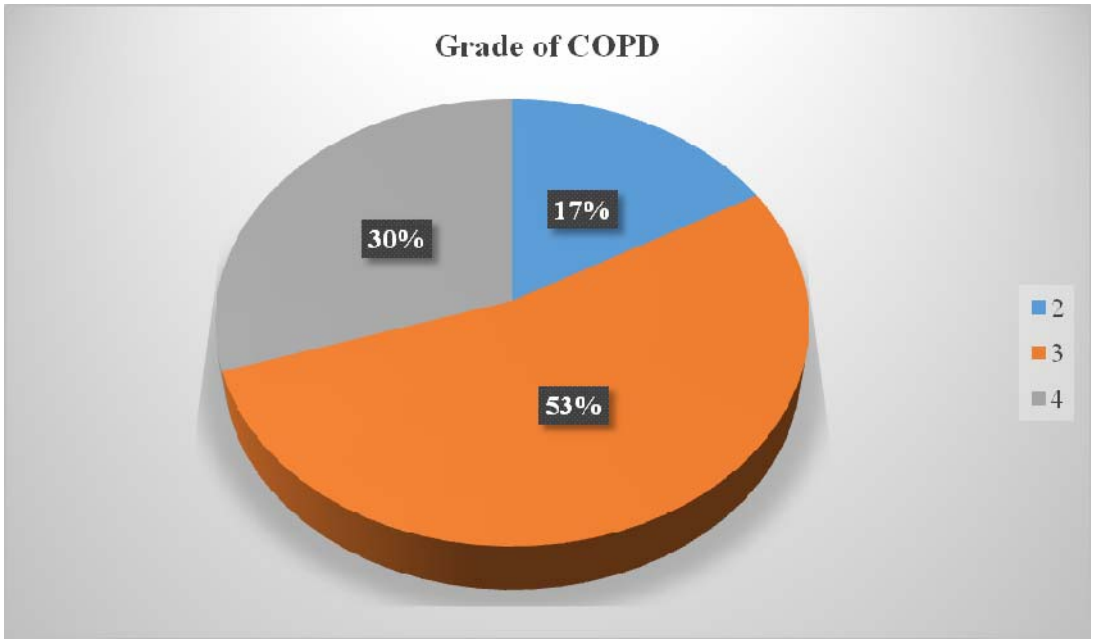


Figure 13: Pie diagram showing Grade of COPD

8. BMI of the COPD Subjects

Table 11: BMI of the COPD Subjects

		Frequency	Percent
BMI	**<18.5**	27	45.0
	18.5to 24.9	26	43.3
	>25	7	11.7
	Total	60	100.0

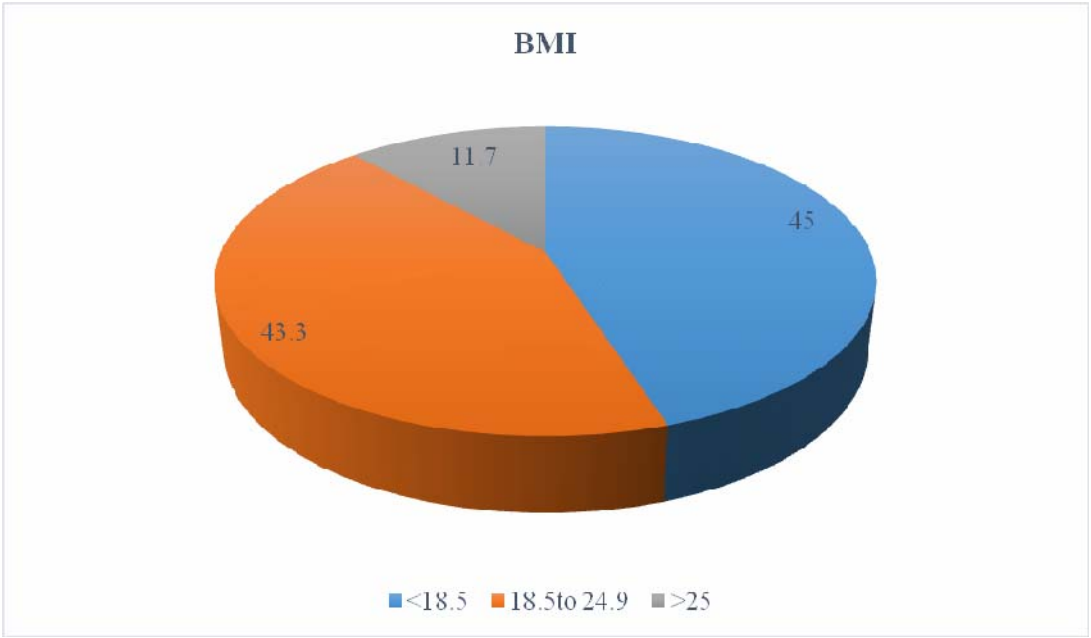


Figure 14: Pie diagram showing BMI among COPD subjects

9. Cyanosis in COPD subjects

Table 12: Cyanosis in COPD subjects

		Frequency	Percent
Cyanosis	**No**	48	80.0
	Yes	12	20.0
	Total	60	100.0

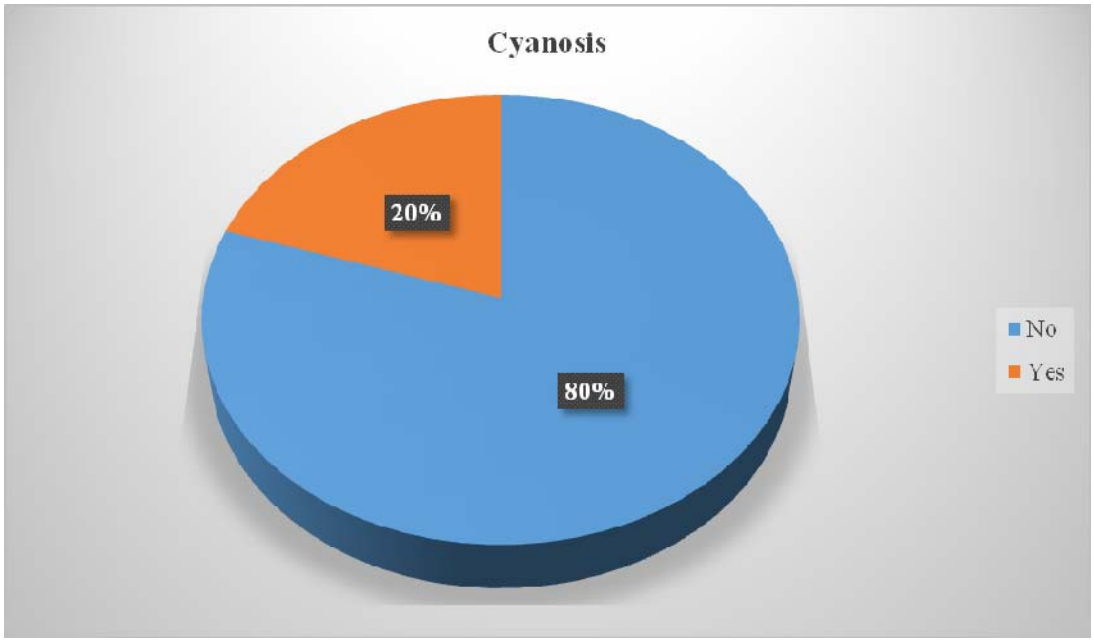


Figure 15: Pie diagram showing Cyanosis in COPD subjects

10. Total Leucocyte count among COPD subjects

Table 13: Total Leucocyte count among COPD subjects

		Frequency	Percent
Total Leucocyte count	**4000 to 11000 Normal**	35	58.3
	>11000 Leucocytosis	25	41.7
	Total	60	100.0

