EARLY DETECTION OF COPD IN ASYMPTOMATIC SMOKERS USING SPIROMETRY

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CERTIFICATE

This is to certify that the dissertation entitled "**EARLY DETECTION OF COPD IN ASYMPTOMATIC SMOKERS USING SPIROMETRY** is a bonafide original work of **Dr.T.MOHANASUNDARAM** in partial fulfillment of the requirements of M.D General Medicine [Branch- 1] examination of THE TAMILNADU Dr. M. G. R. MEDICAL UNIVERSITY to be held in April 2015.

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DECLARATION

I Solemnly declare that the dissertation titled **"EARLY DETECTION OF COPD IN ASYMPTOMATIC SMOKERS USING SPIROMETRY"** is done by me at K.A.P.VISWANATHAM GOVT MEDICAL COLLEGE, TIRUCHIRAPPALLI under the guidance and supervision of **Prof. Dr. P.KANAGARAJ. M.D.,** This dissertation is submitted to The Tamil Nadu Dr. M.G.R. Medical University towards the partial fulfillment of requirements for the award of M.D Degree [Branch-1] in General Medicine

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CONTENTS

ABSTRACT

KEY WORDS – EARLY DETECTION,COPD,ASYMPTOMATIC SMOKERS,PFT

AIM OF THE STUDY:

Smokers with suspected COPD seek medical attention when they become dyspnoeic on mild to moderate exertion, but by than half of the ventilator reserves are lost irreversibly. Hence it seems logical to diagnose COPD early before development of significant symptoms. Since smoking cessation in COPD is found to reduce rapid decline of ventilator function in smokers and to make an attempt to quit smoking in south Indian population

MATERIALS AND METHODS:

Patients attending outpatient department at MGM Govt. Hospital attached to KAPV Govt. Medical College , Tiruchirappalli

EASY ONE spirometer

TYPE OF STUDY:

Unicentric Prospective description study.

USEFULNESS OF THE STUDY:

Chronic obstructive pulmonary disease (COPD) is a major case of chronic morbidity and mortality. Third leading cause of death in 2020Smoking cessation will improve quality of life and decrease the morbidity and mortality

INTRODUCTION

Among Non communicable diseases COPD is emerging as one of the leading cause of mortality in INDIA. The incidence and prevalence of COPD is increasing throughout the world with more population is reaching the age group,above 60 years at which the disease normally develops.

COPD is now ranked sixth among the leading cause of death worldwide according to 1990 world burden of disease study. It is also projected to become third leading cause of mortality by 2020.[1]

Prevalence of COPD in people aged more than 30 years in India is 2.7% in females and 5% in males according to meta analysis of population based study by Jindal SK et al. [2]

Smoking not only causes health hazard to individual also produces environmental tobacco smoking (ETS) to non smokers as it contaminates the atmosphere

Among various causes of COPD tobacco smoking is leading cause. Smokers often ignore the early symptoms of COPD such as cough and sputum production. Even treating physician often ignores it as normal in smokers.

Smokers seek physicians attention only when they develop mild to moderate exertional dyspnoea by the time 50% of their ventilatory reserves lost. The loss is also irreversible. [3]

Therefore it is necessary to diagnose COPD incidence earlier in smokers . Sothat measures such as smoking cessation can be initiated at appropriate time and preserve the ventilatory capacity in smokers.[4]

Post bronchodilator Spirometry remains the gold standard   for diagnosis and follow up of COPD patients .[5]

Air flow limitation is the hallmark of COPD. It is most objectively measured and reproduced by spirometry

Spirometry is best standardized and according to GOLD criteria it can categorize the severity of disease.

This study is done to detect COPD earlier in south Indian smokers and to analyze the association of age of onset, duration, pack years, smoking index and severity of disease according to GOLD criteria.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Smoking cessation dates back to 1975 when Norwegean tobacco act banned all forms of advertisements.[6]

The relationship between cigarette smoking and decline in lung function was studied by Fletcher and Peto et al in 1977 and the same was published in British medical journal in 1977 as the natural history of chronic airflow obstruction.
They published the graphical representation of smoking and smoking cessation and effects on lung function.[7]

The earlier 1977 Fletcher and Peto curve demonstrated slower decline in lung function during early stages. The curve still holds land mark in understanding the natural history of COPD.

Screening for Early detection of COPD among smokers started in Finland in 1998 through program for chronic bronchitis and COPD. In this program early detection of COPD using spirometry was done and patients were followed by smoking cessation clinics.[8]

In Swedes   study, 40 to 55-year-old inhabitants who smoked and symptomatic or non symptomatic COPD were Invited to participate in the study. The participants were given placards and subjected to have spirometry. Of the approximately 5332 eligible smokers in that area, only 512 (9.6%) responded. Out of which 73% had a normal spirometry and

27% had COPD. In this study only 40-55 years age group included. They also included already existing COPD patients. 43% males and 57% females participated in this study but female smokers are low in our country like India. 6 out of 147 participants had asthma during the study. Bronchial asthma patients are not excluded from study. Stralelis G, et al designed this study to assess a method to detect COPD at an early stage.[9]

Kohansal, Martinez-Camblor, Agustı´, et al. done The Framingham Offspring cohort which was started between 1971 and 1975 includes 5,124 males and females all of which had reliable spirometric measurements and appropriate clinical information according to internal National Heart, Lung, and Blood Institute–National Institutes of Health standards smoking increases the rate of reduction of FEV1 in both males and female. They also established that there is considerable variability in the rate of decline of pulmonary function in constant smokers, both in males (from 8 to 63 ml/yr) and females (from 14 to 49 ml/yr). However, this is the first time that a huge cohort of both males and females, with a extensive age range, is followed for up to 26 years to depict pulmonary function changes from adolescence to Old age in healthy never-smokers and to investigate the effects of smoking and smoking cessation. the results were published in American journal of respiratory and critical care medicine vol 180 2009. Limitations of this study are only four spirometry

values available for each participant and several confounders like occupational exposure and environmental tobacco smoke were not excluded.[10]

Gorecka, et al from Poland demonstrated that diagnosis of Airflow limitation shared with smoking cessation advice increased smoking cessation rate. High risk population screening for COPD have been investigated and implemented in Poland in this study out of 11027 smokers more than 40 years screened for airflow obstruction was found in 24.3% of smokers.[4]

In Lung health study (LHS), a large multi-centric study conducted in USA and Canada, spirometry screening of more than 73,000 smokers aged 35 to 60 years was performed in 10 centers. Air flow limitation was noted in 21.8% to 35.7% (mean 25%) cases and severe obstruction (FEV1 <50% of predicted) was seen in 5% of total cases. In LHS study symptomatic smokers were also included. Hence prevalence was high in that group.[11]

Zielinski et al performed a study called "Know the age of your lung study group" evaluated the usefulness of mass spirometry in detection of airflow limitation in high risk smoking population above 39 years of age. Outof 11027 subjects were screened with mean age of 51.8 ± 12.5 years. The average smoking history of 26.1 ± 16.8 pack-years (equal to smoking index of 522±336). In general obstruction was noted in 24.3% cases.

Mild obstruction was seen in 9.5%, moderate in 9.6% and severe in 5.2% subjects. Analysis of sub-groups in the study threw light that obstruction seen in 30.6% of smokers above 40 years of age. This correlate with smoking history of more than 10 pack years (equivalent to smoking index 200) .In contrary only 8.3% of smokers below 40 years and having smoking history of less than 10 pack years (equivalent to smoking index 200).[12]

P.L. Enright, M. Studnicka, J. Zielinski, from The University of Arizona, Tucson, USA conducted study using handy or office spirometer along with primary care physicians for early detection of COPD in smokers. They have demonstrated that recent spirometers are weightless, less space occupying, easy to handle and can be used by primary care physicians. Spirometry to detect and manage COPD and asthma in the primary care setting study also done according to GOLD criteria. FEV1/FVC or FEV1/FEV6 ratio is taken as reference for airflow obstruction detection. So our study we utilized microprocessor enabled spirometer. Microprocessor enabled spirometer can be connected to computer to analyze the data as done in the above study.[13]

In North India Barthwal MS,and Singh S studied the occurrence of COPD in high risk population in Military institutions in Pune, Maharastra using office spirometry. They have analyzed 460 patients and found air flow obstruction in 12.6% of smokers. The sample size for this study has

been calculated based on the data available from foreign authors. They also pointed out that prevalence of COPD increases as age advance. In this study they used 40 years as age cut off. With the available data from India we planned to conduct the study in South Indian population. In our study sample size was calculated based on this study. So prevalence of 12.6% has been used to calculate sample size.[14]

In DIDASCO study which was designed to analyze diagnostic criteria for COPD and asthma. They have divided the patients into two groups . One group was screened with spirometry after inhaled steroids and another with beta agonist.

They screened patient between 35-70 years. GOLD criteria was used to categorize the patients for airflow obstruction. Patients were analyzed for airflow reversibility of 12% from pre to post 400 mcg inhaled salbutamol in FEV1.Patients with reversible airflow limitations were diagnosed as asthma. This study clearly demonstrated that spirometry can be used to detect obstructive lung disease in general practitioners office using FEV1/FVC ratio as reference value. This study also thrown light that 42% of patients with obstructive disease could not have been diagnosed with out spirometry. Thus they recommended routine use of spirometry for obstructive lung disease diagnosis and follow up.[15]

In India Moorthy and Sastry published the report called burden of diseases in India.In that report on the economic burden of COPD in our country pointed out that prevalence of obstructive lung disease is high compared to north India. Prevalence in Madras (Chennai) is 10.2%. So it is rationale to have sample size of around 12% prevalence for our study. That comes roughly 160-170 subjects. [16]

SMOKING INDEX :

In countries like India smoking of tobacco varies between individuals. It may be either cigarette or bidis. Quantity or number also differs.

Cigarettes are 10 per pack and bidis 15-24 per pack. So quantum of smoking by pack years is not applicable to our country. Thus evolved smoking index. Which is expressed as number of cigarettes/bidis smoked per day multiplied by years of smoking. It is not the amount of tobacco present per bidi or cigarette but total particulate matter (TPM) matters when degree of exposure is concerned. TPM per bidi is 23-30 mg which is equal to nicotine content of 1.72-2.05 mg. in cigarette TPM is 21.16-21.94 mg and nicotine content is 1.04-1.21 mg. mean while as we compare pack year and smoking index for example 1 bidi per day for 10 years is same as 10 bidis / day for 1year. It clearly indicates the amount of exposure.

SI is also categorized as mild 100, moderate 100-300 and severe 300 from Lung India, smoking index- a measure to quantify cumulative smoking exposure,1988.[17]

With all these literature review the original curve of Fletcher and Peto has been modified and published as follows in natural history of obstructive lung disease. The earlier curve predicted that lung damage occurs at old age but it was proved wrong. The newer concept is damage to lung volumes in smokers occur at much early as predicted by spirometry.
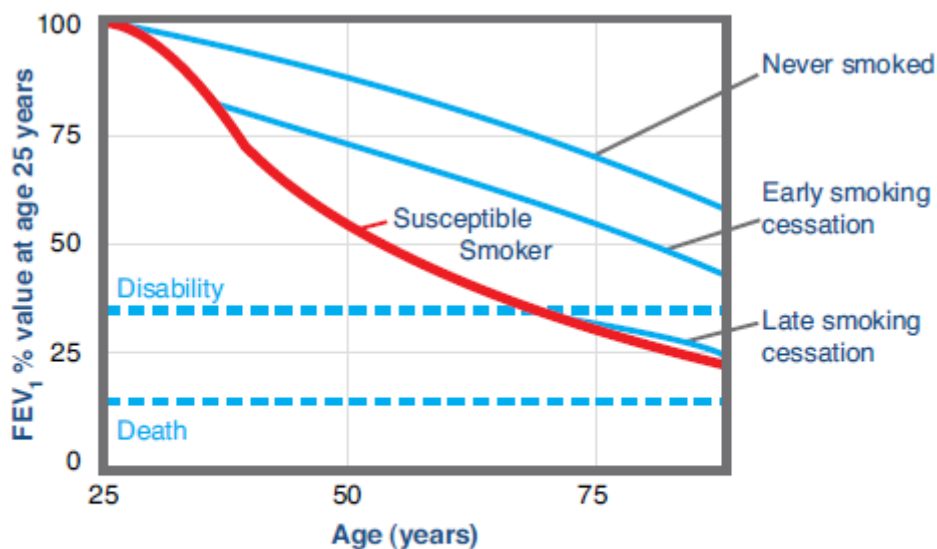
Modified Fletcher-Peto curve redrawn by Jones & Østrem to incorporate findings of recent advances in the natural history of COPD including FEV$_1$ decline data from the UPLIFT study demonstrating greater annual rate of FEV$_1$ decline during early stages of disease

This modified curve of Fletcher and Peto clearly shows that smoking cessation started at earlier age is more beneficial than at later age in regard to obstructive lung pathology. The curve also gives clear evidence that smoking cessation started before forty years is more beneficial than later. So we included from age 25 years in this study. Any intervention that is done after half of lung volume is lost is not useful for improving the quality of life in COPD patients. So our aim is to identify the smokers at risk in earlier stage so that they can be motivated for smoking cessation.

TOBACCO SMOKING

Half of all regular cigarette smokers will eventually be killed by their habit.18. Death due to tobacco is one million in developing countries. This will increase to 10 million in 2020.[19]

Smoking causes increase in incidence of death due to carcinoma lungs, respiratory tract carcinoma, COPD and corpulmonale.

It also advances the incidence of coronary artery disease and cerebrovascular disease related death.

Smoking cessation decreases the morbidity and mortality related to disease of tobacco.

Smoking habit starts for psychosocial reasons like parental smoking, peer stress, feel of independence, rebelliousness usually during adolescence.[20]

Once started pharmacological aspects of nicotine makes it as habit which causes psychological advantages in mood of an individual and causes the habit to persist.

Rusell described smoking as " probably the most addictive and dependence producing form of object specific self gratification known to man".[21]

In developing countries the pattern of smoking is different from developed world. 50% of men and only 10% females smoke in developing countries. Asia is accounting for about 50% 0f world's cigarette smoke.

SAFE   CIGARETTES !!

NO CIGARETTE IS SAFE including substitutes like synthetic tobacco, glycerol particles and modified cellulose.[22]

HEALTH EFFECTS OF SMOKING

RESPIRATORY SYSTEM:

COPD, carcinoma of lungs, carcinoma of upper respiratory tract particularly laryngeal carcinoma.[18]

CARDIOVASCULAR SYSTEM:

Incidence of death related to myocardial infarction is 2-3 times higher in smokers. Cerebrovascular events like stroke,   sub   arachnoid hemorrhage   is also 2-3 times higher . Almost 90% of patients are smokers when peripheral vascular disease is concerned.[23, 24]

GASTROINTESTINAL SYSTEM:

Peptic ulcer disease, carcinoma esophagus and Crohns disease have strong association with smoking.[25]

Carcinoma   stomach and pancreas also significant in smokers.

GENITOURINARY SYSTEM:

Increases the risk of   infertility, renal and bladder cancer in men. In women cervical carcinoma is 4 times more common than non smokers.[26]
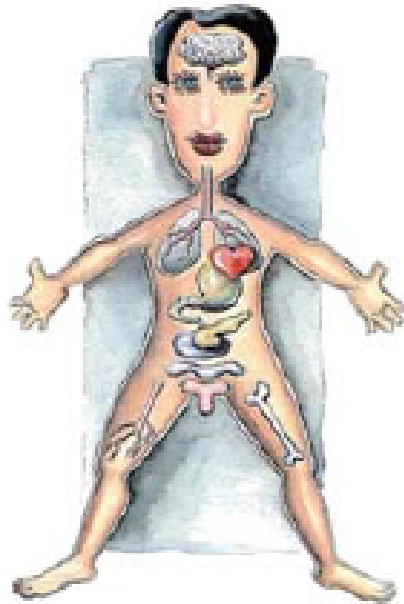
MISCELLANEOUS SYSTEMS:

 Cadmium in tobacco causes cataract

Post menopausal   fractures due to reduced bone density

Palmoplantar pustulosis and premature facial wrinkling .[27] [28] [29]

Health Effects of Smoking

Eyes: macular degeneration

Hair loss

Skin: ageing, wrinkles, wound infection

Brain: stroke

Mouth & Pharynx: cancer; gum disease

Lungs: cancer; emphysema, pneumonia

Heart: coronary artery disease

Stomach: cancer; ulcer

Pancreas: cancer

Bladder: cancer

Women: cervical cancer; early menopause, irregular & painful periods

Men: impotence

Arteries: peripheral vascular disease

Bone: osteoporosis

Smoking during pregnancy
Increased risk of:
- Miscarriage
- Premature birth
- Low birthweight infant.

Environmental tobacco smoke
In children increased risk of:
- Respiratory infections such as bronchiolitis
- Middle ear infection
- Meningococcal infections
- Asthma attacks
- Sudden infant death syndrome (cot death)

In adults increased risk of:
- Lung cancer
- Heart disease.