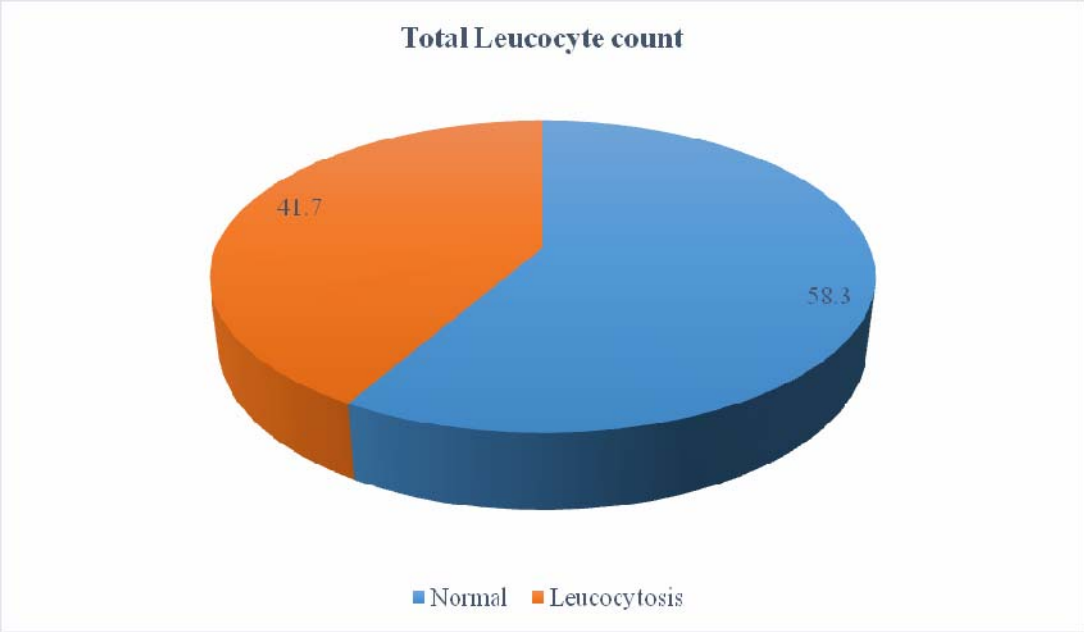


Figure 1: Pie diagram showing Leucocyte count in COPD subjects

11. Neutrophil count in COPD subjects

Table 14: Neutrophil count in COPD subjects

		Frequency	Percent
Neutrophil	**Normal**	36	60.0
	Neutrophilia	24	40.0
	Total	60	100.0

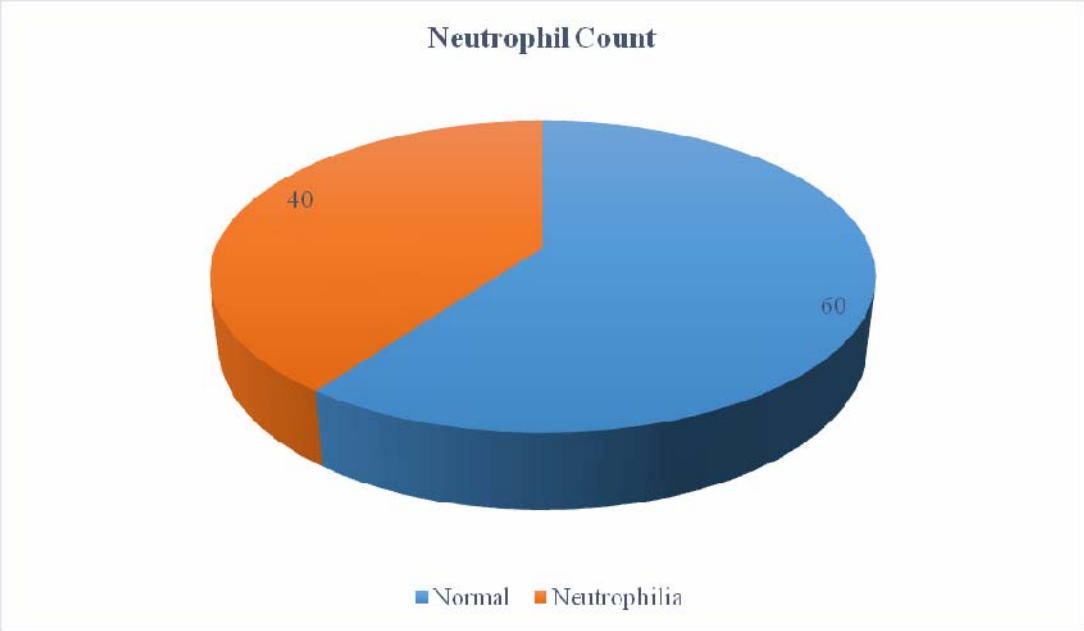


Figure 2: Pie diagram showing Neutrophil count in COPD subjects

12. Percentage predicted FEV1 in COPD subjects

Table 15: Percentage predicted FEV1 in COPD subjects

		Frequency	Percent
Percentage predicted FEV1	**50 to 80**	11	18.3
	30 to 50	31	51.7
	<30	18	30.0
	Total	60	100.0

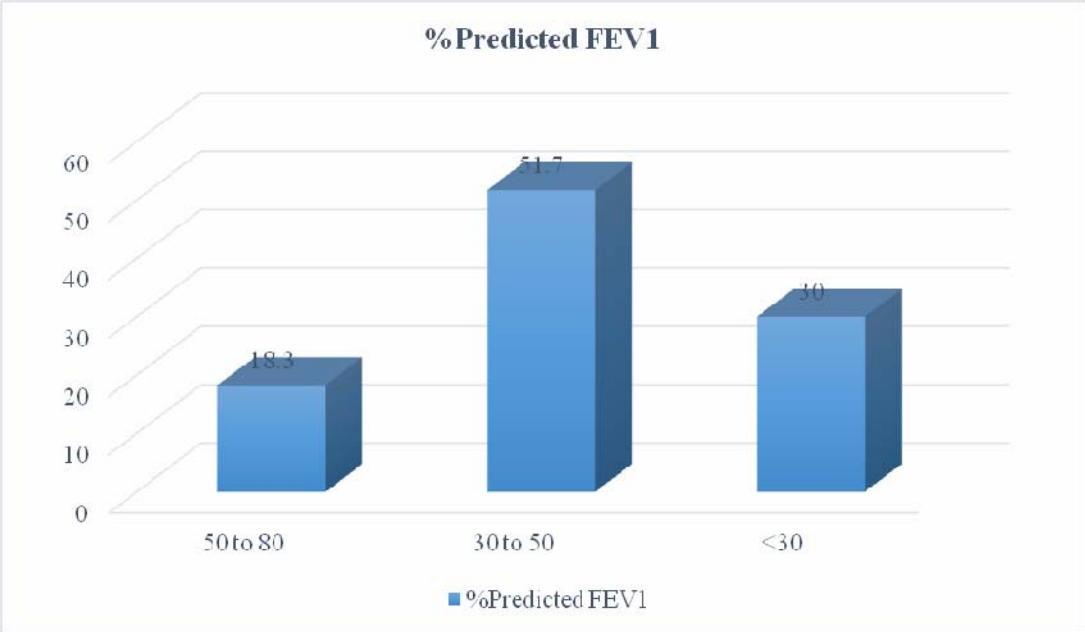


Figure 3: Bar diagram showing %Predicted FEV1 among COPD subjects

13. Scheduled Hospital visits among COPD subjects

Table 16: Scheduled Hospital visits among COPD subjects

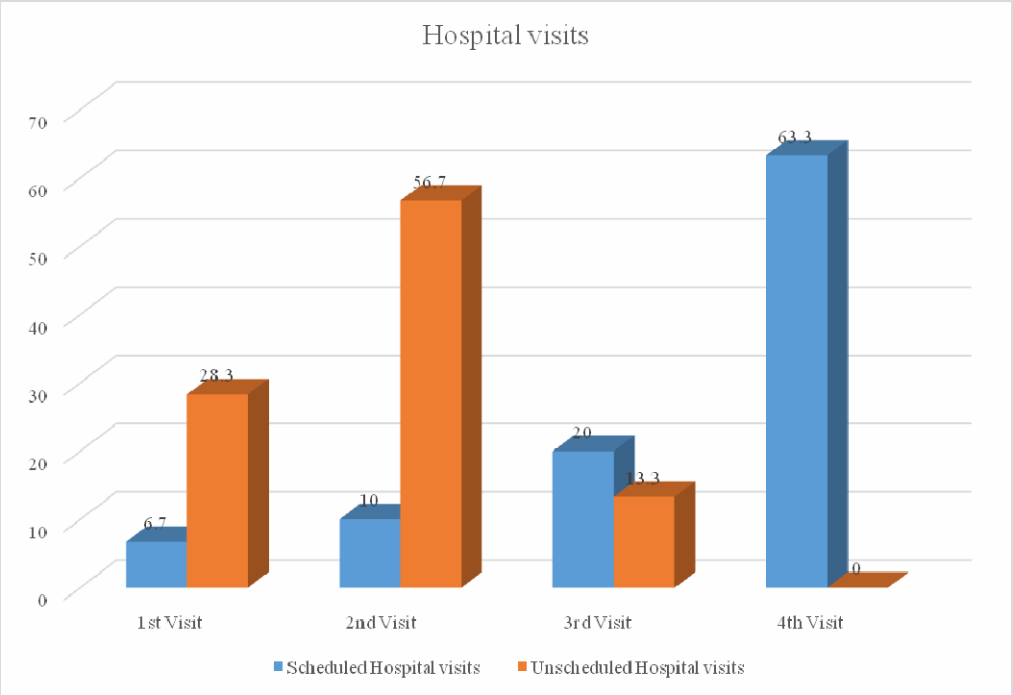
	Frequency (n=60)	**Percent**
1st Visit	4	6.7
2nd Visit	6	10.0
3rd Visit	12	20.0
4th Visit	38	63.3

14. Unscheduled Hospital visits among COPD subjects

Table 17: Unscheduled Hospital visits among COPD subjects

	Frequency (n=60)	**Percent**
1st Visit	17	28.3
2nd Visit	34	56.7
3rd Visit	8	13.3

Figure 4: Bar diagram showing Hospital visits in COPD subjects



15.Hospitalization due to COPD in the previous year

Table 18: Hospitalization due to COPD in the previous year

	Frequency (n=60)	Percent
No Hospitalization	10	16.7
Once	22	36.7
Two or More times	28	46.7

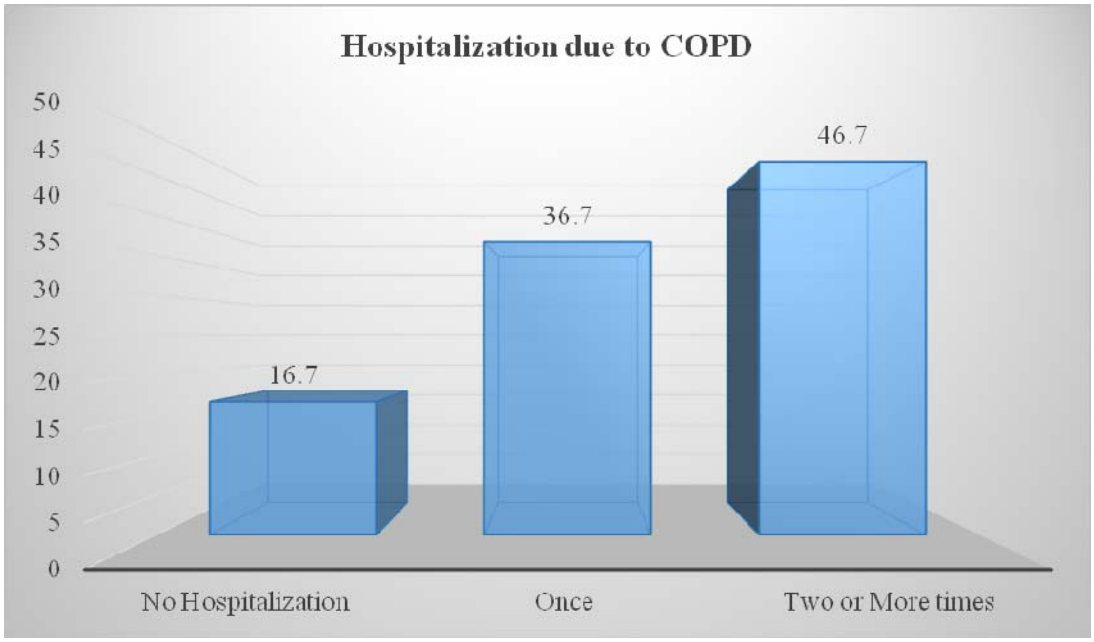


Figure 20: Bar diagram showing Hospitalization due to COPD

16. Antibiotic used among COPD subjects in the previous year

Table 19: Antibiotic used among COPD subjects in the previous year

	Frequency (n=60)	Percent
Antibiotics not used	5	8.3
Once	26	43.3
Two or More times	29	48.4

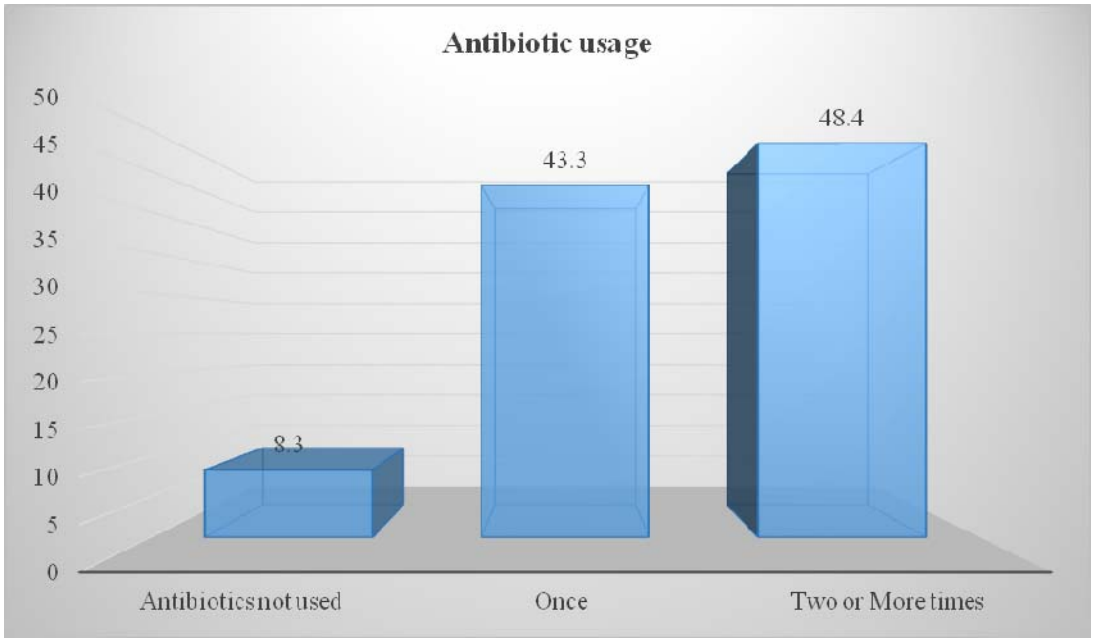


Figure 25: Bar diagram showing antibiotic usage in COPD subjects

17.Comorbidities among COPD patients

Table 20. Comorbidities among COPD patients

Comorbidities	**Frequency(60)**	**Percentage**
DM	17	28.3%
Hypertension	10	16.6%
DM and HTN	05	8.3%

18.Characteristics of COPD subjects with respect to various quantitative variables

Table 21: Characteristics of COPD subjects with respect to various quantitative variables

	Mean	**SD**
Age	66.47	10.36
BMI	20.10	3.18
Duration of Smoking in yrs	29.68	8.13
Total Leucocyte Count	10815.00	4271.69
Neutrophil Count	77.83	8.855
% Predicted FEV1	37.36	12.45
% Predicted FVC	37.26	15.61
% Predicted FEV1/FVC	49.73	11.6
Exacerbation risk score	310.7	45.5
Hospitalization risk score	126.28	31.4

Mean age of COPD subjects was 66.47 ± 10.36 yrs, mean BMI was 20.1 ± 3.18, and mean duration of smoking was 29.68 ± 8.13 yrs.

Mean % predicted FEV1 was 37.36 ± 12.45, % predicted FVC was 37.26 ± 15.61 and mean % predicted FEV1/FVC was 49.73 ± 11.6.

Mean exacerbation score was 310.7 ± 45.5 and mean hospitalization score was 126.28 ± 31.4.

19. Correlation of various quantitative parameters with Exacerbation score

Table 22: Correlation of various quantitative parameters with Exacerbation score.

	Pearson correlation coefficient (r)	**p value**
Exacerbation score	1	
Age	-0.128	0.331
Duration of Smoking	-0.013	0.924
BMI	-0.143	0.275
TLC	0.268*	0.038*
Neutrophils	0.180	0.168
Lymphocytes	-0.273*	0.035*
Eosinophils	0.098	0.456
% Predicted FEV1	0.093	0.482
% Predicted FVC	0.001	0.994
% Predicted FEV1/FVC	0.130	0.321

There was significant positive correlation between Exacerbation score and Total Leucocyte Count and significant negative correlation between Exacerbation score and Lymphocyte count.