Diagrammatic representation of health effects of smoking

MECHANISM OF HARM

1. SMOKERS

2. NON SMOKERS

IN SMOKERS:

LUNGS:-

Toxins like polycyclic aromatic compounds, nitrosoamines, and radioactive polonium causes the following effects that leads to various ill effects in lungs.[30]

RELEASE OF ELASTOLYTIC ENZYMES FROM NEUROPHILS

INCREASES PULMONARY EPITHELIAL PERMEABILITY

DECREASES ALPHA 1 ANTI TRYPSIN LEVELS

BRONCHITIS EMPHYSEMA CARCINOMA

DECREASES NITRIC ACID LEVELS
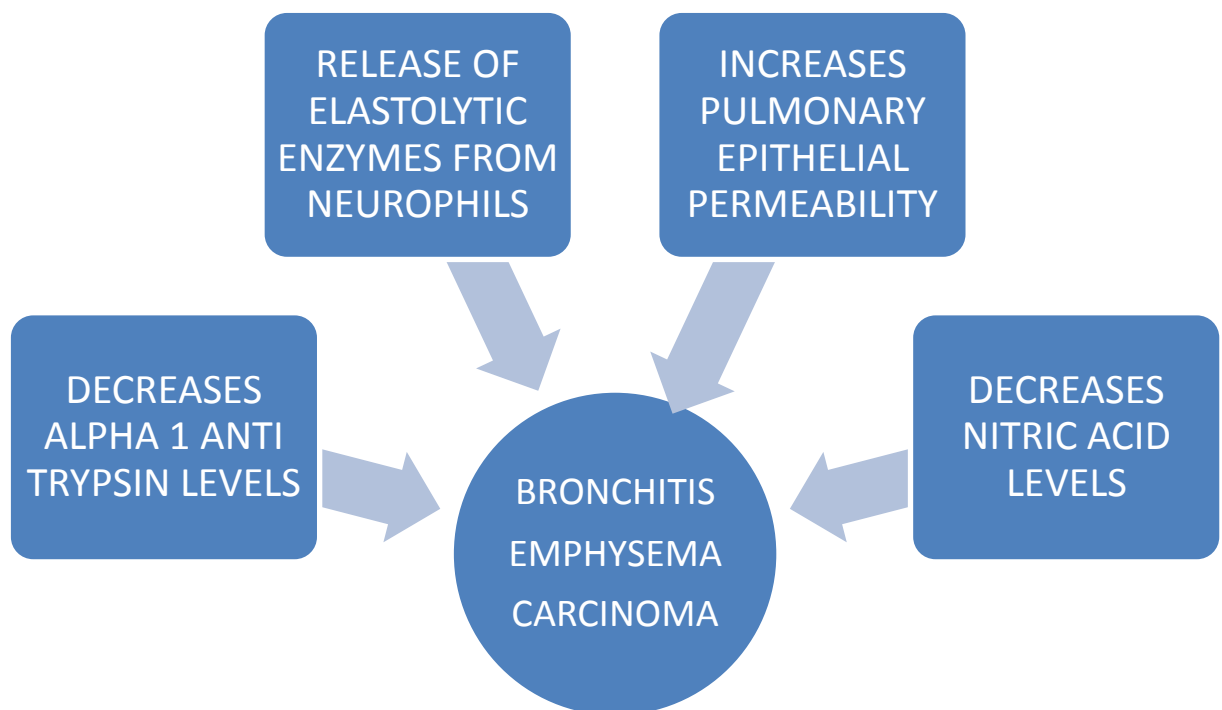
CARDIOVASCULAR: - increase in systemic vascular permeability to lipids causes atherosclerosis.[30]

INCREASED CARBOXY HEMOGLOBIN

DECREASED OXYGEN CARRYING CAPACITY

INCREASED CATECHOLAMINES

PLATELET STICKINESS AND AGGREGATION

MYOCARDIAL INFARCTION
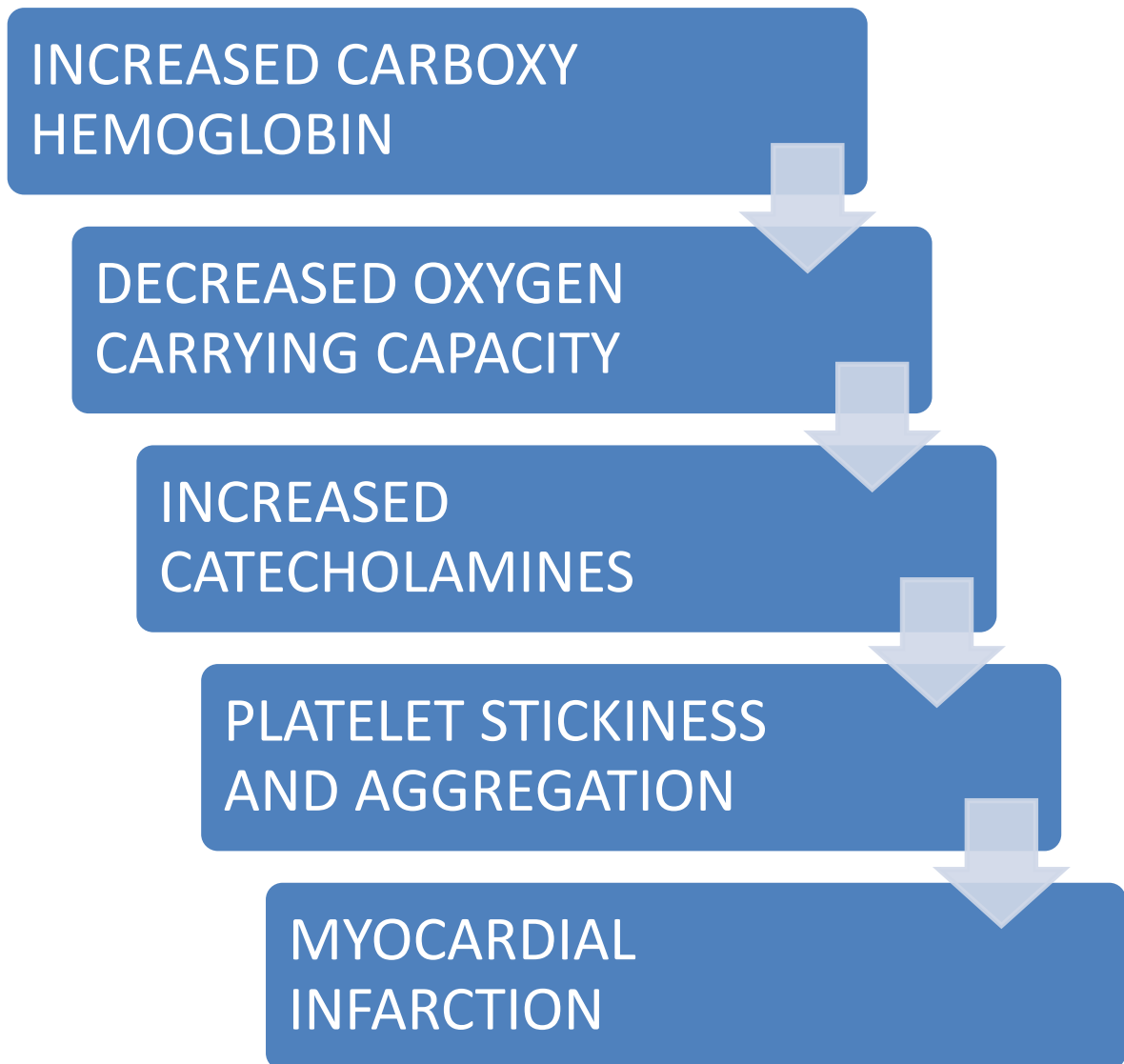
The above chain of events occur in smokers that leads to myocardial infarction, cardiac arrythmias and sudden cardiac death.

NON SMOKERS:- it is variously known as Passive smoking, second hand smoking or environmental tobacco smoking.

EFFECTS DUE TO PARENTAL SMOKING

1.Low birth weight

2.Sudden infant death

3.Pneumonia and bronchitis in children

4. Decreased lung function

5.Asthma in children

6. Increased risk of childhood cancers

7. Learning difficulties in children.[31,32]

EFFECTS DUE TO ENVIRONMENTAL SMOKING

1. Chest colds and loss of work days

2. Increased risk of lung cancer in spouse

3. Worsening of angina

4. Increased rate of death from ischemic heart disease

5. Decreased productivity and economic burden due to illness among workers exposed to environmental tobacco smoke .[33,34]

SMOKING CESSATION

Health education regarding ill effects of smoking to general population, health professionals and politicians is the corner stone.[35]

Strict laws like Norwegian tobacco act 1975 should be implemented to control smoking.

Advertising the financial savings of the individuals who quit smoking is also important. This is done in Norway during 1975 – 1980

Which brought predictable drop in smoking . The Norwegian council on smoking and health also made legislation that offered jobs in asbestos industry only to non smokers. They also raised the price as well as tax on cigarretes. So multi deciplinary approach alone will bring down the incidence of smoking. Early detection of air flow obstruction in smokers offers important   tool to educate the community.

CHRONIC OBSTRUCTIVE PULMONARY DIASEASE

Definition : chronic obstructive pulmonary disease is defined according to GOLD criteria as airflow limitation that is not fully reversible.[5]

COPD includes the following

1. EMPHYSEMA: Anatomically defined condition in which there is destruction and enlargement of alveoli

2. CHRONIC BRONCHITIS: Clinically defined disease which is associated with chronic cough and phlegm

3. SMALL AIRWAYS DISEASE: Characterized by narrowing of Small bronchioles.

Criteria to diagnose COPD is presence of chronic airflow obstruction.

RISK FACTORS

1. **Cigarette smoking:** Association between cigarette smoking and COPD is proved absolutely. There is also correlation between FEV1 and pack years of smoking in general population.
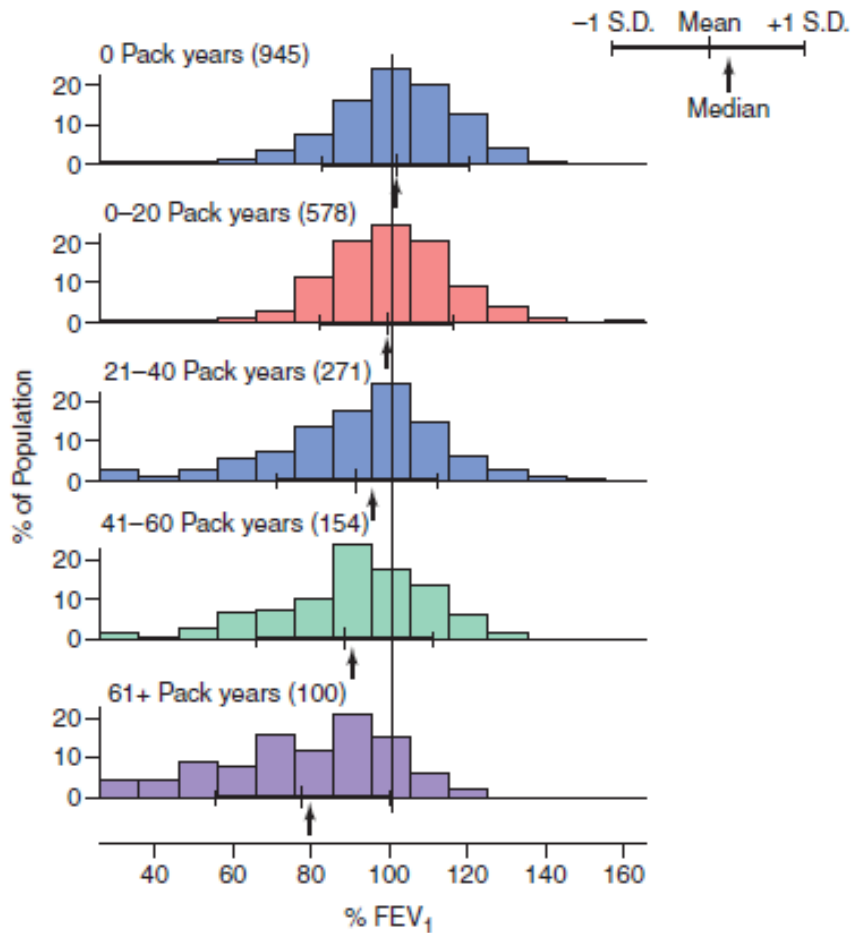
**Distributions of forced expiratory volume in 1 s (FEV₁)
values in a general population sample, stratified by pack-years of
smoking.** Means, medians, and ±1 standard deviation of percent predicted
FEV₁ are shown for each smoking group. Although a dose-response relation-
ship between smoking intensity and FEV₁ was found, marked variability in pul-
monary function was observed among subjects with similar smoking histories.

2. AIRWAY RESPONSIVENESS

Two hypothesis has been formulated based on airway responsiveness
of patients with COPD

i.   **DUTCH HYPOTHESIS**: It states that bronchial asthma, chronic
bronchitis and emphysema are variations of same disease. These
are modulated by genetic and environmental factors to produce
these distinct disease patterns.

ii.   **BRITISH HYPOTHESIS**: It states that asthma and COPD are two different disease entities .Asthma is due to allergic phenomenon and COPD is due to smoking related inflammatory disease.

Validation of these hypothesis awaits analysis of predisposing factors like genetic and environmental factors.

3. **RESPIRATORY INFECTIONS**: This entity awaits to be proven since there is no data available to correlate. These are now important cause of acute exacerbations

4. **OCCUPATIONAL EXPOSURE**: The following occupational exposures have been suggested as risk factors for COPD Coal mining, cotton mill dust and gold Mining.

5. **AMBIENT AIR POLLUTION**: Urban living and biomass combustion in rural areas are proposed but not proven.

6. **PASSIVE OR SECOND HAND SMOKE EXPOSURE**: Maternal smoking is associated with adverse neonatal outcome like low birth weight, reduced lung growth and reduction in post natal lung function.

7. **GENETIC FACTORS**:

i. Alpha one antitrypsin deficiency: Many protease inhibitors have been postulated among them

M allele is most common associated with normal a1AT

S allele with slightly reduced a1AT

Z allele with severely reduced a1AT

PiZ is known to be either individual with one Z and one null allele or two   Z allele and it is the common form of a1AT deficiency.

COPD occurs in earlier age in a1AT deficiency smokers than non smokers.[36]

Other genes responsible for COPD are MMP12 and HHIP.[38]

NATURAL HISTORY OF COPD

The association of cigarette smoking and lung function depends on duration of smoking, intensity of smoking, baseline pulmonary function of individual and environmental factors.

Reduced   levels of FEV1 is closely associated with mortality in COPD.

GRAPHICAL REPRESENTATION OF NATURAL HISTORY OF COPD ON FEV1 TRACKING
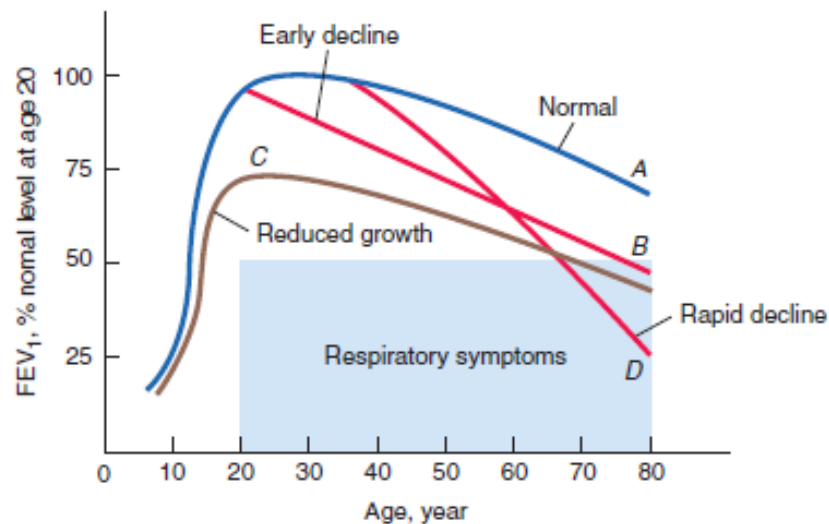
Hypothetical tracking curves of FEV$_1$ for individuals throughout their life spans. The normal pattern of growth and decline with age is shown by curve A. Significantly reduced FEV$_1$ (<65% of predicted value at age 20) can develop from a normal rate of decline after a reduced pulmonary function growth phase (curve C), early initiation of pulmonary function decline after normal growth (curve B), or accelerated decline after normal growth (curve D).

Early interventions like smoking cessation in young age will provide more morbidity and mortality benefits than measures done after significant decline in pulmonary function.

Genetic and environmental factors play a crucial role along with smoking.

PATHOPHYSIOLOGY

Airflow obstruction in the form of persistent reduction in forced expiratory flow rate is classical finding in patients with COPD.

AIRFLOW OBSTRUCTION:

Also known as airflow limitation which is measured by spirometry uses forced expiratory maneuvers. Key parameters obtained are FEV1 and FVC. Patient with COPD have chronic reductions in FEV1/FVC ratio.

Post bronchodilator FEV1 will show improvements up to 15% which is helpful in differentiating from asthma. In asthma there will be larger response to inhaled bronchodilator.

In initial stages of COPD the airflow abnormality is evident at or below the functional residual capacity. It gives scooped out appearance to lower part of flow volume loop. In advanced disease the curve assumes reduced expiratory flow compared to normal

HYPERINFLATION:

It compensates for airflow limitation but has deleterious effects on lung function by flattening diaphragm.

Diagrammatic representation of effects of hyperinflation on lung function

- **DECREASED ZONE OF OPPOSITION**
  - POSITIVE ABDOMINAL PRESSURE DURING INSPIRATION IS NOT APPLIED TO CHEST WALL
  - REDUCED RIB CAGE MOVEMENT AND INSPIRATION

FLATTENING OF DIAPHRAGM

- **SHORTENING OF DIAPHRAGMATIC MUCLE FIBRE**
  - LESS CAPABLE OF GENERATING INSPIRATORY PRESSURES

- **LAPLACE LAW** $p=2t/r$
  - REDUCED RADIUS-r
  - REQUIRES GREATER TENSION-t
  - TO DEVELOPE TRANSPULMONARY PRESSURE-p

GAS EXCHANGE:

PaO2 falls below normal range only when FEV1 is less than 50% of predicted. Rise in PaCo2 occurs only with FEV1values below 25%   of predicted.

Ventilation perfusion mismatch occurring in COPD is characteristic as it is non uniform.

Supplemental oxygen is useful in treating hypoxemia due to COPD because shunting is minimal.

PATHOLOGY

LARGE AIRWAYS: Mucous gland enlargement , goblet cell hyperplasia and squamous cell metaplasia of bronchial mucosa

SMALL AIRWAYS: Airways <2 mm are major sites for resistance in COPD. Reduction in surfactant secreting type 2 cells increases surface tension.