I.e. With increase in exacerbation score there is increase in Total leucocyte count and with increase in exacerbation score there is decrease in lymphocyte count significantly.

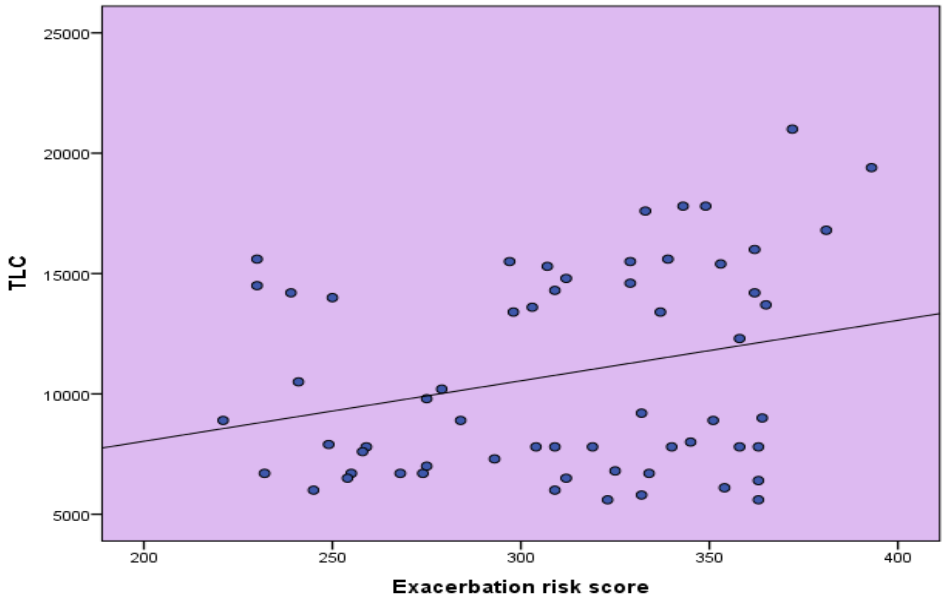


Figure 22: Scatter plot showing Positive correlation between Total leucocyte count and Exacerbation score

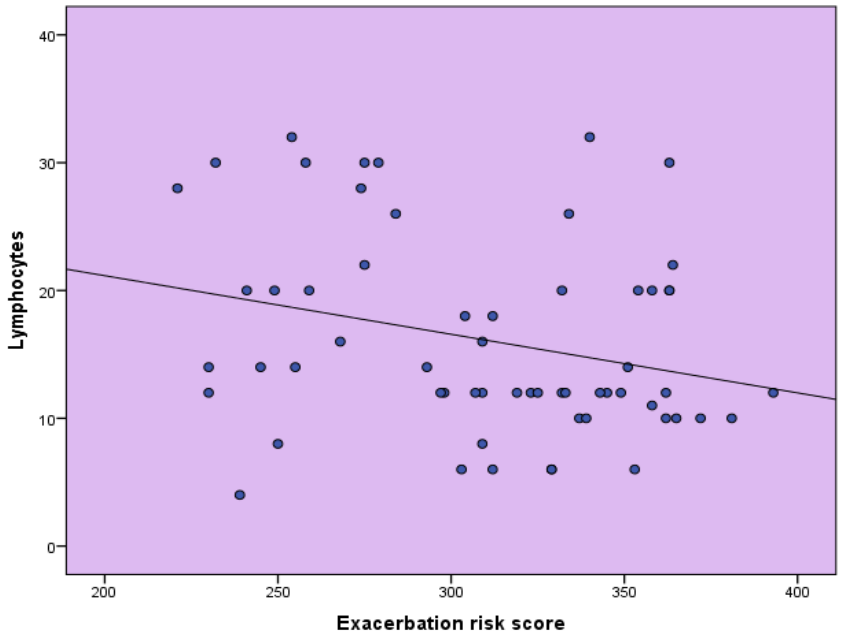


Figure 23: Scatter plot showing negative correlation between Lymphocyte count and Exacerbation score

20. Correlation of various quantitative parameters with Hospitalization score.

Table 23: Correlation of various quantitative parameters with Hospitalization score.

	Pearson correlation coefficient (r)	**p value**
Hospitalization score	1	
Age	0.217	0.096
Duration of Smoking	0.354	0.005**
BMI	0.103	0.432
TLC	-0.107	0.417
Neutrophils	-0.116	0.376
Lymphocytes	0.127	0.335
Eosinophils	0.063	0.634
% Predicted FEV1	-0.326	0.011**
% Predicted FVC	0.026	0.845
% Predicted FEV1/FVC	0.017	0.897

There was significant positive correlation between Hospitalization score and Duration of Smoking. Significant negative correlation was observed between hospitalization score and % predicted FEV1. Hence with increase in Duration there is increased risk for hospitalization and with increased hospitalization score there is decrease in % predicted FEV1.

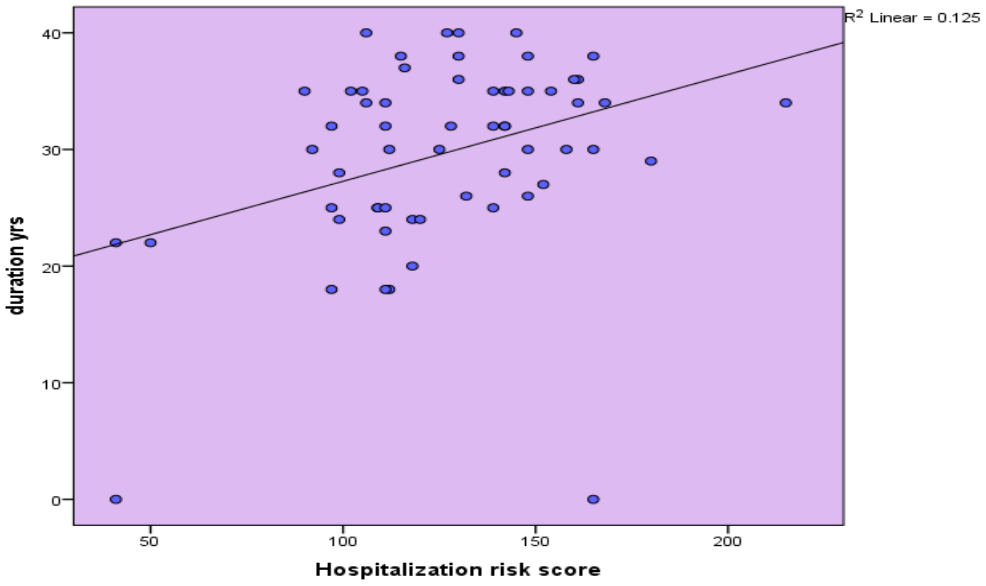


Figure 24: Scatter plot showing positive correlation between hospitalization score and duration of COPD

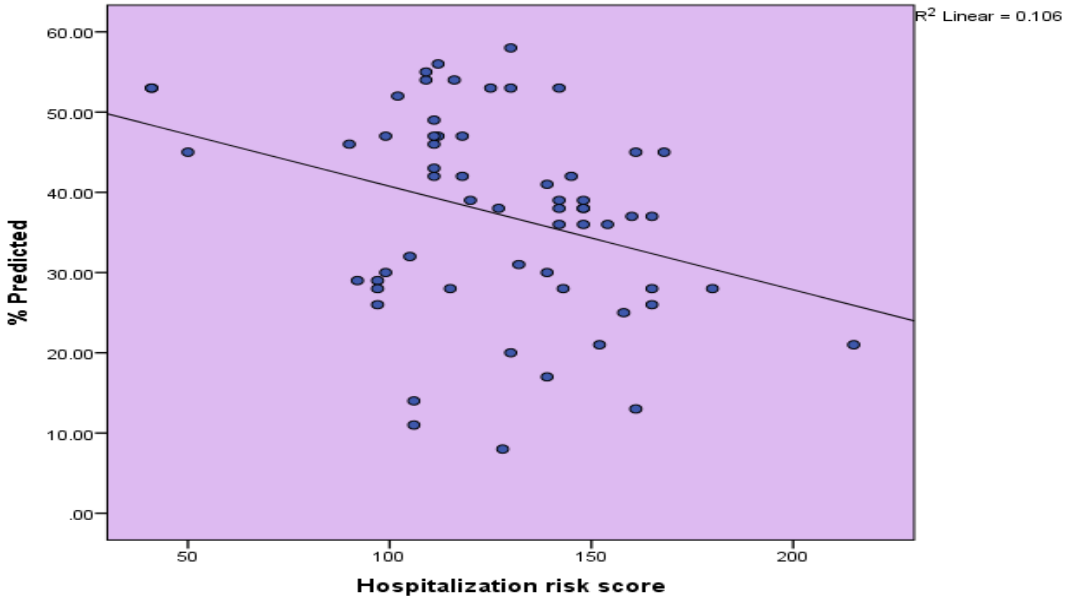


Figure 6: Scatter plot showing negative correlation between hospitalization score and % predicted FEV1

Median Hospitalization score was 127.50 and Median Exacerbation score was 315.50. Based on this the risk factors was compared for exacerbation and hospitalization score.