LUNG PARENCHYMA: Destruction of respiratory bronchioles, alveolar ducts and alveoli results in reduction in gas exchanging air spaces in emphysema. Types of emphysema are cenriacinar and panacinar.

PATHOGENESIS

Fibrosis and collagen accumulation around small airways is significant contributor. Schematic representation of chain of events that occur in smokers and leads to COPD is as follows

Figure showing the pathogenesis of emphysema
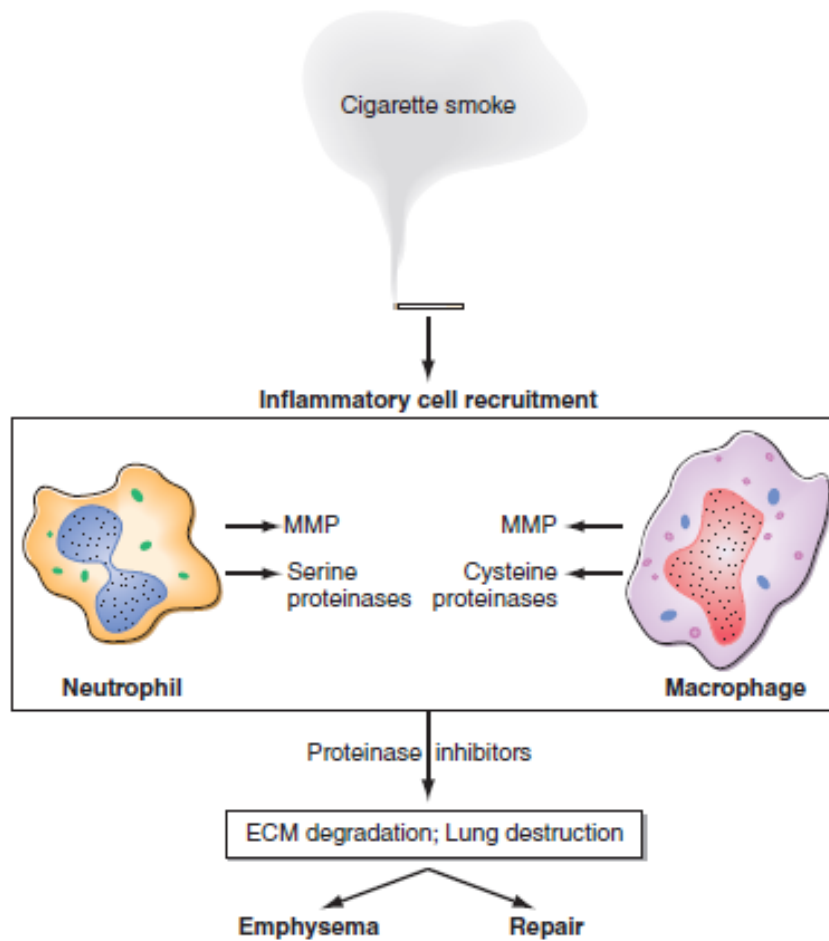
Pathogenesis of emphysema. Upon long-term exposure to cigarette smoke, inflammatory cells are recruited to the lung; they release proteinases in excess of inhibitors, and if repair is abnormal, this leads to air space destruction and enlargement or emphysema. ECM, extracellular matrix; MMP, matrix metalloproteinase.

Prominent steps are

1. Smoking causes recruitment of inflammatory cells to airways

2. Elastase and antielastase hypothesis

3. Extracellular matrix proteolysis

4. Cell death

5. Ineffective repair

CLINICAL PRESENTATION

Majority of smokers are asymptomatic until 50% of their lung volume is lost.

Cough, sputum production and exertional dyspnea are common symptoms in COPD.

Patients usually have symptoms years before and come for medical attention only after worsening.

Physical examination show prolonged expiration and expiratory wheeze.

Pink puffers or emphysematous patients are thin and non cyanotic at rest.

Blue bloaters or chronic bronchitis patients are heavy and cyanotic

Hoovers sign- in advanced disease there is inward movement of rib cage during inspiration.

In severe obstruction the patient will assume **tripod position**.

LABORATORY FINDINGS

1. Pulmonary function testing.

Pulmonary function tests are defined as a series of tests both invasive and non invasive done with standardized equipment .

They are used to identify and quantify many structural and functional abnormalities of the respiratory system .

These include

1. Spirometry

2. Lung volumes by helium dilution or by body plethysmography
   - Tests for ventilatory function

3. Peak Expiratory flow rate using breathometer

4. Pulse oximetry
   - Bedside tests

5. Ventilation –Perfusion scan (V/Q scan)

6. Diffusing capacity for carbon monoxide

   - Tests for diffusion

7. PI max and PE max

   - Test for respiratory muscle function

8. Arterial blood gases

9 . Bronchial challenge tests

10. Exercise test

11. Polysomnography

   1. Test for sleep related disorder

12. Other tests

   1. Chest radiograph

   2. Computed tomography of chest

   3. a1AT levels in serum

   4. Molecular genotyping of PI alleles (M,S ,and Z)

GOLD CRITERIA

GOLD Criteria for COPD Severity

GOLD Stage	Severity	Symptoms	Spirometry
0	At Risk	Chronic cough, sputum production	Normal
I	Mild	With or without chronic cough or sputum production	$FEV_1/FVC < 0.7$ and $FEV_1 \geq 80\%$ predicted
IIA	Moderate	With or without chronic cough or sputum production	$FEV_1/FVC < 0.7$ and $50\% \leq FEV_1 < 80\%$ predicted
III	Severe	With or without chronic cough or sputum production	$FEV_1/FVC < 0.7$ and $30\% \leq FEV_1 < 50\%$ predicted
IV	Very Severe	With or without chronic cough or sputum production	$FEV_1/FVC < 0.7$ and $FEV_1 < 30\%$ predicted or $FEV_1 < 50\%$ predicted with respiratory failure or signs of right heart failure

Abbreviation: GOLD, Global Initiative for Lung Disease.

GOLD: Global Initiative for Obstructive Lung Disease requires FEV1FVC ratio less than 0.7 post bronchodilator.

CRITERIA FOR COPD SEVERITY:

1. Mild COPD   - FEV1/FVC <0.7 and FEV1p> 80%

2. Moderate COPD - FEV1/FVC <0.7 and FEV1p 50% - 80%

3. Severe COPD   - FEV1/FVC <0.7 and FEV1p 30% - 50%

4. Verysevere COPD- FEV1/FVC <0.7 and FEV1p< 30%

or

FEV1p <50% and chronic respiratory failure.

In our study after identifying the patients with COPD the severity is assessed according to above guidelines.

TREATMENT

1. General measures like smoking cessation, oxygen therapy.

2. Bronchodilators – beta agonist, anticholinergics, inhaled

    corticosteroids

3. Oral glucocorticoids

4. Theophylline

5. N-acetyl cystine

6. a1AT augmentation therapy

7. Pulmonary rehabilitation

8. Lung volume reduction surgery

9. Lung transplantation

10. Mechanical ventilatory support .[36]

Figure – Inhalation therapies in COPD according to GOLD guidelines
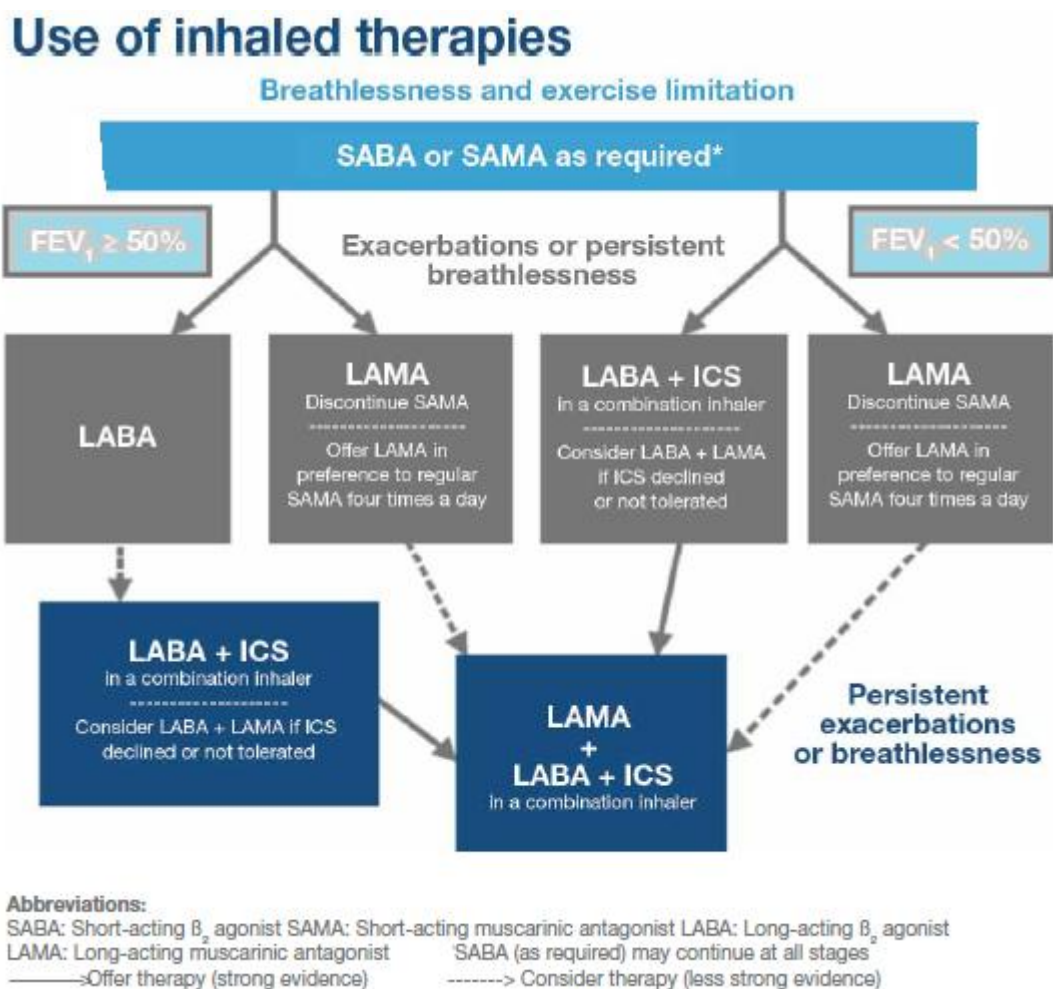
SPIROMETRY

HISTORY

1800 Hutchinson developed simple water sealed spirometer used measure vital capacity

1930 barach developed kymograph or rotating chart drum that displated changes in vital capacity as spirogram.

1941 Cournand and Richard described MVV

1947 Tiffeneau described FEV1/IVC ratio as index of airflow limitation called Tiffeneau index

1950 Gaensler used micro along with water sealed spirometer to time FVC1950 Comroe,Dubois and others described technique to estimate alveolar pressure.

1950 late , Hyatt used flow volume curve to display air way function

1955 Leuallen and Fowler described maximal mid expiratory flow rates 25% and 75% now known as FEF25%-75%

1960 Wright and Mckerrow started using peak flow meter in asthma patients

Spirometry is the most commonly performed lung function test . it is described as GOLD STANDARD to diagnose COPD by WHO and GOLD criteria.

INDICATIONS FOR SPIROMETRY

1. To diagnose the presence or absence of lung disease

2. To quantify the known pulmonary disease severity

3. To measure the environmental and occupational exposure effects

4. To identify the merits and demerits of therapy

5. To assess the risk factors of proposed surgical procedures in view of
   pulmonary disease

6. To evaluate morbidity or impairment for legal or insurance evaluation

7. To evaluate datas for epidemiological and clinical research in the field of lung diseases

CONTRAINDICATIONS TO SPIROMETRY

ABSOLUTE

1. Acute coronary event ,myocardial infarction in last 30 days

2. Recent thoraco abdominal or ophthalmic surgery

3. Recent Cerebrovascular event

4. Poorly controlled hypertention

5. Underlying aortic and cerebral aneurysm

6.Recent pneumothorax

RELATIVE

1. Head ache

2. Stress incontinence

3. Confusion

4. Facial, abdominal and chest pain

5. Dementia

LUNG VOLUMES AND DEFINITIONS

The quantity of air that moves in and out the respiratory tract during each respiratory cycle is called **Tidal volume (TV)**

The further volume of air that can be inspired after a normal tidal inspiration is called **Inspiratory reserve volume (IRV)**

The further volume of air that can be exhaled after a normal tidal expiration is called   **Expiratory reserve volume (ERV)**

The maximal amount of air that can be exhaled after a maximal

inspiration is called **Vital capacity (VC)** . VC = TV + IRV + ERV.

The amount of air that relics in the lungs after maximal expiration is **Residul volume (RV)** . Even with forceful effort it cannot be expired

The quantity of air that remains in the lung after maximal inspiration is termed as

Total lung capacity (TLC) . TLC = FRC + TV + IRV = VC + RV

The volume of air exhaled per minute is called Minute volume.

Maximal voluntary ventilation (Maximum breathing capacity) is the highest amount of air that can be exhaled in a 15 second gap by voluntary effort. This is uttered as liters per minute by multiplying by 4.

The quantity of air that can be forcefully exhaled in 1 second is termed as **Forced expiratory volume 1 (FEV$_1$)**

The maximum amount of air that can be forcefully exhaled is termed as **Forced vital capacity (FVC)**

FEV$_1$/FVC is expressed as a percentage.

The standard volume of air that is exhaled during the mid portion of

FVC is termed as **Mid expiratory flow (MEF25 - 75)**

The peak flow rate during expiration is called as **Peak expiratory flow**

rate   (PEFR) -   normal range is 400-600 L/min

It is a consistent method of differentiating obstructive

airway   disorders and restrictive lung diseases.

 Precise spirometry can only be performed with proper training and

adequate motivation of patients.

LIMITATIONS

1. It requests a well trained technician and patient support for accuracy of test

2. There is a little variability in normal predictive value

3. It should be interpreted in the milieu of a proper history, physical examination and added diagnostic tests.

ADVANTAGES

- Simple & supportive in reaching diagnosis
- Used as a first stride in detecting lung function abnormalities &

Answer important questions such as:

Is there airflow limitation? If so how severe is it?

Is there a response to bronchodilator therapy? If so how much?

Is there barrier present down the major airways?

Is it intra or extra thoracic?

Figure – Lung volumes and capacities
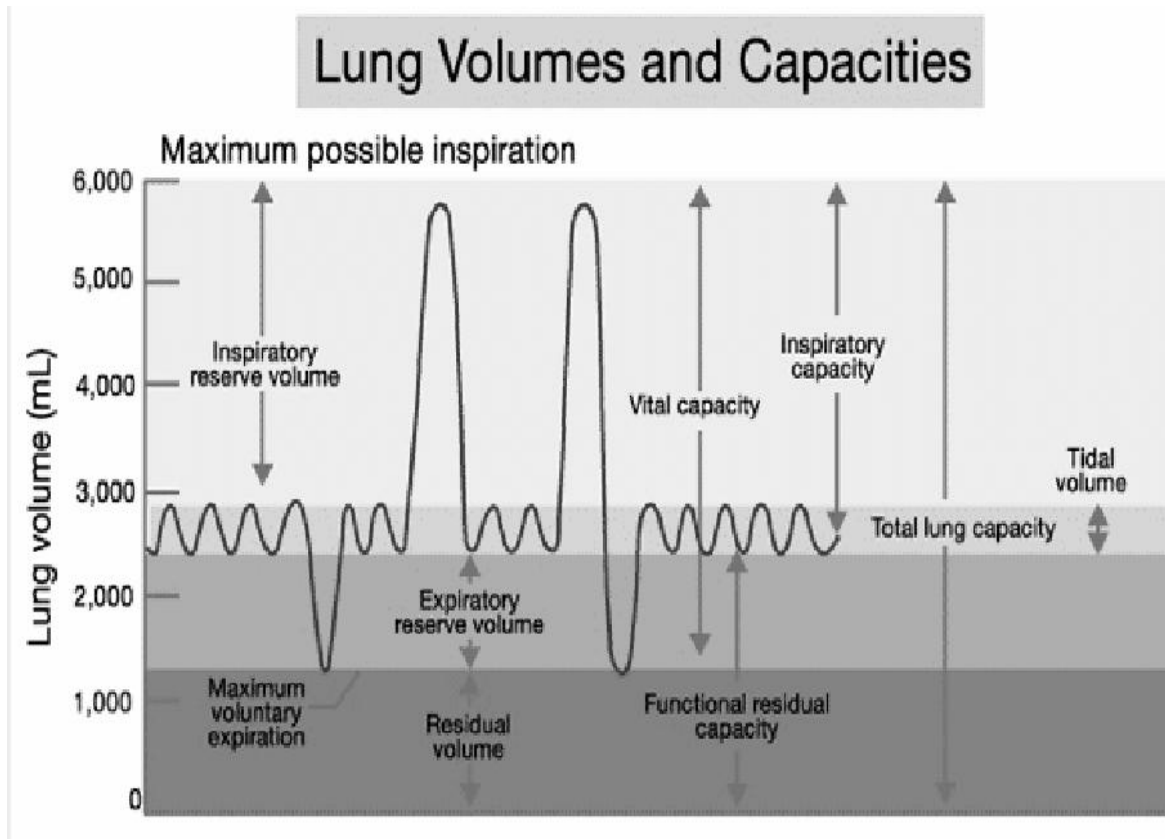
PERFORMING

SPIROMETRY

Preparation

1. **Equipment** :

   - Checking for leaks

   - Fresh mouth piece

   - Checking recording equipment

   - Performing calibrations

2. **Patient**

   - The height and weight are measured

   - Any contraindications   should be ruled out

   - The   procedure   is explained to the individual and should be demonstrated

   - The person should sit erect and look straight ahead to avoid stretching   of trachea.

Basic

Components

   - Maximal inspiration

   - Maximal expiration ('blast' expiration)

- Continued expiration until maximal amount of air is exhaled up to residual volume - at least a 6 seconds of exhalation in adults

Correct maneuver

- The exhaled volume should be delivered from the level of maximum inspiration with maximal exertion.