21. Mean difference of various quantitative data with exacerbation score

Table 24: Mean difference of various quantitative data with exacerbation score.

	Exacerbation score		**t value**	**p value**
	<315 (n=30)	**>315 (n=30)**		
Age	68.50 ± 11.87	64.43 ± 8.29	1.537	0.130
Duration of COPD in years	30.50 ± 6.19	28.87 ± 9.74	0.775	0.441
BMI	20.37 ± 2.93	19.83 ± 3.44	0.657	0.514
TLC	9950 ± 3490.6	11680 ± 4836.45	-1.589	0.118
Neutrophils	76.53 ± 9.066	79.13 ± 8.593	-1.140	0.259
Lymphocytes	17.73 ± 8.300	14.43 ± 6.694	1.695	0.095
Eosinophils	5.60 ± 2.89	6.10 ± 2.88	-0.670	0.505
% Predicted FEV1	35.86 ± 12.69	38.86 ± 12.23	-0.932	0.355
% Predicted FVC	38.8 ± 15.32	35.7 ± 16.01	0.758	0.452
% Predicted FEV1/FVC	49.17 ± 12.59	50.3 ±10.69	-0.375	0.709

It was observed that age, duration of COPD, BMI, Eosinophils, % predicted FEV1, % predicted FVC and % predicted FEV1/FVC do not have significant risk for exacerbation in COPD subjects.

22.Mean difference of various quantitative data with hospitalization score

Table 25: Mean difference of various quantitative data with hospitalization score.

	Hospitalization score		t value	p value
	<127 (n=30)	>127 (n=30)		
Age	64.90 ± 11.155	68.03 ± 9.430	-1.175	0.245
Duration of Smoking in years	27.43 ± 8.411	31.93 ± 7.306	-2.212	0.031**
BMI	19.45 ± 3.12	20.76 ± 3.15	-1.614	0.112
TLC	10493.33 ± 3901.54	11136.67± 4657.02	-0.580	0.564
Neutrophils	78.40 ± 8.45	77.27 ± 9.34	0.492	0.624
Lymphocytes	15.20 ± 6.92	16.97 ± 8.35	-0.892	0.376
Eosinophils	5.93 ± 3.08	5.77 ± 2.7	0.223	0.825
% Predicted FEV1	41.16 ± 12.15	33.56 ± 11.73	2.464	0.017**
% Predicted FVC	36.96 ± 15.05	37.56 ± 16.4	-0.148	0.883
% Predicted FEV1/FVC	49.67 ± 12.06	49.79 ± 11.31	-0.041	0.968

It was observed that duration of COPD and % predicted FEV1 have significant risk for hospitalization in COPD subjects.

These findings are similar to Correlation.

23.Multiple logistic regression predicting the hospitalization with respect to various variables

Table 26: Multiple logistic regression predicting the hospitalization with respect to various variables

Factors Predicting Hospitalization among COPD subjects

		N (%)	χ 2	p value
Age	<50 yrs	3(5.0%)	15.621	0.001**
	51 to 60 yrs	18 (30.0%)		
	61 to 70 yrs	23 (38.3%)		
	>70 yrs	16 (26.7%)		
Duration of smoking	<10yr	2 (3.3%)	11.565	0.003**
	11 to 20 yrs	4 (6.7%)		
	21 to 30 yrs	23 (38.3%)		
	31 to 40 yrs	31 (51.7%)		
BMI	18.5to 24.9	26 (43.3%)	22.703	0.0001***
	<18.5	27 (45.0%)		
	>25	7 (11.7%)		
TLC	4000 to 11000 Normal	35 (58.3%)	0.000	0.994
	>11000 Leucocytosis	25 (41.7%)		

Neutrophils	Normal	36 (60.0%)	.000	0.996
	Neutrophilia	24 (40.0%)		
% Predicted FEV1	50 to 80	11 (18.3%)	12.354	0.005*
	30 to 50	31 (51.7%)		
	<30	18 (30.0%)		
Smoking	Nonsmoker	2 (3.3%)	11.690	0.003*
	Cigarette	12 (20.0%)		
	Beedi	45 (75.0%)		
	Both	1 (1.7%)		
Grade of COPD	Grade 2	10 (16.7%)	.000	0.996
	Grade 3	32 (53.3%)		
	Grade 4	18 (30.0%)		
Antibiotics used	No Antibiotics	6 (10.0%)	.314	0.575
	One course	26 (43.3%)		
	Two or more courses	28 (46.7%)		
Exacerbation score	<315	30 (50.0%)	2.513	0.113
	>315	30 (50.0%)		

In the study it was observed that Age, smoking and Duration of Smoking, BMI, percentage of predictive FEV can predict the Hospitalization among COPD subjects.

DISCUSSION:

In the present study 60 cases were selected on the basis of simple random sampling method from the Medical Wards, Sri R L Jalappa Hospital and research Center, attached to Sri Devaraj Urs Medical College, Tamaka, Kolar.

COPD is a disease of late adulthood. As the age advances the lung function (FEV1) declines and other risk factors add to the disease process. In this study majority of the patients were in the age group of 61 - 70yrs i.e. 38.3%, followed by 30% between 51 to 60 yrs and 26.7% above 70yrs. In the present study mean age is 66.47±10.36.in other study conducted by Albert D et al the mean age group is 64.0± 19.00. In a study by Thiruvengadam KV[42] et al, Kamat SR[43] et al and VK Singh[44] et al. study group had mean age of 55.0±18.00, 50.0±20.20, and 52.0±20.00 respectively.

COPD is a male dominant disease; the high prevalence in them is due to higher prevalence of smoking, also they are more susceptible to smoking than females.[62] In this study majority were males i.e 58(96.7%) and 2(3.3%) were females. In a study conducted by VK Singh[44] et al male patients were 94.6 %and females were 5.4%. Similar results were seen in Thiruvengadam KV[42] et al and Kamat SR[43] et al where male patients were 87 % and 88.8% respectively and female patients were 13 % and 11.2 % respectively.

Chronic productive cough is usually the first symptom of COPD. Dyspnoea is the reason for which most patients seek medical attention. Wheezing, fever and chest tightness are relatively nonspecific symptoms. In this study cough with

expectoration was present in all the patients . 20% of subjects presented with fever. In a study by Thiruvengadam KV et al and Kamat SR et al all the subjects in study group had cough with expectoration.

Smoking is the primary risk factor for copd. In this study it was observed that 96.7% of COPD subjects were smokers and 3.3% of them were nonsmokers. All the male patients had history of smoking. Majority i.e. 75% were using Beedi ,20% Cigarette and 1.7% both cigarette and Beedi majority of the patients i.e 31(51.7) smoked for about 31 to 40 years , followed by 23(38.3%) patients who smoked for about 21-30 years. In a study conducted by Thiruvengadam KV et al all the male patients had history of smoking.

There were two females in the present study group. Though they were non smokers, both of them were exposed to smoke of fuels. In this part of the country, cooking is predominantly by using wood and cow dung. This is possibly a strong risk factor for development of COPD among female patients.[17]

Cyanosis which indirectly indicates increased $PaCO_2$ levels has been observed in 20 patients which account for 20%. In studies done by Kessler et al and Lau et al Increased $PaCO_2$ has proved to be an independent predictive factor for hospital admission.[45,46] In another study by Garcia-Aymerich et al it was reported that $PaCO_2$ to be a significant factor in the univariate analysis for hospitalization following an exacerbation of COPD.[47]

In this study majority of the patients 27(45%) were found to low BMI below 18.5kg/mt^2 and 7(11.7%) patients have BMI more than 25kg/mt^2. Weight loss is one of the extra pulmonary complication of the COPD. In studies conducted by Kessler et al, Garcia-Aymerich et al there is an association between low BMI and hospitalizations.[45,47]

COPD hospitalizations in the prior year was found to be associated with risk of rehospitalizations . In this study 28(46.7%) patients had more than 2 hospitalizations due to COPD exacerbation. In studies conducted by Garcia-Aymerich et al and Connolly et al more than three COPD admissions the prior year associated with an increased risk of readmission.[47,48]

In some studies use of long-term home of supplemental oxygen (LTOT) was independently associated with admission or shorter time to first readmission for acute exacerbations of COPD

In this study majority of the patients i.e 49(81.7%) have percentage of predicted FEV_1 less than 50%. Hospitalizations due to exacerbation of COPD were associated with impairment of PEFR and FEV_1. The consistent and important association of decreased FEV1 during frequent exacerbations is well known. A low FEV_1 is also a pre-eminent risk factor for mortality from COPD in most epidemiological studies. There was significant positive correlation between Hospitalization score and Duration of Smoking. Significant negative correlation was observed between hospitalization score and % predicted FEV1(p value 0.011). Hence

with increase in Duration of smoking there is increased risk for hospitalization and with increased hospitalization score there is decrease in % predicted FEV1.

Bacterial infection is one of several important causes of COPD exacerbations that may coexist. In this study 25 (41.7%) patients have an elevated leucocyte count which indicates infection. Elevated neutrophil count is seen 24(40%) patients . There was significant positive correlation(p value – 0.038) between Exacerbation score and Total Leucocyte Count and significant negative correlation(p value- 0.035) between Exacerbation score and Lymphocyte count. i.e, with increase in exacerbation score there is increase in Total leucocyte count and with increase in exacerbation score there is decrease in lymphocyte count significantly.

In the present study after Multiple logistic regression with respect to various variables factors predicting Hospitalization among COPD subjects , strong risk factors in predicting the AECOPD hospitalizations are Age, percentage of predicted $FEV_{1,}$ Duration of Smoking, BMI.

CONCLUSION

Computerized spirometry is a very useful investigation in the diagnosis of chronic obstructive pulmonary disease. Forced expiratory volume in the first second (FEV1) is an important parameter to diagnose as well as to assess the severity of the disease. The mean age group was 66.47 years.

There was significant positive correlation between Exacerbation score and Total Leucocyte Count and significant negative correlation between Exacerbation score and Lymphocyte count.

There was significant positive correlation between Hospitalization score and Duration of Smoking. Significant negative correlation was observed between hospitalization score and percentage of predicted FEV1. Hence with increase in Duration there is increased risk for hospitalization and with increased hospitalization score there is decrease in predicted FEV1.

Age, percentage of predicted FEV1, Duration of Smoking, BMI are the main predictive risk factors for hospitalizations due to AECOPD.

SUMMARY

60 patients of COPD patients were studied.

Computerized spirometry is the most sensitive investigation in diagnosing and assessing the severity of the disease.

Majority of the patients were in the age group of 61-70 years.

COPD is more common in males.

All male patients were smokers and average duration of smoking is 29.68yrs and all female patients had history of exposure to fuel smoke. •

Majority (51.7%) of the patients had severe airflow limitation (Stage11 -FEV1 30-50%)

Age, smoking and duration of Smoking , low predicted FEV_1 values, BMI are the main risk factors which are useful in predicting the hospitalizations due to COPD exacerbations.

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ANNEXURES

PROFORMA

STUDY OF RISK FACTORS FOR EXACERBATIONS AND HOSPITALIZATIONS DUE TO COPD

NAME
AGE
SEX
OCCUPATION
ADDRESS
IP NO
DOA
DOD

PRESENTING COMPLAINTS

1. Cough with or with out expectoration
2. Breathlessness
3. Wheezing
4. Chest pain
5. Hemoptysis
6. Fever
7. Any other symptom

PAST HISTORY: history of similar complaints, History of TB, asthma, epilepsy, cardiac illness, ischemic heart disease, DM, Hypertension.

FAMILY HISTORY:

History of asthma, tuberculosis, allergic disease,
Number of family members smoking
Exposure to smoke

PERSONAL HISTORY:
HABITS:
SMOKING: CIGARETTES/ BEEDIS
DURATION: LESS THAN 10 YEARS
10 - 20YEARS
20 - 30 YEARS
MORE THAN 40 YEARS
QUANTITY
EXPOSURE TO BURNT FUILS
CURRENT OR EX SMOKER
TOBBACO CHEWING
SNIFF INHALATION

ALCOHOL
OCCUPATIONAL EXPOSURE TO DUST/ FUMES / CHEMICALS

GENERAL PHYSICAL EXAMINATION
Comfortable / dyspnoea
Build: well/moderate/poorly build
Nourishment: well-nourished/moderate/poorly
Weight: height:
Body mass index

VITAL SIGNS
Pulse
Blood pressure
Respiratory rate
Temperature

Pallor
Cyanosis
Clubbing
Koilonychia
Icterus
lymphadenopathy

SYSTEMIC EXAMINATION :

Respiratory system
Cardiovascular system
Perabdomen
Cns

INVESTIGATIONS:

Complete blood count
Renal function test
RBS
Urine routine
Spirometry

QUESTIONNAAIRE:

1. AGE:
2. CURRENT SMOKER:
3. DURATION OF COPD DIAGNOSIS:
4. PREDICTED FEV1 AND FEV1/FVC:
5. BODY MASS INDEX (kg/m^2):
6. HOME OXYGEN USE:
7. SCHEDULED HOSPITAL VISITS FOR COPD IN THE PRIOR YEAR

- 1 VISIT
- 2 VISIT
- 3 VISIT
- 4 VISIT

8. UNSCHEDULED HOSPITAL AND EMERGENCY DEPARTMENT VISITS IN PRIOR YEAR

- 1 VISIT
- 2 VISIT
- 3 OR MORE

9. COPD HOSPITALIZATIONS PRIOR YEAR

- NO HOSITALIZATION
- 1 TIME
- 2 OR MORE

10. ANTIBIOTICS FOR COPD PRIOR YEAR

- NO COURSE
- 1 COURSE
- 2 COURSE

11. MEDICATIONS AT ENTRY

12. COMORBIDITIES

EXACERBATION RISK SCORE

VARIABLES	**POSSIBLE POINTS**	**INDIVIDUAL AND TOTAL SCORES**	
AGE,YEAR			
<45	0		
45-54	20		
55-64	40		
65-74	60		
75-84	80		
>=85	100		
PERCENTAGE OF PREDICTED FEV1			
10-19	75		
20-29	66		
30-39	56		
40-49	47		
50-59	38		
60-69	28		
THEOPHYLLINE AT ENTRY	26		
PRODUCTIVE COUGH	31		

COPD DURATION, YEAR			
1	0		
2	5		
3	9		
4	14		
5	19		
6	23		
7	28		
8	33		
ONE OR MORE ANTIBIOTIC COURSES FOR COPD IN PRIOR YEAR	63		
SYSTEMATIC STEROID COURSES FOR COURSE IN PRIOR YEAR			
1	39		
2 OR MORE	70		
ONE OR MORE HOSPITAL	24		
ADMISSION FOR COPD IN PRIOR YEAR			
TOTAL			

HOSPITALIZATION RISK SCORE

VARIABLE	POSSIBLE POINTS	INDIVIDUAL AND TOTAL SCORE
AGE, YEARS		
<70	0	
70-74	12	
75-79	23	
80-84	35	

>=85	46	
PERCENTAGE OF PREDICTED FEV1		
10-19	89	
20-29	78	
30-39	67	
40-49	56	
50-59	44	
60-69	33	
ORAL STEROIDS AT ENTRY	22	
ONE OR MORE CVS MORBIDITY	28	
UNSCHEDULED CLINICAL FOR ED VISITS FOR COPD PRIOR YEAR		
1	3	
2 OR MORE	24	
ONE OR MORE HOSPITAL ADMISSION FOR COPD PRIOR	40	
TOTAL		

KEY TO MASTER CHART

M	MALE
F	FEMALE
YRS	YEARS
BMI	BODY MASS INDEX
Y	YES
N	NO
TLC	TOTAL LEUCOCYTE COUNT
DLC	DIFFERENTIAL LEUCOCYTE COUNT
N	NEUTROPHIL
L	LYMPHOCYTE
M	MONOCYTE
PFT	PULMONARY FUNCTION TEST
FEV_1	FORCED EXPIRATORY VOLUME
FVC	FORCE VITAL
SA	SHORT ACTING
LA	LONG ACTING
ICS	INHALATIONAL CORTICO STEROIDS
OS	ORAL STEROIDS
THEOPHYL	THEOPHYLLINE
DM	DIABETES MELLITUS
HTN	HYPERTENSION