- The maneuver is started immediately with a 'blast' . There should be rapid rise to peak flow, and the attempt is sustained.

- The exhalation should continue to the residual volume. (exhalation continued Up to vital capacity).

It should not be troubled by coughing or sneezing.

There should not be any leak from mouthpiece

ATS/ERS recommendations are as follows:

FVC minimum duration	6 sec (3 sec for children) or plateau in the volume time curve, subject cannot or could not continue to exhale
FVC end of test criteria	Subject cannot or should not continue further exhalation or the volume time curve shows an obvious plateau or the forced exhalation is of reasonable duration
FVC maximum number of maneuvers	8, both in adults and children
FVC maneuver acceptability	Unsatisfactory start of expiration Back extrapolated volume > 5% of FVC or 150 ml, Whichever is greater Coughing which interferes with measurement of FEV1 and /or FVC. Early termination of expiration Valsalva maneuver A leak An obstructed mouth piece Effort that is not maximal
FVC and FEV1 reproducibility	the largest and second largest FVC and FEV1 should not differ by 150 ml

NORMAL VALUES

The outcome of Spirometry are reported as **absolute (measured) values and as predicted percentage of normal values.** Normal values will depend on the individuals age, sex, ethnicity and height. There is no universal standardization for normal values and the values that differ from one laboratory to the other.

Thus normal reference values were obtained by performing tests in thousands of people based on age, sex, ethnicity and height.

FACTORS DETERMINING LUNG VOLUMES

- HEIGHT- shorter persons have lesser lung volumes

- GENDER - females have lesser lung volumes than males

- AGE – lung volume keeps on rising in children, steady in adults and as age advances the ERV decreases and RV,FRC increases .

- ETHNICITY – values vary for Africans, Asian , and White populations

Normal value = 80 - 120% of predicted

SPIROMETRY REPORT : typically consists of absolute numerical values or graphical depiction of the same or a mixture of both.

Common Numerical Values

- ☐ FEV1
- ☐ FVC
- ☐ FEV1/FVC
- ☐ PEFR
- ☐ FEF 25-75%

Graphical representation

- Time - Volume curve

- Flow - Volume loop

The Volume-Time curve explained:
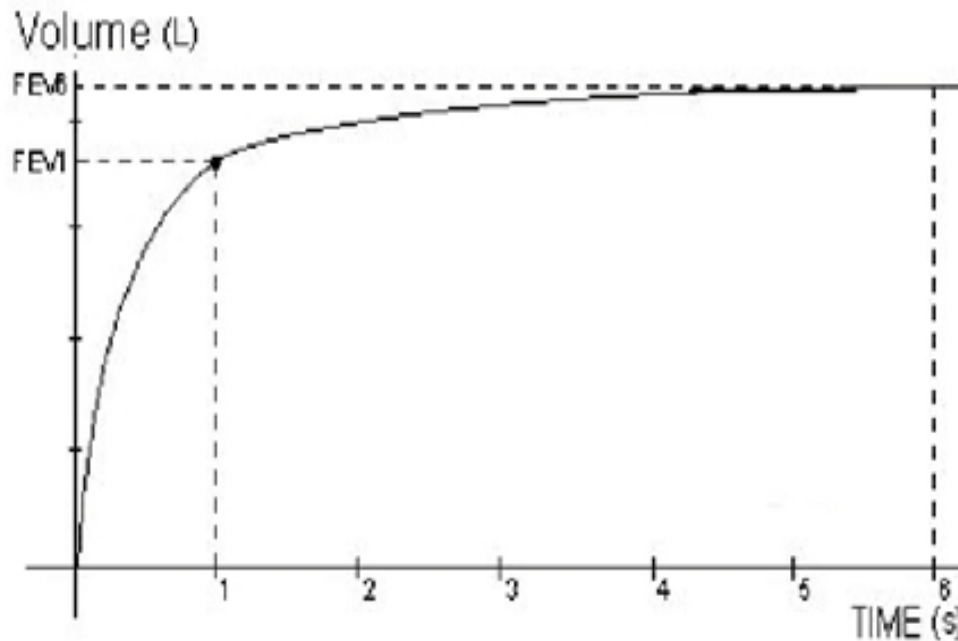
FEV1 (Forced Expiratory Volume in the first second) is the volume expired in the first second of the test .

FEV1%=FEV1/FVC X100.

roughly 80% of all the air is exhaled out in the first second by a healthy individual out of their lungs during the FVC exercise.

 FEV1% will be reduced in case of barrier in upper airways.

Too high FEV1% is indicative of restriction .

OBSTRUCTIVE PATTERN:

Either intrathoracic or extrathoracic.

FEV1 % = observed FEV1 / predicted FEV1 < 80%

FEV1 / FVC % = observed FEV1 / observed FVC < 75%

Severity of obstruction can be graded based on FEV1% based on GOLD criteria as 80% mild, 80%-50% moderate,50%-30% severe,<30% very severe

FEV1 /FVC may erroneously be normal due to air trapping which cause markedly

Reduced FVC in persons with moderate to severe obstruction.

FEV1 / FVC will be less than 70-80% in elderly due to age related decline without major obstruction. Early stages of neuromuscular disorders can cause low

FEV$_1$ /FVC due to reduction in FEV1. In obstructive disorders MMFR, PEFR are reduced to less than 75% of their predicted values .

CLASSIFICATION BASED ON FEV1 AND FVC VALUES
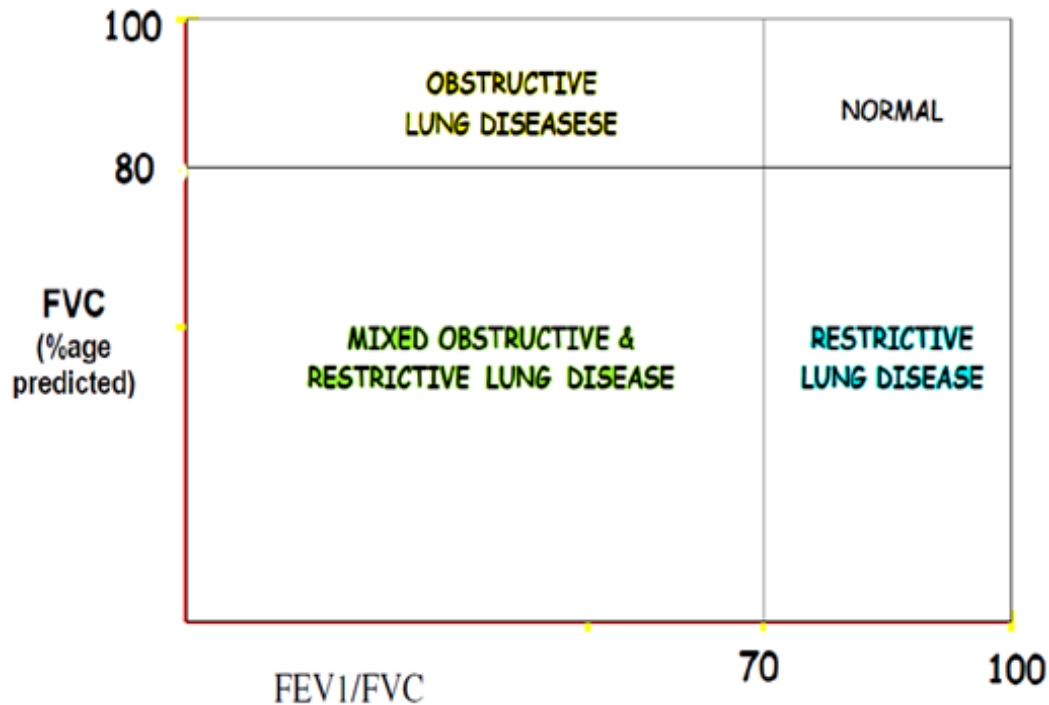
RESTRICTIVE PATTERN:

Pleural and parenchymal fibrotic diseases, chest wall diseases

FVC % = observed FVC / predicted FVC < 75%

Reduced FVC is not sufficient for diagnosis but it can suggest the probability of restrictive abnormality. It mainly depends on patient's performance . fallaciously low values of FVC occurs in moderate to

severe obstruction . Restrictive diseases has to be confirmed by extent of Residual   volume (RV) and Total Lung Capacity (TLC) by Helium dilution technique and Body Plethysmography. However interpretation of spirometric data with clinical correlation is sufficient for all practical purposes.

INTERPRETATION OF SPIROGRAM

Acceptable spirogram
↓
Is FEV1/FVC ratio low? <70%

Yes → Obstructive disorder
↓
Is FVC low? <80%

Yes → Hyperinflation Vs combined defect → Further testing (lung volumes)

No → Pure obstruction → Reversible w/ use of B₂ agonist
  Yes: asthma
  No: COPD

No → Is FVC low? <80%

Yes → Restrictive disorder → Further testing

No → Normal spirometry results
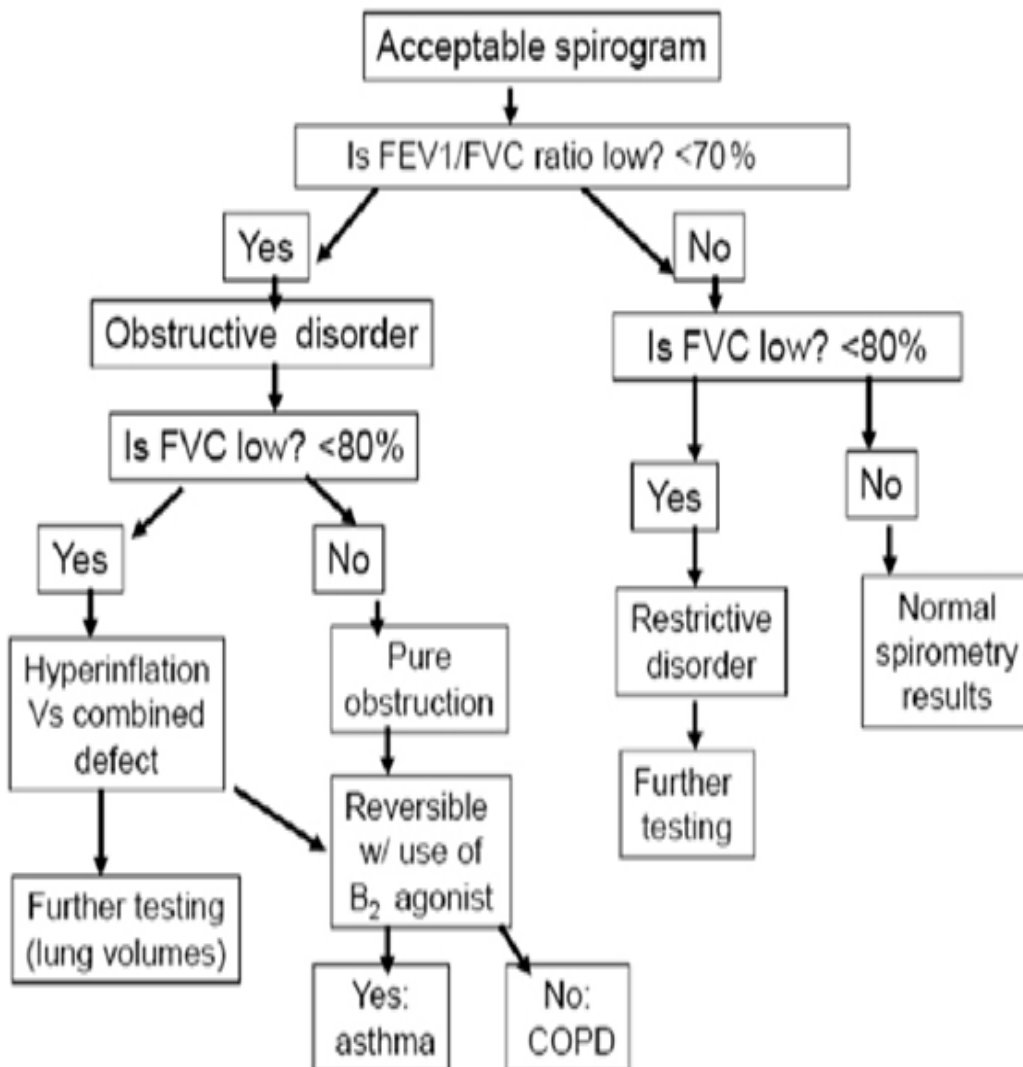
The Flow-Volume loop explained:
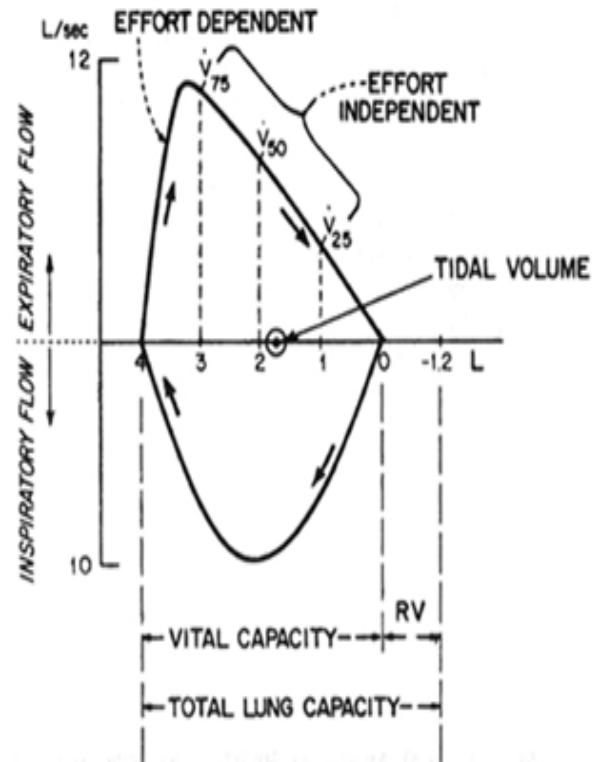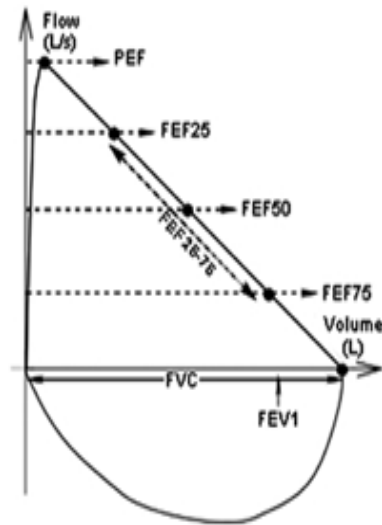
The spirometric proportions are recorded in a graphic representation called Flow –Volume loop. It has volume in X axis and time in Y axis. At point zero both flow and time are zero. Once the patient exhales it reaches a crest within 150ms which is called Peak Expiratory Flow(PEF). This peak flow represents the air exhaled from the proximal larger airways. After the peak the curve rapidly descends and reaches 25% , which is called FEF 25%.

After 75% of the air exhaled it reaches FEF 75%.

The mean flow between 25% and 75% is called FEF 25-75% . This gives a measure of airflow in the medium sized airways. This parameter is the first to decline in most of the respiratory diseases. Almost 90% of the air is exhaled in the first second . FVC is achieved if the flow reaches zero.

Obstructive Airway Disease:

In obstructive airway diseases like COPD and Asthma the small airways are narrowed and flow volume loop shows a concave pattern or scooped out pattern.
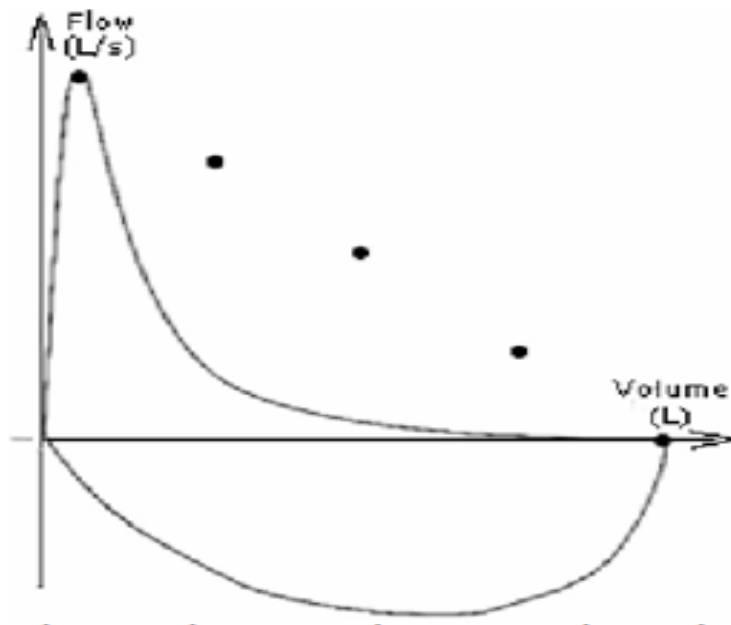
The PEF is normal since the air in larger airways is expelled easily.
Since smaller airways are narrowed the air is expelled slowly leading to a
low flow. This causes sharp fall in the flow volume loop. Both FEV1 and
FEF 25-75 are low.