MASTER CHART

S.NO:	Name	Age	sex	IP No:	COMPLAINTS				Smoking Habbits			Alcohol	BMI	Cyanosis	Clubbing	Investigations				PFT - SPIROMETRY							grading of copd	Current Smoker	Home oxygen	Scheduled hospital visits for COPD in the prior year				Unscheduled hospital and emergency department visits in prior year			COPD Hospitalizations prior year			Antibiotics for COPD prior year			Medications at entry					EXACERBATION		HOSPITALISATION		COMORBIDITIES	Exacerbation risk score	Hospitalization risk score
					Cough	Expectorations	Breathlessness	Fever	Cigarette	Beedi	duration yrs)					TLC	DLC			FEV1			FVC			FEV1/ FVC	1/2/3/4			1 VISIT	2 VISIT	3 VISIT	4 VISIT	1 VISIT	2 VISIT	3 OR MORE VISIST	No Hospitalization	1 time	2 or more	No course	1course	2course	SA	LA	ICS	OS	THEOPHYL	1ST	2 OR MORE	1ST	2 OR MORE			
																	N	L	E	Predicted	Actual	% Predicted	Predicted	Actual	% Predicted	% Predicted																											
1	FAZLUR REHMAN	60	M	11745	P	P	P			Beedi	32	N	21.4	Y		7300	76	14	10	2.5	1.06	43	2.42	0.59	22	45	3		Y	*					*			*		*			*	*	*		*		*		*	DM	293	111
2	KARYAKARTHAN	69	M	12345	P	P	P	A		Beedi	38	Y	17.6	N		7800	60	32	8	1.67	1.02	58	3.12	1.32	41	55.7	3		N	*					*			*		*			*	*	*		*		*		*	DM	340	130
3	CHINNAPPA	65	M	76	P	P	P	A		Beedi	32	N	17.5	N		5600	74	20	6	2.46	0.96	39	2.5	0.6	23	30.7	3		N				*			*			*			*	*	*		*		*		*		363	142
4	ALLAH BAKSH	60	M	942605	P	P	P	P		Beedi	38	N	23.5	Y		17800	86	12	2	1.47	0.56	38	3.19	1.35	42	40.3	3		Y				*			*			*			*	*	*				*		*	DM/HTN	343	148
5	THAPPANNA	65	M	16021	P	P	P	A		Beedi	25	Y	18	N		5600	78	12	10	2.14	1.06	49	2.72	0.74	26	61.8	3		N				*			*			*			*	*	*		*		*		*		323	111
6	VENKATESHAPPA	63	M	6553	P	P	P	P		Beedi	25	N	19	N		13600	90	6	4	2.75	1.06	41	2.4	0.38	16	66.4	3		N				*			*			*			*	*	*				*		*	DM	303	139
7	BASHA	77	M	18405	P	P	P	A	Cigarette		40	N	24.5	N		9000	68	22	10	2.32	0.98	42	2.25	0.93	41	32.2	3		N	*					*			*				*		*	*			*		*		364	145
8	SRINIVAS	65	M	40142	P	P	P	P	Cigarette		25	N	19.5	N		14300	90	8	2	2.41	1.31	54	2.09	0.73	35	63.6	2		N				*	*				*				*		*	*	*		*		*		HTN	309	109
9	VENKATESHAPPA	65	M	41480	P	P	P	A		Beedi	27	N	17.4	N		6400	64	30	6	1.75	0.37	21	2.17	1.16	53	45.7	4		N	*				*			*			*			*	*	*		*		*			363	152
10	VENKATA REDDY	60	M	35440	P	P	P	P	Cigarette		20	N	25.4	Y		15600	84	14	2	1.63	0.68	42	2.17	0.72	33	39.1	3		Y				*	*				*			*			*	*	*	*	*		*			230	118
11	CHIKKAMUNIYAPPA	80	M	41487	P	P	P	A		Beedi	37	N	18	N		8900	66	28	6	1.35	0.73	54	2.28	0.46	20	28.2	2		N		*			*			*			*			*				*		*	DM	221	116
12	THIPPANNA	90	M	21865	P	P	P	A		Beedi	40	N	18.8	N		8900	68	26	8	2.78	1.05	38	2.18	1.2	55	60.5	3		N				*	*				*			*			*		*		*		*			284	127
13	SIVANESHAN	74	M	937266	P	P	P	P	Cigarette		32	N	26.4	N		21000	86	10	4	2.48	0.74	30	2.52	1.32	52	48	3		N		*			*			*			*			*		*		*		*	HTN	372	139
14	DODDA REDDY	70	M	31575	P	P	P	A		Beedi	34	Y	16.5	N		7800	64	20	6	2.53	1.19	47	2.25	0.89	40	49.84	3		Y				*			*			*			*	*	*				*		*		363	111
15	HARSHAVARDHAN	95	M	9629	P	P	P	A	Cigarette		35	N	19.9	N		7800	78	20	2	2.54	0.71	28	2.99	1.26	42	53.8	4		N				*			*			*			*	*	*				*		*	DM	259	143
16	VIJAY KUMAR	58	M	34479	P	P	P	P	Cigarette		32	N	26.5	N		16000	88	10	2	2.92	1.06	36	2.44	1.09	44	50.4	3		N	*						*			*			*	*	*				*		*		362	142
17	NARAYANAPPA	72	M	791766	P	P	P	A		Beedi	24	N	26.3	N		14200	92	4	4	2.48	0.74	30	2.44	1.09	44	27.2	3		N				*		*			*			*			*	*	*				*		*		239	99
18	NANJUNDAPPA	66	M	32509	P	P	P	A		Beedi	18	N	17	N		7800	80	18	2	2.38	1.38	56	2.6	1.47	56	50.5	2		N	*				*			*			*			*	*	*				*		*	DM	304	112
19	RAMAPPA	48	M	23547	P	P	P	A		Beedi	24	N	19	N		6700	76	14	10	2.01	0.95	47	2.59	0.55	21	60.1	3		Y				*	*				*			*			*	*	*				*		*		255	118
20	NANJAMMA	80	F	916884	P	P	P	P	NON SMOKER			N	25.9	Y		17600	84	12	4	2.6	0.67	26	2.5	0.75	10	60.3	4		N				*			*			*			*	*	*	*	*	*	*		*	HTN	333	165
21	JAYASHANTAVEERA	70	M	943773	P	P	P	A		BEEDI	30	N	17.4	Y		9800	70	22	8	2.01	0.95	47	2.47	1.16	47	57.5	3		Y				*		*			*			*			*	*	*	*			*		*		275	112
22	NANJUNDA GOWDA	66	M	31119	P	P	P	A		BEEDI	22	Y	16.9	Y		14000	86	8	6	1.92	0.86	45	2.62	1.26	48	55.2	3		Y				*		*			*			*			*	*	*		*		*		DM	250	50
23	MOHD ILIYAZ	55	M	8615	P	P	P	A	CIGARETTE		22	N	24.5	Y		10500	76	20	4	2.54	1.34	53	2.67	0.42	16	21.5	2		Y	y				*			*			*			*		*		*		*			241	41
24	NANJAPPA	65	M	45462	P	P	P	A		BEEDI	25	N	17	N		7900	78	20	2	1.97	0.65	26	2.65	1.4	52	41.6	4		N				*	*				*			*			*		*		*		*	DM	249	97
25	PAPIREDDY	60	M	46752	P	P	P	P		BEEDI	24	Y	17.4	N		15400	90	6	4	2.5	0.96	39	1.82	0.14	8	44.5	3		N				*	*				*			*			*		*		*		*	DM/HTN	353	120
26	MOHD AKBAR	60	M	36303	P	P	P	A		BEEDI	26	N	24.9	N		6700	64	26	10	2.86	1.12	39	2.18	1.2	55	58.4	3		Y				*		*			*			*			*	*	*				*		*		334	148
27	OBULAPPA	46	M	48077	P	P	P	A		BEEDI	23	Y	18.9	N		6700	62	28	10	2.66	1.23	46	2.57	1.32	51	59	3		N	y				*			*			*			*		*			*		*	DM	274	111
28	VENKATARAMANAP	66	M	500045	P	P	P	A		BEEDI	25	N	17.9	N		16800	84	10	6	2.78	1.85	55	2.43	1.27	52	63.6	2		Y			*	*		*			*			*			*	*					*		*	DM/HTN	381	109
29	HOWDEGOWDA	54	M	49430	P	P	P	A		BEEDI	18	N	19.3	N		6100	70	20	10	1.83	0.78	42	2.38	0.48	20	38.3	3		N			*		*				*			*			*	*					*		*		354	111