Obstructive airway disease:
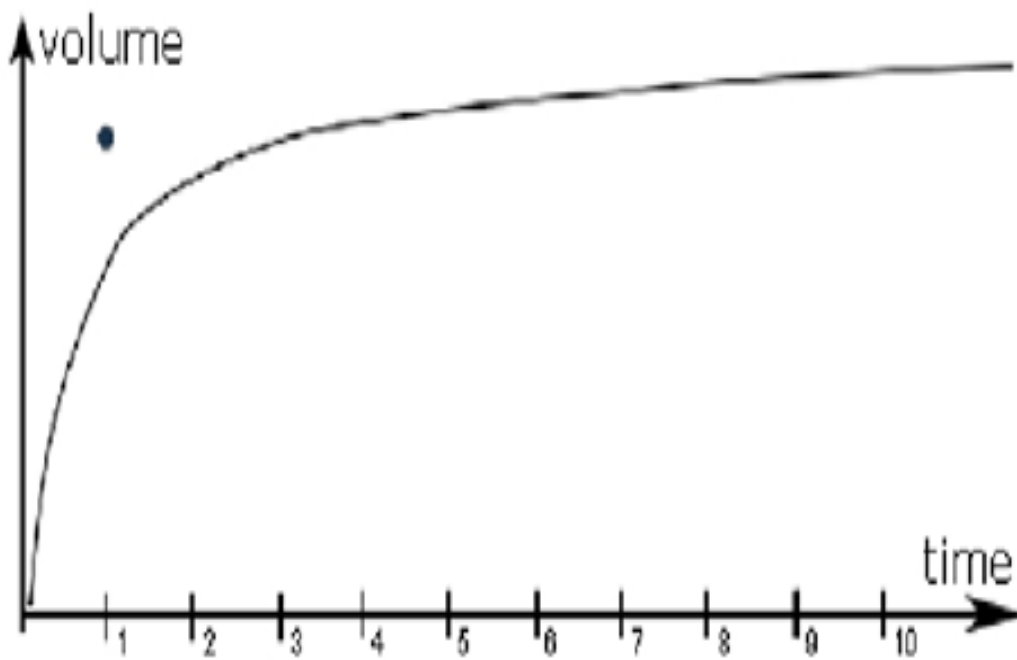
Fig: low FEV1

Restrictive Lung Disease:

Restrictive lung diseases are characterized by low total lung volume . spirometry can point out the probability of restriction and it has to be established by other methods. Since there is no obstruction the curve of flow volume is normal but the FVC is reduced. Peak Expiratory Flow can be normal or low.
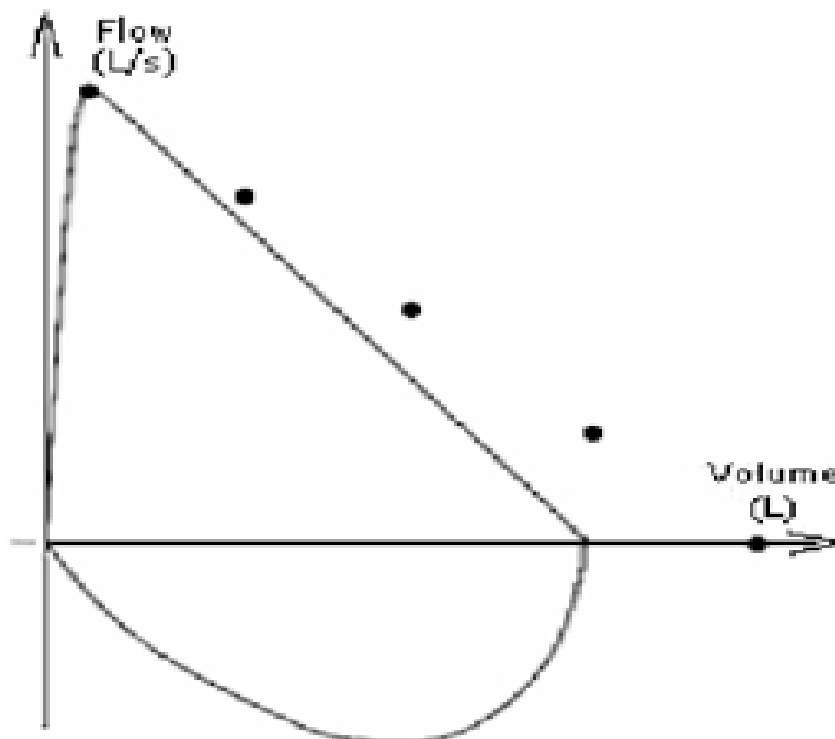
Fig: Low FVC with normal shape in restrictive lung disease:
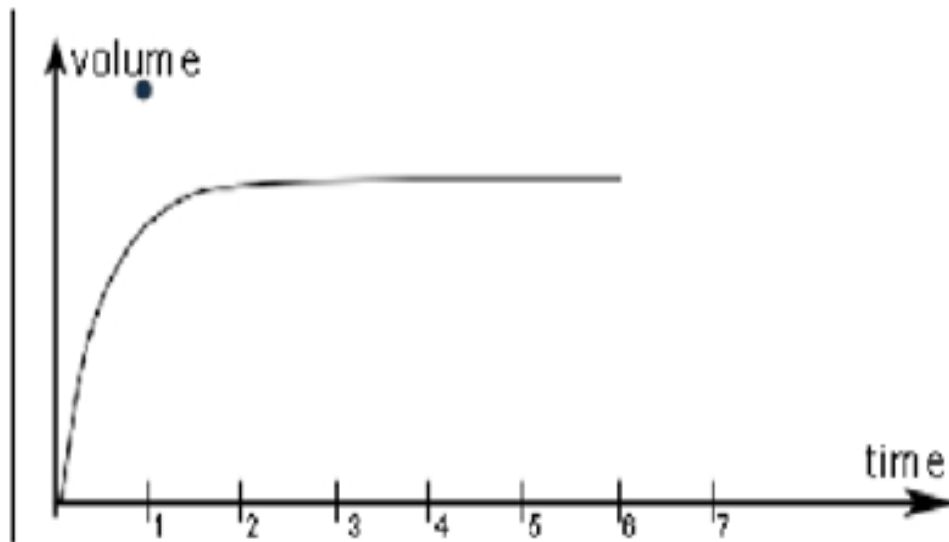
Fig: Too low FEV1 in restrictive lung disease in volume - time curve.

UPPER AIRWAY OBSTRUCTION (UAO) :

The following are the characteristics of upper airway obstruction.

- Midpoint maximal inspiratory flow is FIF 50% < 100 L/min

- Ratio of midpoint maximal expiratory flow to midpoint maximal inspiratory flow: FEF50% > 1/FIF50%

- Ratio of forced expiratory volume in 1 second to peak expiratory flow rate FEV1/PEFR > 10 ml /L/minute

- Ratio of forced expiratory volume in 1 second to forced expiratory volume in 0.5 seconds FEV1/FEV0.5 > 1.5

Extra thoracic obstruction can be classified into following categories.

1. Extra thoracic Obstruction

-variable

The obstruction is more significant during inspiration and expiration is normal. This occurs due to the fact that during expiration the obstruction is overcome by the force of expiration. In flow –volume loop the inspiratory part is flattened and expiratory part is normal.

e.g :laryngeal tumours, extrathoracic goiter, paralysis of vocal cord.
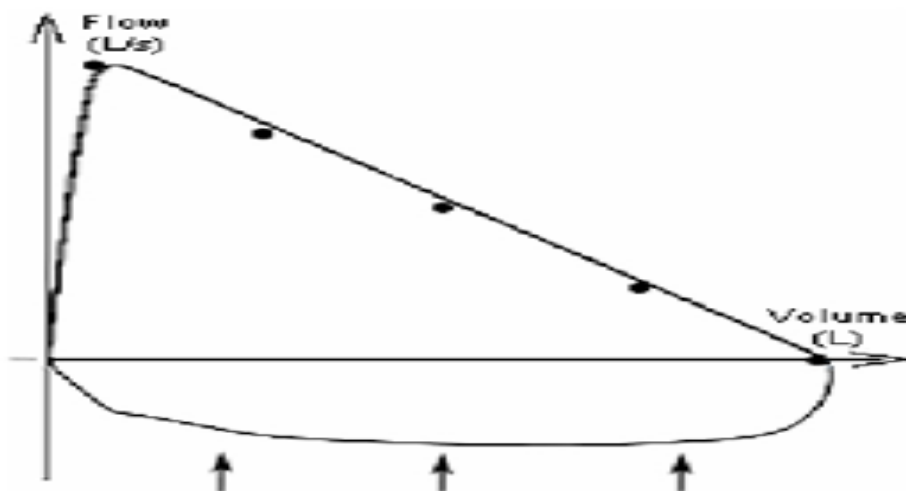
2. Intra thoracic Obstruction -

variable

In intra thoracic obstruction, during inspiration the trachea is sucked out and during expiration it causes partial obstruction. Inspiratory part of the flow – volume loop is normal and the expiratory part is flattened.
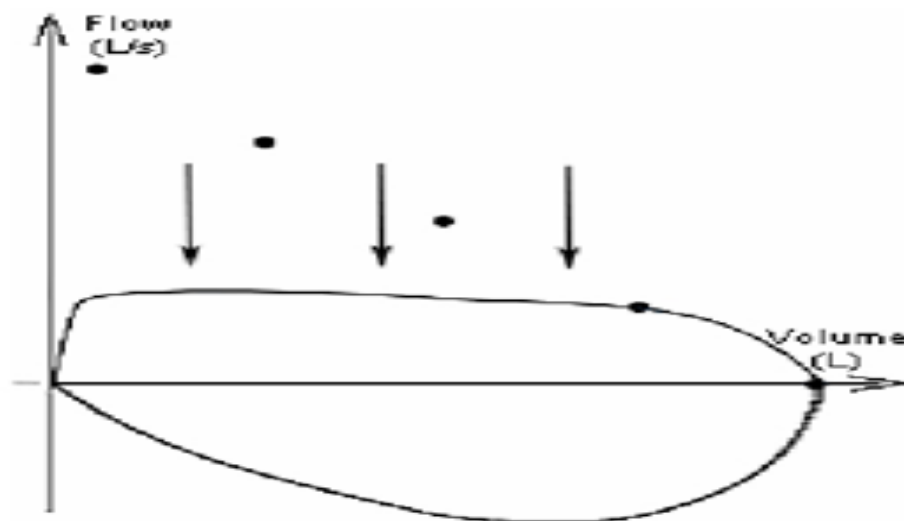
2. **Fixed obstruction of the Large Airways:**

The obstruction can be both extra thoracic and intra thoracic. Both inspiratory and expiratory part of the flow- volume loop are flattened. e.g. intra tracheal tumours, tracheal stenosis.[37]
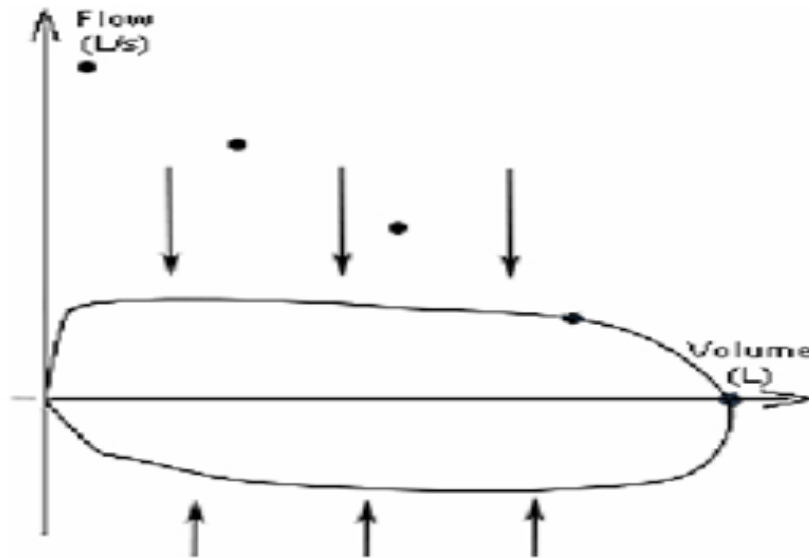
TROUBLESHOOTING: Common cause for inconsistent spirometry is

patient technique. Other causes are as follows

1. Incomplete inspiration and sub optimal expiration

2. Delayed maximal effort that under estimates FEV1

3. Inadequate emptying of lungs occurs commonly in COPD

4. Incomplete sealing of lips around mouth piece underestimates FVC

and FEV1

5. Exhalation through nose

6. Coughing

7. Mouth piece obstruction by teeth

.

AIMS AND OBJECTIVE

AIMS AND OBJECTIVE

1. Early detection of COPD in asymptomatic smokers by using spirometer in south India.

2. To correlate BMI, smoking index and age of onset of first smoke with FEVI/FVC Ratio.

3. To Study the relationship between SI and FEV1FVC ratio with severity of COPD.

MATERIALS AND METHODS

MATERIALS AND METHODS

PLACE OF STUDY:

MAHATMA GANDHI MEMORIAL GOVERNMENT HOSPITAL attached to KAP VISWANATHAM GOVERNMENT MEDICAL COLLEGE, TIRUCHIRAPPALLI in southern region of India

DEPARTMENT IN WHICH STUDY CONDUCTED:

Department of General Medicine

PERIOD OF STUDY: From JANUARY 2014 to August 2014

STUDY DESIGN : A prospective descriptive cross sectional study

ETHICAL COMMITTEE: Institutional ethical committee approval obtained. The study population was well explained about the study and its purpose in local language. Informed and written consent obtained from study population

INCLUTION CRITERIA:

1.Subjects with history of smoking and age above 25 years

2.No significant respiratory symptoms

3. Regular smokers

4. Willing to undergo spirometry

5. Willing to give consent to participate in the study

EXCLUTION CRITERIA:

1. Subjects with smoking cessation

2. History of respiratory disease like tuberculosis, bronchial asthma or occupational lung disease

3. On inhaled bronchodilators or corticosteroids

4. Diabetes mellitus, hypertension and coronary artery heart disease

5. Chest wall and vertebral deformities like pectus,kyphosis,scoliosis

6. Inadequate spirometry like air escape, failure to reach plateu are excluded

STUDY GROUP :

Patients attending the out patient department of tertiary care hospital ,MAHATMA GANDHI MEMORIAL GOVERNMENT HOSPITAL attached to KAP VISWANATHAM GOVERNMENT MEDICAL COLLEGE, TIRUCHIRAPPALLI in southern region of India

SAMPLE SIZE: Calculated from prevalence in North Indian and Madras study. Total number of subjects included was 174. All are men with history of smoking

MATERIALS:

1.EASY ONE spirometer

2. Disposable mouth piece

3. Weighing scale

4. Stadiometer

5. Printed materials explaining ill effects of smoking and benefits of smoking cessation regarding health and financial concerns

SPIROMETER

Easy one spirometer. It is a handy spirometer based on ultra sonic flow sensor system. The benefit of this spirometer is disposable flow tube can be inserted between transducers that prevents cross infectivity. in view of the fact that the tube acts a transparent barrier sorting out the airflow and transducer it does not require calibration. Also this spirometer is not affected by the composition of gas is added advantage. This type of compact, microprocessor integrated spirometer is recommended in various studies for screening of smokers for COPD. In our study we used same type of instrument which can be connected to computer to get the report.

EASYONE SPIROMETER:
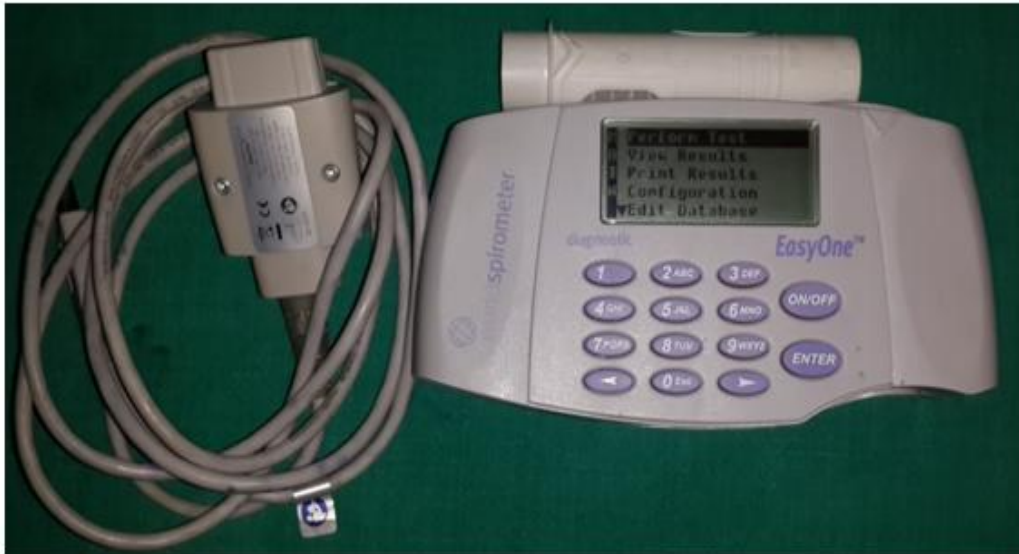
METHODOLOGY

After getting consent from subjects they were given short lecture using printed modules in a language Tamil and demonstration of spirometry is done by the technician who does the procedure. Quantum of smoking was calculated using smoking index.

Smoking index: number of cigarettes or bidies per day mutiplied by number of years of smoking. Smoking index selected because number of cigarettes,bidis vary depending upon the manufacturer hence it is more

appropriate than pack years.

Height ,weight and BMI was considered. They were subjected to spirometry 15 mins after 400 mcg of salbutamol nebulisation as per GOLD criteria. The predicted and measured values of FEV1, FVC, FEV1/FVC, PEFR,FEF 25-75   for all the patients were recorded. Minimum of three trials and maximum of eight trials done for each subject based on guidelines from American Thoracic Society.

The data were analyzed as per GOLD criteria and the subjects classified as mild, moderate, severe and very severe air flow obstruction using statistical test.

RESULTS

FIGURE - 1 Age   distribution of smokers in percentage

PERCENTAGE OF SMOKERS

- 28-38 YEARS
- 39-49 YEARS
- 50-60 YEARS
- 61-71 YEARS
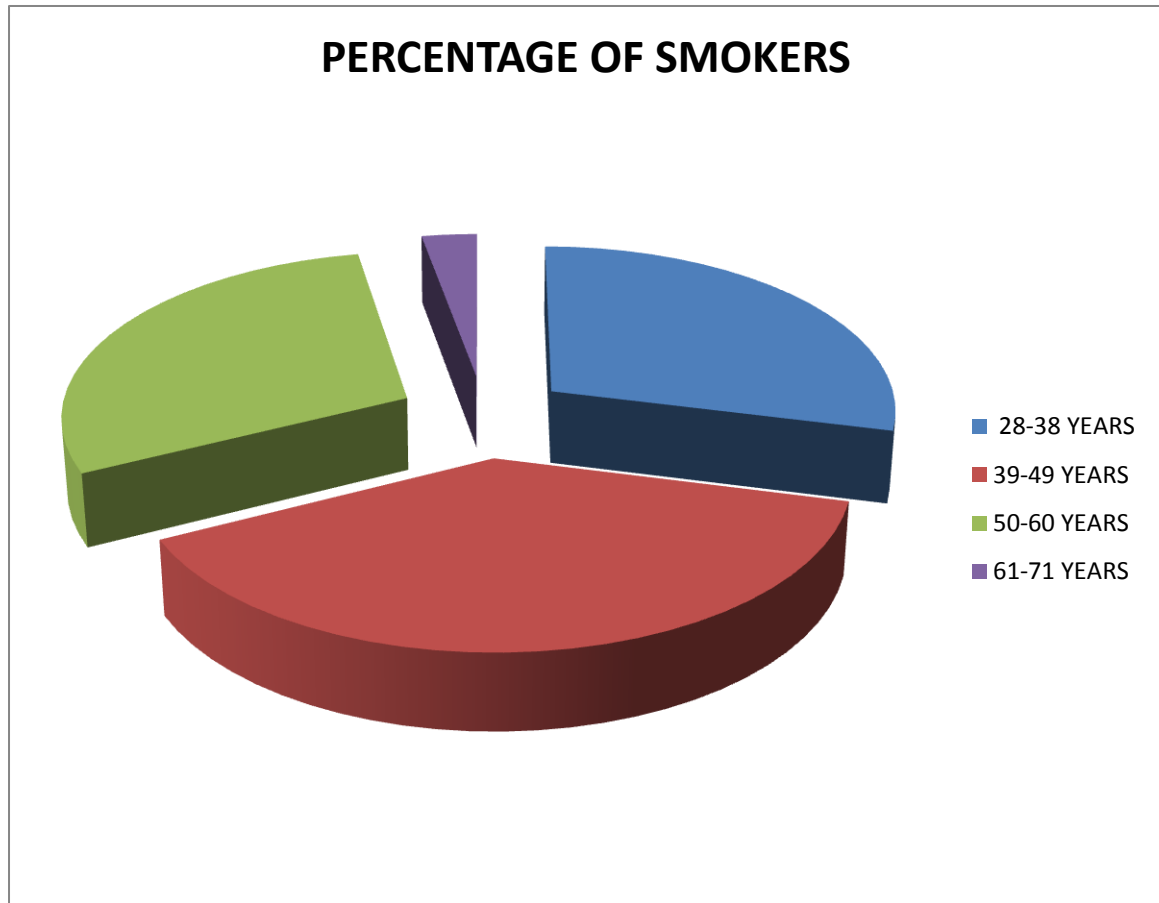
28-38 years 28.7% (n=50)

39-49 years 38.5% (n=68)

50-60 years 29.3% (n=51)

61-71years   2.8%   (n=5)

FIGURE - 2 BMI distribution of smokers in percentage
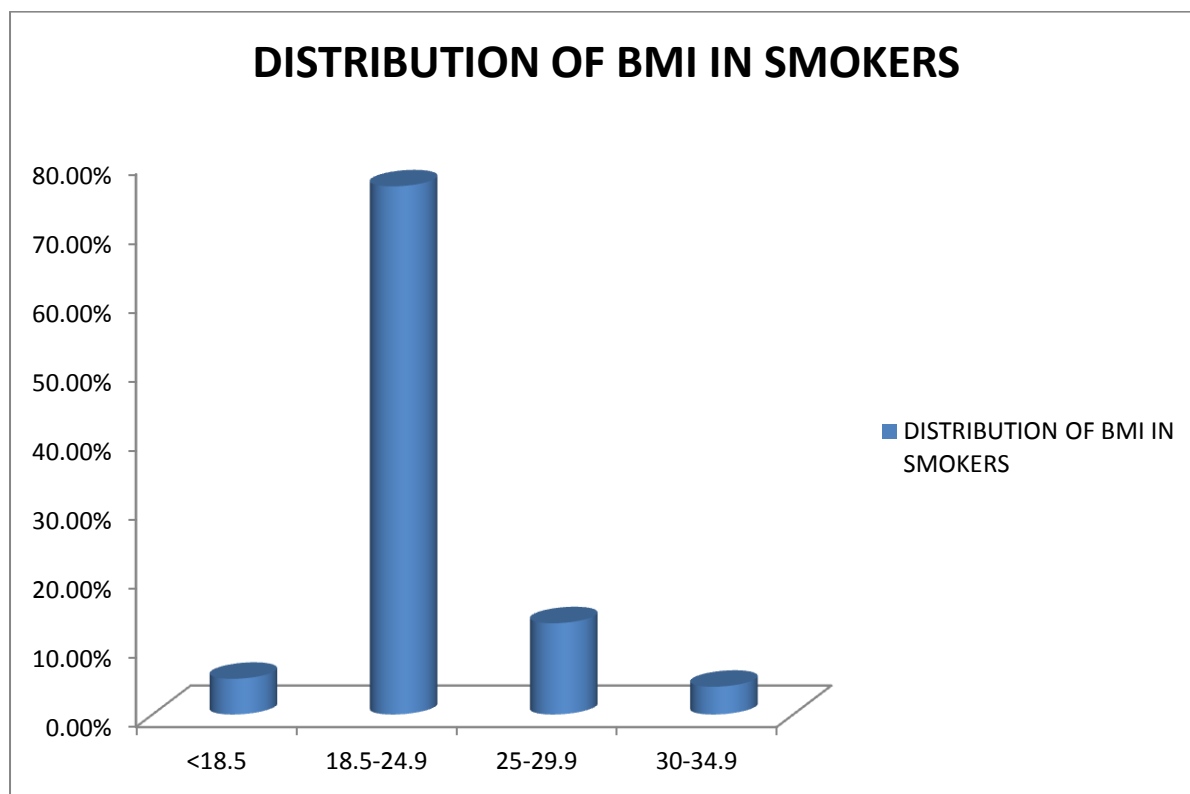
BMI – Body mass index

1. <18.5   5.17% (n=9)

2. 18.5- 24.9   76.43% (n=134)

3. 25.0- 29.9   13.21%(n=23)

4. 30.0-34.9   4.02% (n=8)

FIGURE - 3 Smoking index distribution in smokers
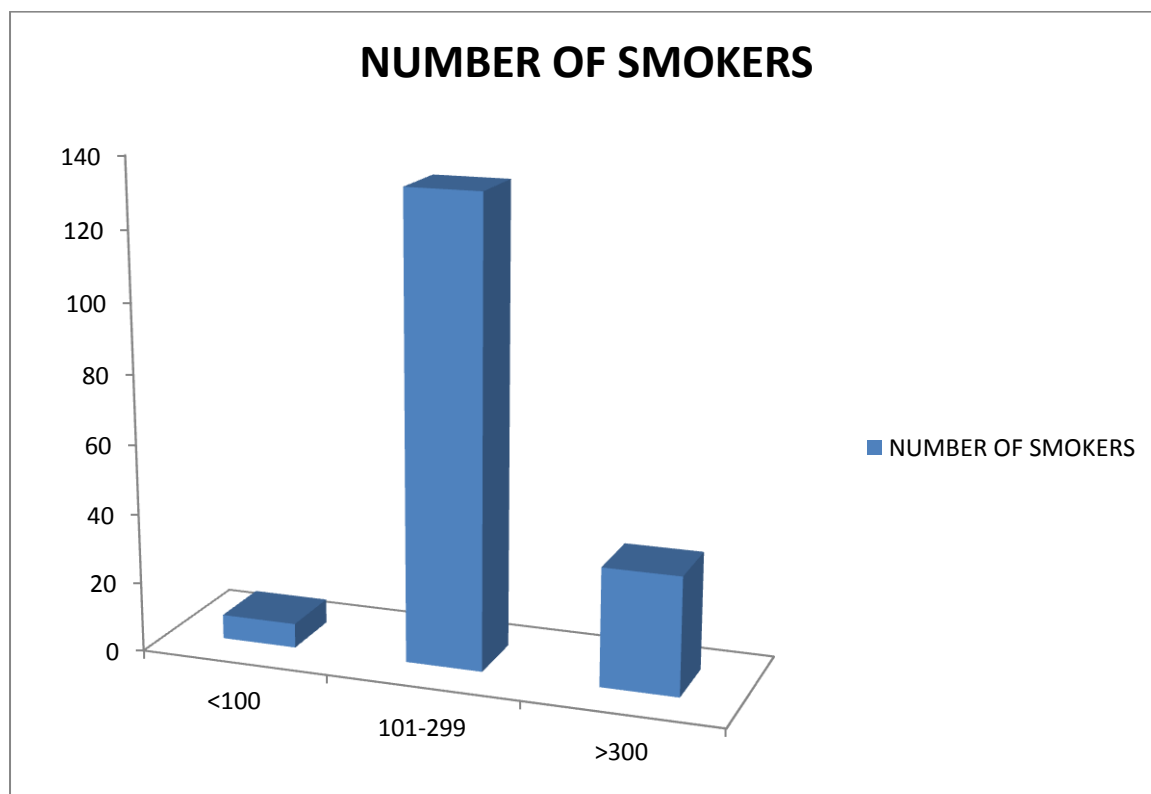
SI	NUMBER OF SMOKERS	PERCENTAGE
<100	7	4.02%
101-299	133	76.43%
>300	34	19.43%

FIGURE - 4 Age of first smoke among smokers
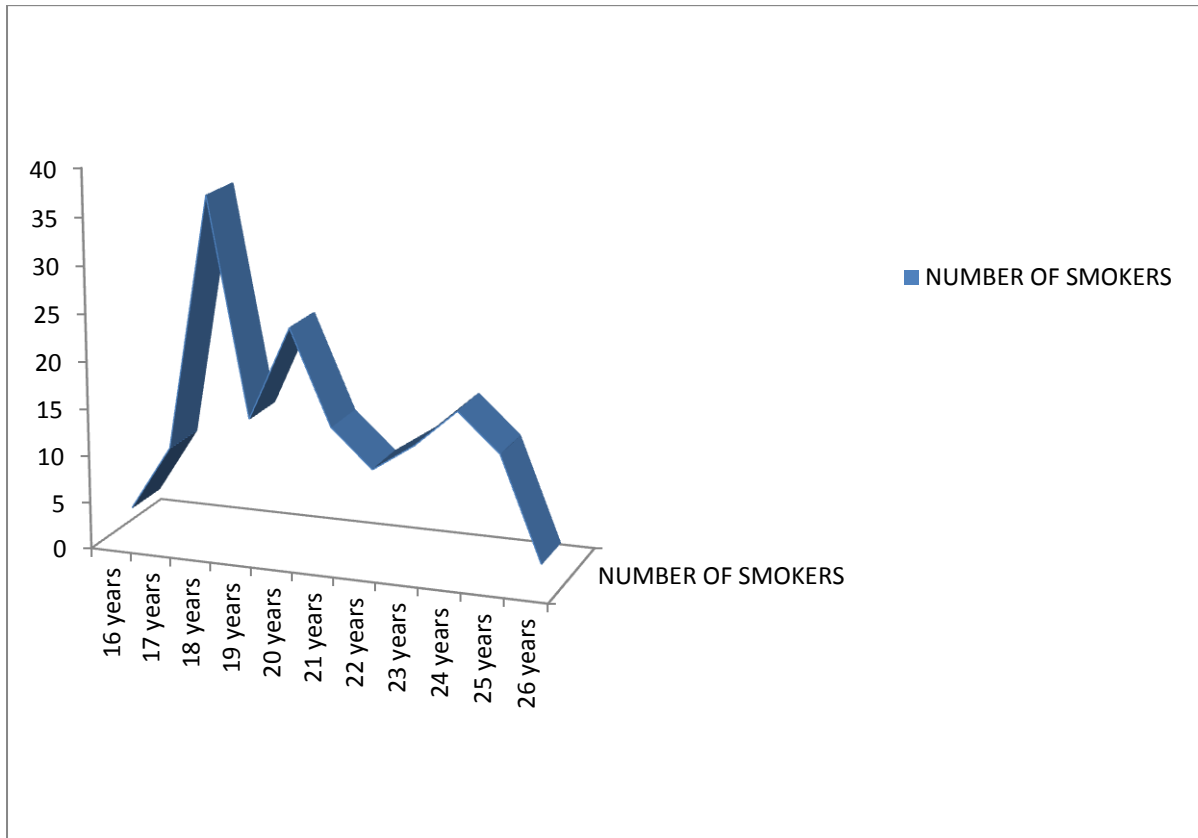
1. Youngest age is 16 years

2. Maximum number observed is at 18 years

FIGURE- 5 Distribution of obstructive lung disease in spirometry
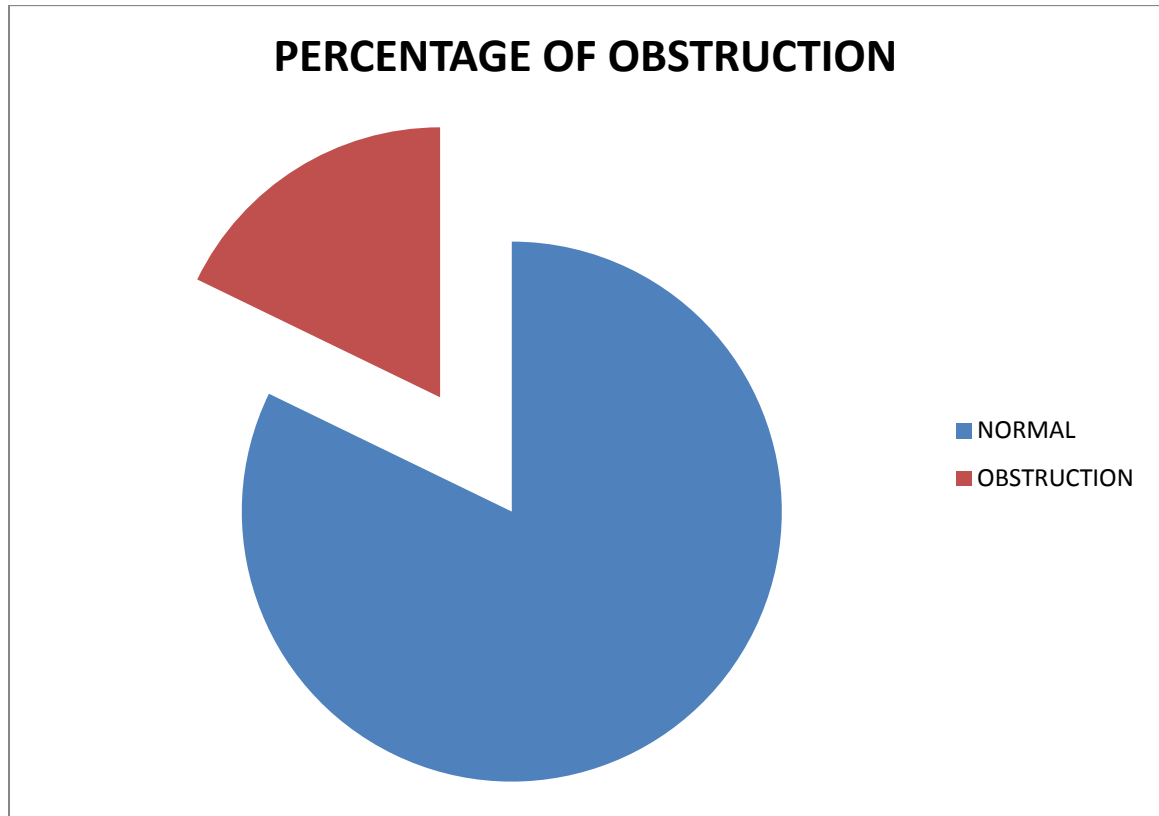
PERCENTAGE OF OBSTRUCTION

- NORMAL
- OBSTRUCTION

Normal spirometry – 82.18%(n=143)

Obstruction   - 17.81%(n=31)

Among obstructive pattern

Mild obstruction   - 61.29%(n=19)

Moderate obstruction- 38.7%(n=12)

TABLE 1

PARAMETERS (N=174)	MEAN(SD)	MINIMUM	MAXIMUM
AGE	44.9943 (8.794)	28	65
ONSET	20.65 (2.634)	16	26
BMI	22.6925 (3.101)	16.5	32
SI	226.821 (77.315)	80	450
FVCp	87.31 (58.383)	58	822
FEV1p	79.97 (16.248)	51	152
FEV1/FVCp	98.55 (17.961)	60	139
MEF 25-75	64.4 (31.458)	11	191
MEF 75	68.68 (23.448)	18	137
MEF 50	66.66 (24.668)	22	133
MEF 25	59.90 (32.588)	7	247
PEF	69.74 (22.198)	24	128
FVC m	3.2059 (.78459)	1.33	5.46
FEV1m	2.7059 (.68959)	1	4.53
FEV1/FVC m	.7755 (.07193)	0.18	0.85

Onset   - age of first smoke

BMI   -Body mass index

SI   -Smoking index

FVCp   - Forced vital capacity (Percent)

FEV1p – Forced expiratory volume in 1 second(percent)

MEF 25-75 – Mid expiratory flow

PEF   - Peak expiratory flow

FVCm   - Forced vital capacity (measured)

FEV1m – Forced expiratory volume in 1 second(measured)

TABLE 2

ONE SAMPLE T TEST		
PARAMETERS (N=174)	MEAN(SD)	p VALUE
AGE	44.9943 (8.794)	0.075
ONSET	20.65 (2.634)	0.001***
BMI	22.6925 (3.101)	0.101
SI	226.821 (77.315)	0.001***
FVCp	87.31 (58.383)	0.001***
FEV1p	79.97 (16.248)	0.002**
FEV1/FVCp	98.55 (17.961)	0.018*
MEF 25-75	64.4 (31.458)	0.065
MEF 75	68.68 (23.448)	0.651
MEF 50	66.66 (24.668)	0.062
MEF 25	59.90 (32.588)	0.035*
PEF	69.74 (22.198)	0.564
FVC m	3.2059 (.78459)	0.054
FEV1m	2.7059 (.68959)	0.322
FEV1/FVC m	.7755 (.07193)	0.001***