MASTER CHART

30	VENKATESHAPPA	85	M	47257	P	P	P	A		BEEDI	38	Y	18	N		6000	76	12	6	2.98	0.86	28	2.31	1.1	47	40.1	4		N				*		*			*			*		*	*					*		*	DM	309	115
31	VENKATARAYAPPA	85	M	48179	P	P	P	A		BEEDI	35	N	17.5	N		7800	74	16	10	2.4	0.77	32	1.31	0.59	45	54.9	3		N				*		*			*			*		*	*			*		*				309	105
32	MOHAMMED ZAKIR	45	M	47769	P	P	P	A		BEEDI	18	N	26.4	N		5800	78	20	2	1.6	0.46	29	2.4	0.77	32	60.9	4		Y				*	*				*			*		*	*			*	*		*		HTN	332	97
33	MOHA	70	M	48461	P	P	P	A		BEEDI	36	N	21.7	N		6500	80	18	2	1.28	0.47	37	3.82	2.19	57	39.9	3		Y				*		*			*			*		*		*		*		*		*	DM/HTN	312	160
34	H. MUNIKRISHNA	60	M	49382	P	P	P	P		BEEDI	35	N	23.5	N		15300	82	12	6	1.56	0.59	38	2.57	0.34	13	30.9	3		Y				*		*				*			*	*		*		*		*		*		307	148
35	MUNIYAPPA T	56	M	50696	P	P	P	A		BEEDI	35	N	16.7	N		7800	74	20	6	2.2	0.83	38	2.45	0.18	7	57.2	3		N				*		*			*			*		*	*		*	*		*		*	HTN	358	142
36	MUNIYAPPA	70	M	51503	P	P	P	P		BEEDI	26	N	20	N		19400	80	12	8	1.88	0.59	31	2.65	1.4	52	52.8	3		N			*			*				*			*	*	*	*		*		*		*	DM	393	132
37	SUBRAMANI	80	M	51840	P	P	P	A		BEEDI	34	N	20.3	N		6700	78	16	6	2	0.41	21	2.65	1.25	47	45.6	4		N				*		*			*			*		*	*	*		*		*		*		268	215
38	VENKATARAMAYYA	59	M	51836	P	P	P	A		BEEDI	34	N	17.4	N		13400	86	10	4	1.83	0.25	14	2.45	1.25	51	55.7	4		N			*			*				*			*	*	*	*				*		*		337	106
39	CHANDRAPPA	65	M	1706	P	P	P	A		BEEDI	36	N	24.7	N		7600	64	30	6	2.14	0.42	20	2.57	0.34	13	67.9	4		N				*		*			*			*				*				*		*	DM	258	130
40	NARAYANAPPA	58	M	109169	P	P	P	A		BEEDI	32	Y	18.8	N		14800	84	6	10	2.19	0.17	8	3.82	2.19	57	64.7	4		N				*		*				*			*	*		*				*		*		312	128
41	DODDANARAYANAI	63	M	58644	P	P	P	A		BEEDI	36	N	18.3	Y		6500	58	32	10	1.09	0.14	13	3.17	1.6	50	40.3	4		Y				*					*			*		*	*			*		*		*		254	161
42	VARADHAPPA	60	M	60160	P	P	P	A		BEEDI	40	N	18.9	N		14600	90	6	4	1.52	0.16	11	2.06	0.91	44	61.8	4		N				*	*					*			*	*	*		*	*		*		*	DM	329	106
43	HRUDHAYANANDH	82	M	59766	P	P	P	A		BEEDI	34	Y	19.5	Y		6000	80	14	6	1.93	0.86	44.7	2.31	1.1	47	67.2	3		Y				*	*				*			*		*		*		*		*		*		245	168
44	HYDERALI	60	M	947279	P	P	P	A		BEEDI	32	N	18	N		6800	78	12	10	1.68	0.48	28	2.38	0.48	20	32.2	4		N				*		*				*			*	*	*	*		*		*		*	HTN	325	97
45	VENKATAPPA	55	M	941186	P	P	P	P		BEEDI	35	Y	17.2	N		17800	86	12	2	1.87	0.98	52	2.45	1.27	52	63.6	2		N				*		*			*			*		*	*	*		*	*		*		DM	349	102
46	MUNIVENKATAPPA	65	M	3020	P	P	P	A		BEEDI	34	N	17.3	N		8900	76	14	10	1.31	0.59	45	2.57	1.32	51	63.3	3		N			*			*				*			*	*	*	*		*		*		*		351	161
47	KRISHNAPPA	69	M	3072	P	P	P	A		BEEDI	35	N	19	Y		14500	84	12	4	2	0.33	17	2.18	0.9	41	45.7	4		Y				*		*				*			*	*	*			*		*		*		230	139
48	VENKATESHAPPA	55	M	68887	P	P	P	A			28	Y	20.8	N		7800	78	12	10	2.53	1.19	47	1.82	0.14	8	39.1	3		N			*			*				*			*	*	*	*			*		*		HTN	319	99
49	RAMESH	53	M	41668	P	P	P	A			29	N	20.7	N		13400	82	12	6	2.54	0.71	28	2.67	0.42	16	48	4		N				*		*			*			*		*		*				*		*	DM/HTN	298	180
50	RAMAPPA	63	M	937865	P	P	P	A			30	Y	24	N		6700	68	30	2	2.92	1.06	36	2.62	1.26	48	49.84	3		N				*		*				*			*	*	*	*				*		*		232	148
51	BYAMMA	65	F	979925	P	P	P	A	NON SMOKER		34	N	17.7	Y		15600	86	10	4	2.56	1.36	53	2.47	1.16	47	53.8	2		Y				*		*				*			*	*	*					*		*	HTN	339	41
52	SRINIVAS GOWDA	57	M	980380	P	P	P	A	cig		30	N	23.1	N		12300	84	11	5	2.54	0.66	25	2.5	0.75	10	50.4	4		N			*			*			*			*		*	*					*		*		358	158
53	PAPANNA	73	M	978060	P	P	P	A		beedi	35	N	18.2	N		8000	78	12	10	2.92	1.06	36	2.59	0.55	21	27.2	3		N			*			*				*			*	*		*				*		*	DM	345	154
54	VENKATESHAPPA	70	M	980709	P	P	P	A		beedi	28	N	17.3	N		15500	90	6	4	2.56	1.36	53	2.44	1.09	44	60.4	2		N			*			*				*			*	*		*				*		*		329	142
55	GANGI REDDY	75	M	979925	P	P	P	A	cig		30	N	17.5	N		9200	80	12	8	2.54	1.34	53	2.44	1.09	44	50.5	2		Y			*			*			*					*		*				*		*	HTN	332	125
56	KRISHNA GOWDA	65	M	947326	P	P	P	A	cig		30	Y	16.8	N		13700	86	10	4	2.92	1.06	37	2.99	1.26	42	46.7	3		N			*			*				*			*	*						*		*		365	165
57	VENKARAVANAPPA	80	M	980843	P	P	P	P	cig		40	Y	18.4	N		14200	84	12	4	2.56	1.36	53	2.25	0.89	40	53.7	2		N			*			*				*			*	*						*		*	DM	362	130
58	OBUL REDDY	76	M	947865	P	P	P	A		beedi	38	N	21.4	Y		7000	64	30	6	2.54	0.71	28	2.52	1.32	52	40.3	4		Y				*		*				*			*	*		*				*		*		275	165
59	GANGAPPA	75	M	979939	P	P	P	A	cig		35	N	26.7	N		10200	64	30	6	2.62	1.23	46	2.28	0.46	20	50.4	3		N			*			*				*			*	*						*		*	HTN	279	90
60	CHOWDAPPA	70	M	985436	P	P	P	A		beedi	30	N	18.2	N		15500	86	12	2	2.48	0.74	29	2.17	1.16	53	60.2	4		N				*		*				*			*	*		*				*		*	DM	297	92