*is p value <0.05

**is p value <0.01

***is p value < 0.001

TABLE 3A

	ONSET	FVCm	FVCp	FEV1m	FEV1p	FEV1FVCm	FEV1FVCp
CHI SQUARE	64.613a	107.609b	77.59c	87.33b	180.39d	108.46e	79.36d
Df	10	97	52	97	46	21	46
p VALUE	0.001***	0.217	0.012*	0.749	0.001***	0.001***	0.002**

TABLE 3B

	PEF	MEF25-75	MEF75	MEF50	MEF25	BMI	SI	AGE
CHI SQUARE	69.86f	61.55g	71.07h	85.03i	98.41j	108.89k	240.25l	57.72m
Df	67	80	68	71	78	83	39	35
p VALUE	0.382	0.938	0.376	0.122	0.059	0.03*	.001***	.009**

*is p value <0.05

**is p value <0.01

***is p value < 0.001

TABLE 4

	HEIGHT	WEIGHT	ONSET	FVCm	FVCp	FEV1m	FEV1p	FEV1FVCm	FEV1FVCp	PEF	MEF25-75	BMI	SI	AGE
HEIGHT	1													
p VALUE														
WEIGHT	.391***	1												
p VALUE	0.001													
ONSET	-0.013	-0.046	1											
p VALUE	0.862	0.546												
FVCm	.482***	.192*	-0.034	1										
p VALUE	0.001	0.011	0.661											
FVCp	-0.057	-0.032	0.123	-0.034	1									
p VALUE	-0.034	0.672	0.106	0.658										
FEV1m	.460***	.243***	-0.085	.956***	-0.042	1								
p VALUE	0.001	0.001	0.268	0.001	0.586									
FEV1p	0.014	0.044	0.069	0.002	0.049	0.007	1							

p VALUE	0.859	0.567	0.369	0.979	0.521	0.923							
FEV1FVCm	0.044	0.063	0.021	0.084	-0.125	0.126	.257***	1					
p VALUE	0.565	0.406	0.78	0.272	0.099	0.098	0.001						
FEV1FVCp	-0.077	-0.021	-0.042	-0.088	-.229**	-0.088	.254***	.460***	1				
p VALUE	0.312	0.787	0.583	0.25	0.002	0.25	0.001	0.001					
PEF	0.128	.193*	0.008	.154*	-0.135	.167*	.377***	.345***	.353***	1			
p VALUE	0.092	0.011	0.916	0.043	0.075	0.028	0.001	0.001	0.001				
MEF25-75	0.078	-0.004	0.018	0.091	-.151*	0.089	.383***	.313***	.704***	.485***	1		
p VALUE	0.307	0.961	0.81	0.234	0.046	0.241	0.001	0.001	0.001	0.001			
BMI	-.259***	.756***	-0.037	-0.106	0.003	-0.039	0.05	0.038	0.039	.167*	-0.047	1	
p VALUE	0.001	0.001	0.633	0.163	0.973	0.606	0.511	0.616	0.606	0.028	0.535		
SI	-0.006	-0.036	-0.009	-.187*	0.133	-.225**	-.158*	-.476***	-.406***	-.256***	-.216**	0.041	1
p VALUE	0.94	0.636	0.902	0.014	0.08	0.003	0.038	0.001	0.001	0.001	0.004	0.593	

AGE	-.197**	-0.13	0.069	-.387**	0.114	-.478***	-0.058	-.300***	-0.04	-0.088	-0.046	0.017	.616***	1
Pvalue	0.009	0.088	0.364	0.003	0.135	0.001	0.445	0.001	0.6	0.247	0.543	0.82	0.001	

*is p value <0.05

**is p value <0.01

***is p value < 0.001

SUMMARY

SUMMARY

FIGURE 1 Shows

Age   distribution of smokers in percentage

39-49 years 38.5% (n=68) is commonly observed data

FIGURE 2 shows

BMI distribution of smokers in percentage

18.5- 24.9   76.43% (n=134)

FIGURE 3 shows

Smoking index distribution in smokers

SI 101-299 in 76.43% (n=133)

FIGURE 4 shows

Age of first smoke among smokers

1. Youngest age is 16 years

2. Maximum number observed is at 18 years

FIGURE 5 shows

Distribution of obstructive lung disease in spirometry

Normal spirometry – 82.18% (n=143)

Obstruction   - 17.81%(n=31)

Among obstructive pattern

Mild obstruction - 61.29% (n=19)

Moderate obstruction- 38.7% (n=12)

TABLE 1

Distribution of parameters in mean and standard deviation

Age group – 44.99(8.79) in years

Age of first smoke - 20.65 (2.634) in years

BMI – 22.69(3.10)

SI - 226.82 (77.31)

FVCp – 87.31(58.38)

FEV1p -79.97(16.24)

FEV1FVCp – 98.55(17.96)

MEF 2575 – 64.4(31.45)

MEF75 – 68.68 (23.44)

MEF50 – 66.66(24.66)

MEF25- 59.9(32.58)

FEV1m – 2.70(.071)

FEV1FVCm - 0.77(0.071)

FVCm – 3.2 (0.78)

TABLE 2

One sample T test

FEV1FVCp   and MEF25 have   p value < 0.05

FEV1p has p value <0.01

Age of first smoke, SI,FVCp and FEV1FVCm have p value <0.001

TABLE 3

Chi square test

 BMI - 108.46 (p value <0.05)and FVCp -77.59(p value <0.05)

 Age - 57.724(p value < 0.01) and FEV1FVCp -79.386(p value 0.002)

Age of first smoke , SI -240.25, FEV1p- 180.39 and FEV1FVCm -108.46

 p value < 0.001

TABLE 4

Correlation coefficient

SI has significant negative correlation with FEV1m _ 0.225(p 0.003) ,FEV1p _0.158 (p 0.03), FEV1FVCm _0.476(p0.001) , FEV1FVCp _0.406 (p 0.001) , PEF _0.256 (p 0.001) ,MEF 25-75 _0.216(P 0.004)

FEV1FVCm has significant positive correlation with FEV1p 0.257 (p 0.001)

FEV1FVCp has significant negative correlation with _0.229 (p 0.002) and significant positive correlation with FEV1p 0.254 (p 0.001), FEV1FVCm 0.460 (p0.001)

MEF 25-75 has significant positive correlation with FEV1p 0.383(p 0.001) , FEV1FVCm 0.313 (0.001) , FEV1FVCp 0.704 (p 0.001) ,PEF 0.485 (p 0.001)

DISCUSSION

DISCUSSION

This study was conducted for earlier detection of COPD in smokers even before the occurance of symptoms and signs of obstructive lung disease. The diagnostic criteria used for case finding is as specified in GOLD guidelines. The portable spirometer (Easy one)was used to perform the spirometry. The population in the study group is representative of patients attending the out patient department in the tertiary care hospital Tiruchirappalli,South India. The prevalence of COPD in this population is 10.2%. the prevalence of smoking has increased and 50% of male smoke cigarette or bidis. Our aim is to detect the presence of COPD earlier in asymptomatic smokers and to correlate the severity of obstructive pattern with SI.

All the participants were male. Since female smoking is not socially accepted in this region only a little proportion smoke. It was ensured that all the participants continue to smoke and does not have respiratory symptoms and signs during the study. Occupational history suggestive of exposure to lung disease have been excluded from the study. Most of them were sales representatives, vendors and auto/taxi drivers.

All are subjected to 400 mcg salbutamol nebulisation fifteen minutes prior to spirometry as per GOLD guidelines. Spirometry was

performed by single technician by demonstrating technique before study. Participants were well informed with printed material regarding ill effects of smoking and benefits of smoking cessation.

The parameters collected were age of first cigarette, BMI,SI,FEV1,FEV1/FVC both measured and percent,MEF25-75,MEF75,MEF50 and MEF 25. The results were statiscally analyzed.

AGE: The mean age was 44.994 (8.794). Most of them were between 39-49 years(n=67) 38.5%. youngest age in this study is 28 years. Age group 61-71 years is only 2.87% (n=5). significant negative correlation with FVCm _0.387(p 0.003), FEV1m _0.478(p 0.001) ,FEV1FVCm _0.300(p 0.001).This correlates well with Natural history pattern of COPD in which as the age advances the severity of disease progresses as explained by Fletcher and Peto curve. Less number of patients in >60 years is probably due to occurrence of symptoms as age advances and Our study included only asymptomatic patients.

BMI: The mean BMI was 22.6925(3.1010). about 76.43(n=133) were in 18.5-24.9 BMI range. Underweight noted only in 5.172%(n=9) probably our study included only asymptomatic population of smokers. Since most of the participants are middle aged working group they were in BMI range of normal to overweight 89.64% (n=140). There is no correlation of BMI with severity of obstructive pattern in our study.

SMOKING INDEX: About 78.735% (n=137) participants had moderate SI i.e 100-300. Severe SI observed in 21.26%(n=37). SI and age has significant positive correlation coefficient 0.616(p 0.001) which is consistent with previous studies. SI and FEV1/FVC ratio both m and p has significant negative correlation coefficient (p 0.001) i.e SI increases FEV1/FVC ratio decreases. Moderate obstruction had SI of 400 (88.25) and mild obstruction had SI of 310(66.50). SI also has significant negative correlation coefficient (p 0.001) with MEF 25-75 which is again consistent with presence of small airway disease in smokers with COPD. This parameter was less correlated in previous north Indian study . FEV1m_ 0.225(p 0.003) , FVCm _0.187(0.01) alone had correlation with SI for diagnosis of obstructive lung disease. When percentage is considered they does not correlate. Thus FEV1/FVC ratio is gold standard for screening presence of airflow limitation in smokers as indicated in study Stralelis G, et al and Zielinski et al. is consistent with our study.

Age of first smoke: Majority started smoking around 20 years. About 1/5 th (n=37) 19.54 % started to smoke at 18 years. Age of first smoke does not have any correlation with obstructive lung disease in our study(p=.839). It is the quantity of smoke and not the duration of smoke

correlates with severity of airflow limitation. Previous studies also given the same report.

FVC: It has also got significant negative correlation coefficient (p 0.001) with FEV1/FVC ratio. These are well established in various studies and reproduced in our study also.

FEV1: Significant positive correlation coefficient (p 0.001) with,FEV1/FVC, MEF 25-75 which is consistent from previous studies. According to GOLD criteria 19/174 had mild and 12/174 had moderate obstruction pattern. All the participants with obstructive spirometry are asymptomatic during study. But when only FEV1 value is considered 57.47% (n=100) had FEV1 >80. 42.52% (n=74)had FEV1 50-80%. So in determining the obstructive pathology we need FEV1/FVC or FEV1/FEV6. FEV1 alone is not useful as screening criteria for diagnosis of COPD in asymptomatic smokers.

FEV1/FVC: Airflow limitation with FEV1/FVC ratio <70 was noted in 17.816%(n=31). Out of which when applied to GOLD guidelines mild obstruction noted in 61.2903%(n=19). Moderate obstruction seen in 38.7096%(n=12). None of them had severe or very severe obstruction. FEV1/FVC has Significant positive correlation coefficient (p 0.001) with FEV1and MEF25-75 . It has also got significant negative correlation coefficient (p 0.001) with SI and FVC.

MEF25-75: has Significant positive correlation coefficient (p 0.001) with FEV1p and FEV1/FVCm , FEV1FVCp ratio . It has also got significant negative correlation coefficient (p 0.001) with SI. This parameter is less correlated in previous trials used for screening of COPD. This parameter needs further large trials.

CONCLUSION

CONCLUSION

1. The most common age of first smoking is 18 years and all participants had started smoking by 26 years.

2. The youngest age of first smoking is at 16 years

3. The age of first smoking does not have significance with airflow limitation

4. The most common age group found is 39-49 years

5. The most prevalent BMI is 18.5-24.9 and does not have significance in respect to airflow obstruction .

6. SI has significant negative correlation with FEV1/FVC and Significant positive correlation coefficient with age.

7. The quantum of smoking correlates with severity of airflow obstruction as indicated by SI

8. There is 17.8% of asymptomatic smokers have airflow limitation in the form of obstructive lung disease.

9. There is 61.29% of asymptomatic smokers had mild COPD and 38.7% had moderate COPD as per GOLD guidelines

10. The FEV1/FVC ratio as a screening tool to detect the presence of COPD in asymptomatic smokers is established

11. Handheld in office spirometry is useful for screening the smokers for presence of airflow obstruction before significant symptoms.

12.MEF 25-75 also has significant positive correlation coefficient

with FEV1/FVC ratio and significant negative correlation with SI

LIMITATIONS AND RECOMMENDATIONS

1. The period of study is low, large data would have been collected if done for long time.

2. Serial spirometry not done on same participant since it is cross sectional study

3. Study group is just adequate

4. History regarding occupational exposure is not probed in depth

5. Non smokers as control group not done

6. Environmental tobacco smoking and genetic predisposition to COPD are not ruled out.

7. Economic burden of individual due to smoking is not calculated

8. MEF 25-75 value needs further large trials to use as earlier tool for airflow limitation

9. Regular use of hand held spirometer by primary care physician is recommended to screen airflow limitation in asymptomatic smokers

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MASTER CHART

S.NO.	AGE	HEIGHT	WEIGHT	BMI	ONSET	PY	SI	FVCm	FVCp	FEV1m	FEV1p	FEV1/FVCm	FEV1/FVCp	PEF	MEF25-75	MEF75	MEF50	MEF25
1	32	170	60	20.8	20	12	240	3.36	126	3.02	78	0.6	60	41	43	34	40	83
2	53	171	56	19.2	23	9	180	3.67	76	2.98	84	0.78	116	91	114	100	133	123
3	43	146	45	21.1	23	10	200	2.46	70	2.09	54	0.66	66	54	18	43	22	12
4	36	160	58	22.7	23	8	160	2.72	58	1.98	79	0.72	139	80	113	81	78	247
5	44	160	60	23.4	20	10	200	3.11	69	2.7	78	0.84	116	53	76	56	79	109
6	60	172	65	22	24	36	720	3.85	35	2.99	78	0.53	72	21	7	7	6	9
7	33	175	58	18.9	20	6	120	5.09	69	4.31	82	0.83	121	68	86	75	83	111
8	43	160	62	24.2	21	12.5	230	3.33	75	2.9	79	0.84	109	60	69	63	70	78
9	39	165	45	16.5	20	8	160	2.52	73	2.15	69	0.82	99	73	50	74	80	84
10	54	148	55	25.1	16	7.2	144	2.78	70	2.31	58	0.77	89	49	25	44	31	24
11	50	160	50	19.5	18	7.5	150	3.58	106	2.94	100	0.78	99	37	18	18	24	35
12	44	165	55	27.1	19	10	200	4.02	82	3.33	80	0.79	101	112	57	84	61	59
13	43	160	55	25.4	24	11.5	230	3.11	76	2.7	78	0.84	106	102	73	83	79	67
14	38	154	60	25.3	20	5	102	3.28	83	2.86	72	0.84	89	64	41	66	46	35
15	41	159	57	22.5	21	11.5	230	3.5	86	3.05	63	0.69	69	38	33	42	33	27
16	59	160	63	24.6	18	20	400	3.44	55	2.99	65	0.67	67	31	9	28	16	5
17	53	175	65	21.2	19	9	180	4.36	89	3.5	93	0.78	107	65	90	73	86	110
18	50	148	50	26.5	23	5	100	2.88	74	2.42	86	0.78	125	68	82	74	85	137
19	42	158	60	22	25	10	200	2.57	87	2.2	73	0.81	89	76	33	61	39	26
20	65	148	45	20.5	22	20	400	1.99	69	1.62	84	0.77	130	72	99	70	98	128
21	43	160	57	22.3	25	11.5	230	3.65	95	3.23	79	0.83	89	71	44	58	52	51
22	33	157	55	21.5	20	4.8	96	2.97	78	2.58	68	0.84	90	38	41	37	47	27
23	45	160	52	20.3	17	13	260	1.58	155	1.25	152	0.75	104	25	21	19	81	122
24	50	163	54	20.3	19	18	320	3.65	74	3.19	51	0.69	69	36	27	33	29	89
25	34	158	54	21.6	18	8.5	170	3.02	83	2.62	83	0.84	103	83	75	88	86	60

26	38	150	70	31.1	17	10	200	2.66	69	2.77	81	0.81	122	109	106	110	107	144
27	38	168	64	22.7	18	15	315	4.35	76	3.63	54	0.68	68	40	24	34	37	29
28	33	160	59	23	17	17	340	2.9	71	2.5	60	0.68	68	26	30	38	35	23
29	39	168	69	24.4	16	10	200	3.61	82	3.89	82	0.82	104	82	81	91	90	72
30	58	154	56	23.6	19	15.5	330	3.02	69	2.45	67	0.77	102	47	48	47	49	54
31	44	173	58	19.4	25	13.5	270	4.48	65	3.67	84	0.7	70	32	37	34	38	36
32	35	186	75	21.7	17	7.5	150	5.46	87	4.49	54	0.81	99	75	78	85	89	57
33	41	171	61	20.9	20	10	200	4.44	73	3.67	81	0.7	70	76	23	47	29	39
34	53	156	60	24.7	21	15	300	3.27	73	2.68	71	0.78	69	93	55	96	81	37
35	31	169	69	24.2	23	13	260	4.74	81	4.05	75	0.83	95	67	58	82	75	46
36	51	151	60	26.3	18	15	300	2.47	103	2.09	80	0.69	70	52	62	75	85	40
37	51	150	50	22.2	21	10	200	2.97	67	2.48	60	0.79	96	61	34	46	60	40
38	56	155	55	22.9	25	17.5	350	3.13	80	2.55	98	0.77	130	52	112	52	97	77
39	56	160	56	21.9	21	15	300	3.42	89	2.77	83	0.77	112	54	191	59	93	110
40	57	157	65	26.4	26	15.5	310	3.11	112	2.52	85	0.68	68	32	24	30	61	79
41	60	160	58	22.7	25	18.5	370	2.66	64	2.13	80	0.7	70	63	49	53	48	48
42	53	170	65	22.5	23	17.5	350	2.38	100	2	80	0.69	69	61	23	48	48	150
43	37	156	51	21	18	10	200	3.68	101	3.14	91	0.81	96	46	68	45	79	61
44	44	160	82	32	17	10	200	3.73	84	3.11	84	0.79	105	128	77	137	101	57
45	45	168	76	26.9	24	12.5	250	3.65	70	2.85	80	0.7	70	54	25	52	48	49
46	40	151	56	24.6	20	10	200	3.02	80	2.6	69	0.18	91	46	38	39	68	36
47	36	158	57	22.8	20	10	200	3.82	81	3.26	75	0.81	98	66	54	68	66	45
48	59	162	52	19.8	16	20	400	3.46	78	2.76	97	0.76	131	66	121	64	118	47
49	53	177	60	19.2	19	15	300	4.22	98	3.29	80	0.67	67	74	27	56	31	28
50	36	160	67	26.2	23	9	180	3.11	82	2.7	80	0.84	101	79	59	78	63	51
51	39	163	64	24.1	18	10	200	2.87	79	2.47	79	0.81	106	99	80	105	104	59
52	35	174	60	19.8	19	8	160	5.03	79	4.27	81	0.83	105	68	77	72	75	76
53	45	160	45	17.6	19	10	200	3.11	79	2.7	74	0.84	97	93	59	93	75	34
54	60	156	54	22.2	25	17.5	350	3.09	822	2.48	52	0.65	65	24	15	22	22	12

55	38	159	59	23.3	25	7.2	144	2.98	127	2.59	109	0.84	89	51	19	44	43	66
56	44	161	60	23.1	20	11	220	3.79	112	3.76	109	0.79	102	72	88	82	108	89
57	46	151	68	29.8	22	13.5	270	2.43	130	2.04	109	0.85	83	85	61	84	74	39
58	47	160	79	30.9	19	13.5	270	2.53	77	2.15	88	0.8	121	49	33	70	60	77
59	35	170	75	26	20	18	360	4.82	90	4.03	80	0.69	69	48	33	47	37	33
60	60	160	55	21.5	17	17.5	350	2.69	62	2.16	78	0.76	132	107	158	109	60	62
61	45	150	54	24	25	12	240	2.36	80	2	81	0.68	68	55	11	42	23	70
62	57	160	45	17.6	21	17.5	350	3.39	80	2.27	70	0.77	91	51	33	56	51	22
63	42	171	63	21.5	22	18	360	2.15	81	1.8	80	0.7	70	44	54	42	32	21
64	36	172	65	22	18	6	160	3.3	67	2.92	80	0.74	123	83	121	89	102	45
65	63	175	65	21.5	20	11.4	228	3.84	67	2.92	80	0.74	102	78	101	81	76	51
66	39	162	58	22.1	25	10	200	3.11	83	2.7	95	0.84	119	76	98	75	96	46
67	61	171	69	23.6	19	20	400	3.05	95	2.59	84	0.77	97	104	56	85	77	29
68	44	159	57	22.5	21	11	220	4.05	84	3.54	82	0.83	103	88	73	97	82	72
69	49	160	56	21.9	22	15	300	2.82	116	2.1	80	0.69	69	54	56	78	70	59
70	39	169	65	22.8	17	15	300	3.95	114	3.45	81	0.69	69	57	61	60	41	39
71	60	140	58	29.6	19	10.5	210	2.26	64	2.13	65	0.76	105	63	49	63	60	58
72	36	175	68	22.2	25	9	180	4.59	75	3.79	77	0.85	100	68	70	73	74	69
73	47	160	62	24.2	18	10	200	3.54	59	2.94	57	0.79	103	47	44	46	49	50
74	44	170	82	28.4	22	11	220	3.73	84	3.11	85	0.79	105	128	77	137	101	57
75	49	166	52	17.9	22	10	200	3.46	78	2.76	97	0.76	131	66	131	64	117	77
76	44	168	60	21.3	24	8.8	176	3.4	70	2.83	63	0.85	83	68	26	73	46	9
77	63	177	65	20.7	22	20	400	4.22	81	3.69	80	0.66	66	74	57	54	23	7
78	44	170	67	23.2	23	11	220	3.11	82	2.7	80	0.84	101	79	59	78	63	51
79	39	163	64	24.1	22	9.5	190	2.87	78	2.47	79	0.82	106	99	80	105	104	59
80	35	174	60	19.8	20	8.5	170	5.03	79	4.27	81	0.8	105	68	77	72	75	76
81	35	160	60	23.4	18	8.5	170	3.11	79	2.6	75	0.84	97	93	59	93	75	34
82	40	166	58	21	18	9.5	190	3.68	66	3.21	61	0.83	97	57	45	65	46	42
83	58	160	60	23.4	21	22.5	450	3.09	82	2.48	51	0.65	65	24	15	22	26	12

84	46	163	63	23.7	18	8.8	176	3.79	112	3.16	109	0.79	102	72	88	82	108	89
85	36	161	70	27	24	9	180	2.43	130	2.04	109	0.85	83	85	61	84	74	39
86	47	162	70	26.7	18	11	220	2.53	77	2.15	88	0.8	121	49	52	42	60	77
87	52	160	55	21.5	25	8.1	162	2.69	62	2.16	78	0.76	110	107	150	100	60	46
88	49	160	56	21.9	25	12	240	3.11	83	2.7	95	0.84	119	70	98	75	96	146
89	51	173	60	20	19	15	300	3.05	95	2.59	84	0.77	97	104	56	85	76	39
90	38	157	56	22.7	21	10	200	4.05	85	3.5	83	0.83	103	88	73	97	82	72
91	49	160	58	22.7	18	10	200	2	68	1.65	70	0.79	110	35	45	49	42	74
92	48	165	62	22.8	24	7.2	144	4.22	88	3.66	86	0.83	115	65	89	71	94	128
93	48	168	65	23	24	11.2	224	2.84	64	2.42	75	0.8	125	68	85	75	80	66
94	52	155	56	23.3	20	13.5	270	1.66	65	1.33	68	0.75	94	43	53	39	33	25
95	61	159	50	21.8	25	20	400	2.97	110	2.29	80	0.69	69	99	39	74	43	26
96	49	166	60	21.8	21	12	240	1.79	95	1.44	100	0.76	112	83	62	73	51	84
97	30	170	68	23.5	19	5	100	3.3	95	2.9	77	0.8	84	87	12	70	59	95
98	49	170	62	21.5	20	10	200	2.17	81	1.8	69	0.77	91	76	28	67	36	21
99	39	166	60	21.8	24	9.5	190	4.2	90	3.5	78	0.8	88	113	41	78	50	33
100	55	160	75	29.3	20	12	240	2.55	74	2.15	71	0.79	103	62	59	68	77	36
101	39	169	69	24.2	25	9.5	190	2.96	74	2.55	78	0.82	110	38	70	28	46	67
102	45	157	52	21.1	20	10	200	3.13	104	2.65	111	0.79	114	85	120	94	130	153
103	51	148	68	31	20	9	180	2.74	103	2.22	116	0.76	119	120	96	127	33	56
104	44	164	60	22.3	21	7.2	144	2.79	69	2.38	81	0.81	124	71	103	79	93	53
105	35	160	73	28.5	20	8.5	170	2.07	89	2.65	89	0.82	104	73	81	77	86	73
106	38	155	56	23.3	18	10	200	3.6	80	3.07	75	0.8	99	72	58	79	76	39
107	51	153	69	28.7	18	15	300	2.56	80	2.17	75	0.79	90	59	33	60	40	24
108	55	168	62	22	21	12	240	1.84	109	1.5	100	0.77	97	87	45	64	54	33
109	37	162	52	19.8	25	10	200	4.03	85	3.4	73	0.81	89	60	41	58	48	36
110	47	166	51	18.5	17	11	220	2.9	83	2.27	86	0.75	108	77	68	83	80	72
111	59	155	65	27	25	10.2	204	2	74	1.65	74	0.79	106	44	43	47	42	51
112	58	162	60	22.9	25	10.2	204	2.34	75	1.95	77	0.79	100	77	44	80	75	43

113	57	160	61	23.8	24	10.2	204	2.79	66	1.45	68	0.76	118	54	64	55	71	69
114	32	160	45	17.6	23	7.5	150	3.28	93	2.86	96	0.84	107	71	84	77	92	91
115	57	160	59	23	17	10.2	204	2.05	71	1.7	84	0.79	125	82	90	96	93	90
116	59	164	58	21.6	23	20	400	3.57	75	2.8	80	0.67	67	74	40	47	31	30
117	49	163	68	25.6	19	10	200	2.57	75	2.8	68	0.76	94	74	40	57	41	40
118	38	167	65	23.3	24	10	200	4.29	79	3.59	89	0.8	105	110	75	120	84	55
119	43	160	58	22.7	18	9.5	190	3.11	77	2.7	68	0.84	91	48	42	38	42	53
120	48	149	55	24.8	24	9	180	2.2	78	1.8	81	0.79	112	61	58	64	58	71
121	37	158	50	20	18	9.5	180	2.58	114	2.21	118	0.85	105	114	120	60	74	91
122	56	163	45	16.9	18	9	180	3.3	76	2.61	74	0.75	101	79	49	84	66	38
123	36	171	60	20.5	26	9	180	4.29	90	3.55	97	0.85	106	100	105	95	55	60
124	56	171	71	24.3	18	18	360	4.29	123	3.51	81	0.64	64	63	41	66	67	97
125	39	154	70	29.5	20	9.5	190	4.05	88	3.54	96	0.83	103	99	72	99	82	71
126	58	155	76	31.6	20	10.2	204	3.08	102	2.49	96	0.77	100	69	64	73	67	69
127	41	162	70	26.7	24	9.5	190	2.78	75	2.38	79	0.81	112	89	92	94	74	67
128	37	160	61	23.9	22	9.5	180	3.05	92	2.65	74	0.84	84	47	62	68	71	47
129	50	161	62	23.9	18	15	300	2.45	101	2.08	102	0.8	108	71	93	73	97	94
130	28	163	45	16.9	20	5	100	4.4	73	3.79	82	0.83	118	90	96	102	87	40
131	43	159	63	24.9	18	9.5	190	3.04	89	2.61	80	0.81	96	75	51	81	49	57
132	50	155	50	19.8	24	15.5	310	2.77	96	2.14	81	0.69	69	54	46	36	34	42
133	52	155	50	19.8	19	14	280	2.72	62	2.09	61	0.74	102	52	38	57	46	39
134	29	169	58	20.3	24	5	100	3.64	74	3.17	88	0.84	115	72	101	79	85	43
135	28	160	48	18.7	19	4	80	3.55	86	3.1	89	0.84	107	62	87	67	88	60
136	43	167	63	22.6	20	9.5	190	4.16	63	3.44	84	0.79	94	52	60	59	75	39
137	56	160	50	19.5	24	10.2	204	2.84	83	2.34	78	0.77	99	90	46	60	53	48
138	53	158	45	18	22	9	180	1.33	103	1	83	0.74	84	34	31	25	32	52
139	49	160	50	19.5	23	12	240	3.6	82	2.97	75	0.79	96	78	45	83	74	31
140	37	160	50	19.5	19	9.5	180	2.68	95	2.29	100	0.85	106	88	105	100	112	87
141	32	180	88	27.8	18	6	120	5.38	89	4.53	80	0.83	91	85	57	81	66	42

142	31	150	60	26.7	20	6.5	130	3.49	77	3.06	76	0.82	106	81	81	95	86	86
143	50	155	47	19.6	18	13	260	2.68	84	2.27	84	0.8	107	88	76	95	84	63
144	56	159	55	21.8	24	13.6	272	3.1	59	2.43	75	0.75	133	53	89	73	63	68
145	33	155	64	23.5	22	7	140	3.73	76	3.22	75	0.81	105	68	77	75	113	62
146	50	162	60	22.9	19	9	180	3.17	58	2.45	69	0.75	122	86	108	93	89	65
147	36	166	64	21.9	20	9	180	3.39	58	2.74	71	0.77	130	71	81	79	70	37
148	58	159	50	19.8	18	20	400	3.05	68	2.38	54	0.69	69	51	19	36	24	22
149	39	170	65	22.5	18	20	400	3.29	70	3.83	55	0.68	68	41	26	38	31	26
150	47	165	55	20.2	19	22.5	450	2.79	70	2.38	50	0.68	68	26	24	21	26	33
151	46	165	55	20.2	17	11	220	2.79	63	2.37	74	0.8	125	69	83	70	83	90
152	31	160	50	19.5	24	6.5	130	3.37	91	2.9	82	0.84	107	65	78	67	82	78
153	37	165	60	22	18	9.5	180	2.43	130	2.04	109	0.85	83	85	61	84	74	39
154	48	166	67	24.3	18	13	260	2.53	77	2.15	88	0.8	121	49	52	42	60	77
155	51	170	71	24.6	22	15	300	2.69	62	2.16	78	0.76	110	107	150	100	60	46
156	49	160	50	19.5	21	13	260	3.11	83	2.7	95	0.84	119	70	98	75	96	146
157	40	168	66	23.4	23	9.5	190	3.05	95	2.59	84	0.77	97	104	56	85	76	39
158	34	170	70	24.6	21	8	160	4.05	85	3.5	83	0.83	103	88	73	97	82	72
159	42	170	68	23.5	18	11	220	2	68	1.65	71	0.79	110	35	45	49	42	74
160	36	160	50	19.5	20	9	180	2.72	62	2.09	61	0.74	102	52	38	57	46	39
161	42	165	68	25	18	9.5	190	3.64	74	3.17	88	0.84	115	72	101	79	85	43
162	29	169	58	20.3	23	5	100	3.55	86	3.1	89	0.84	107	62	87	67	88	60
163	28	160	48	18.7	19	5	100	4.16	63	3.44	84	0.79	94	52	60	59	75	39
164	43	167	63	22.6	18	9.5	190	2.84	83	2.34	78	0.77	99	90	46	60	53	48
165	56	160	50	19.5	24	18	360	1.33	103	1	83	0.74	84	34	31	25	32	52
166	53	158	45	18	20	16.5	330	3.6	82	2.97	75	0.79	96	78	45	83	74	31
167	49	160	50	19.5	20	9.3	186	2.68	95	2.29	100	0.85	106	88	105	100	112	87
168	37	160	50	19.5	18	9.5	180	5.38	89	4.53	80	0.83	91	85	57	81	66	42
169	50	155	50	20.8	18	16	320	2.77	96	2.14	81	0.69	69	54	46	36	34	42
170	44	164	60	22.3	18	11	220	2.57	75	2.8	68	0.76	94	74	40	57	41	40

171	35	160	73	28.5	20	8.5	170	4.29	79	3.59	89	0.8	105	110	75	120	84	55
172	38	155	56	23.3	18	10	200	3.11	77	2.7	68	0.84	91	48	42	38	42	53
173	51	153	49	20.9	18	15	300	2.2	78	1.8	81	0.79	112	61	58	64	58	71
174	55	168	62	22	21	12	240	2.58	114	2.21	118	0.85	105	114	120	60	74	91

PROFORMA

NAME: AGE: SEX:

STUDY NO.:

ADDRESS:

HEIGHT: WEIGHT: BMI:

HISTORY: AGE OF FIRST SMOKE:

DURATION:

SMOKING TYPE: CIGAR/ BEEDIES/CIGARETTS/ETS

PACK YEARS:

SMOKING INDEX:

PRE EXISTING ILLNESS:

PREMEDICATION:

PFT:

PARAMETER	TRIAL 1	TRIAL 2	TRIAL 3
FVCm			
FVCp			
FEV1m			
FEV1p			
FEV1 FVC m			
FEV1FVC p			
MEF 25- 75			
MEF 75			
MEF50			
MEF 25			
PEF			

GOLD STAGING:

IMPRESSION:

ABBREVIATIONS

a1AT – Alpha 1 Antitrypsin

ABG – Arterial Blood Gas

ATS – American Thoracic Society

BMI – Body Mass Index

COPD – Chronic Obstructive Pulmonary Disease

ERS – Europian Respiratory Society

ERV – Expiratory Reserve Volume

ETS – Environmental Tobacco Smoke

FEV1 – Forced Expiratory Volume in one second

FRC – Functional Residual Capacity

FVC –Forced Vital Capacity

GOLD –Global Initiative for Obstructive Lung Diseases

HHIP –Hedgehog Interacting Protien

IRV – Inspiratory Reserve Volume

LHS – Lung Health Study

MEF – Mid Expiratory Flow

MMP 12 – Matrix Matelloprotienase

PEF – Peak Expiratory Flow

PEFR – Peak Expiratory Flow Rate

RV – Residual Volume

SI – Smoking Index

TLC – Total Lung Capacity

TPM – Total Particulate Matter

TV – Tidal Volume

VC – Vital Capacity

V/Q – Ventilation Perfusion Ratio

WHO – World Health Organization

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Early detection of COPD in asymptomatic smokers

using spirometry proposed by **Dr.Mohana Sundaram**

part of fulfillment of M.D/M.S course in the subject of

Medicine for the year **2012-2015** by The Tamilnadu

Dr.MGR Medical University has been cleared by the

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K.A.P.Viswanatham Govt. Medical
College, Tiruchirapalli -1

EARLY DETECTION OF COPD IN ASYMPTOMATIC

SMOKERS USING SPIROMETRY

Dissertation submitted to

The Tamil Nadu Dr. M.G.R. Medical University

In partial fulfillment of the regulations for

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& M.G.M.GOVERNMENT HOSPITAL,

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