ORIGINAL ARTICLE

EARLY DETECTION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN SMOKERS USING SPIROMETRIC SCREENING

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ABSTRACT:

Introduction: COPD is a substantially underdiagnosed disorder, with the diagnosis typically missed or delayed until the condition is advanced. Spirometry is the most frequently used pulmonary function test and enables health professionals to make an objective measurement of airflow obstruction and assess the degree to which it is reversible. Hence, the present study was planned to evaluate the role of spirometric screening in the early detection of COPD in chronic smokers, the high-risk Indian population. It was anticipated that the preliminary data thus generated would be useful in contribution in the field of spirometric screening for early detection of COPD in our country. **Material and Methods**: The present study was conducted among 400 smokers, active or ex with smoking index of 100 or more. The Spirometry test comprised of the estimation of Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV1) and FEV1/FVC ratio. All COPD cases were referred for further management including smoking cessation assistance at departmental quit smoking clinic. The Chi-square Test was applied to find the statistical significance with p value of less than 0.05 considered as statistically significant. **Results:** The pulmonary function test was performed by spirometry on 400 cases,148 subjects had normal spirometry, 122 had obstructive pattern, 121 restrictive pattern and 9 revealed mixed pattern. Among 122 subjects having obstructive pattern, only 61 patients were diagnosed as COPD cases. Out of 148 subjects with normal spirometry pattern, 105 subjects were at stage 0 COPD. Out of 400 subjects 15.2% were having COPD and 26.2% were at risk of development of COPD.105 subjects who were in stage 0 are those at risk of developing COPD of those diagnosed as COPD patients 3.9% were in stage I, 11.5% in stage II , 33 in stage III and 19 were in stage IV of COPD. **Conclusion:** It may be concluded that the endeavor for detection of COPD in its earlier stages using spirometric screening in the moderate or heavy smokers is highly rewarding and may be recommended in appropriate settings.

Keywords: COPD; Smokers; Spirometry

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INTRODUCTION

Smokers with suspected COPD seek medical attention when they become dyspnoeic on mild to moderate exertion, but by than half of the ventilatory reserves are lost irreversibly. Hence it seems logical to diagnose COPD early before development of significant symptoms.[1]

Cigarette smoking is the single most important identifiable etiological factor in COPD, although only 15 to 20% of smokers develop COPD. Apart from smoking, many other factors have been associated with development of COPD.

Air pollution and occupational exposure to metals like cadmium, welding fumes, other dusts etc as well as passive smoking also play a role in COPD, Chronic bronchopulmonary infection is another factor responsible for COPD. There is also some genetic basis for this disease like deficiency of alpha 1-antitrypsin. a protease inhibitor. Never the less, on the whole, more than 90% of COPD cases are caused by tobacco smoking, the remainder are attributable to aforesaid other factors.[2,3]

COPD is a substantially underdiagnosed disorder, with the diagnosis typically missed or delayed until the condition is

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advanced. Spirometry is the most frequently used pulmonary function test and enables health professionals to make an objective measurement of airflow obstruction and assess the degree to which it is reversible. As a diagnostic test for COPD, spirometry is a reliable, simple, non-invasive, safe, and non-expensive procedure.[4] The ratio of the two measurements (FEV_1 / FVC) is calculated to assess a patient's lung function. In patients with COPD, FEV1 and FVC readings, as well as FEV_1 / FVC ratios, will be lower than predicted (reference) values based on age, sex, height and race. Airflow limitation is clinically confirmed when the $FEV1 / FVC$ postbronchodilator value is < 0.70.[5]

Hence, the present study was planned to evaluate the role of spirometric screening in the early detection of COPD in chronic smokers, the high-risk Indian population. It was anticipated that the preliminary data thus generated would be useful in contribution in the field of spirometric screening for early detection of COPD in our country.

MATERIAL AND METHODS

The present cross-sectional and descriptive study was conducted in the Department of Tuberculosis and Respiratory Diseases, Government Medical College Hospital, Chandigarh among 400 smokers, active or ex with smoking index of 100 or more. An awareness and education campaign on Chronic obstructive Pulmonary Disease (COPD) was conducted in the initial phase of the study from where subjects were enrolled for the study.

The study was conducted after obtaining ethical clearance from Ethics Committee of Government Medical College, Chandigarh and a written and verbal from subject prior to inducting him/her in the study. Acute exacerbation of COPD cases, patients with associated diseases viz. bronchiectasis, tuberculosis, pneumonia, chest deformity, neoplasia etc. and pregnant patients were excluded from the study.

Smoking index [SI] was calculated fromnumber of bidis/cigarettes smoked per day multiplied by number of years of smoking.[6] Spirometry was performed on eligible subjects in Pulmonary Function Test Laboratory (PFT Lab) of the department, during the induction period of 18 months. Each enrolled smoker was subjected to detailed medical history, general physical and systemic examination and routine investigations including spirometry and bronchodilator reversibility testing; wherever applicable.

The Spirometry test comprised of the estimation of Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV_1) and FEV_1/FVC ratio. Spirometry was performed using Spiro Analyzer, Model ST-90, Fakuda Sangyo Co. Ltd. Tokyo, Japan. The test was performed as per the guidelines by the "British Thoracic Society [BTSl with the association of Respiratory Technicians and Physiologists (ARTP) and American Thoracic Society (ATS). The predicted values of 3 parameters; FVC, FEV1 and FEV1/FVC were based on the reference values recommended by European Community for Coal & Steel (ECCS), which have been approved by European Respiratory Society.[7]Interpretation of spirometry vide infra, was done according to the European Respiratory Society Guidelines[8]and Global Initiative for Chronic obstructive Lung Disease (GOLD) guidelines:[9]

Table 1: The reference values of FVC, FEV1 and FEV1/FVC recommended by European Community for Coal & Steel (ECCS) (approved by European Respiratory Society)[7]

Disease pattern	Parameters	Value
Obstructive pattern	FEV_1/FVC	<85% of predicted [ECCS]
	FEV_1/FVC	<70% [gold]
Restrictive pattern	FEV_1/FVC	> 100% of predicted
	FVC	< 80% of predicted
Mixed pattern	FEV_1/FVC	85 to 99% of predicted
	FVC	<80 % of predicted
	FEV_1	$\geq 70\%$ of predicted

The subjects with obstructive pattern on spirometry were further investigated by performing bronchodilator reversibility testing so as to rule out reversible obstructive airway disease i.e. asthma. The test was performed by administering a combination of 2.5 mg salbutamol respiratory solution and 500µg of ipratropium bromide respiratory solution to the patient through nebulization. Repeat spirometry after 30 minutes of salbutamol and ipratropium bromide administration showing improvement in $FEV_1$by 15% and 200ml both, were taken as positive reversibility test. Negative bronchodilator reversibility with obstructive pattern on spirometry constituted the confirmed diagnosis of COPD.

All confirmed COPD cases were further classified into stages according to the severity of obstruction as per GOLD guidelines 2003 criteria. All COPD cases were referred for further management including smoking cessation assistance at departmental quit smoking clinic. The smokers without COPD were also requested to visit quit smoking clinic for further needful and counselling. The Chi-square Test was applied to find the statistical significance with p value of less than 0.05 considered as statistically significant
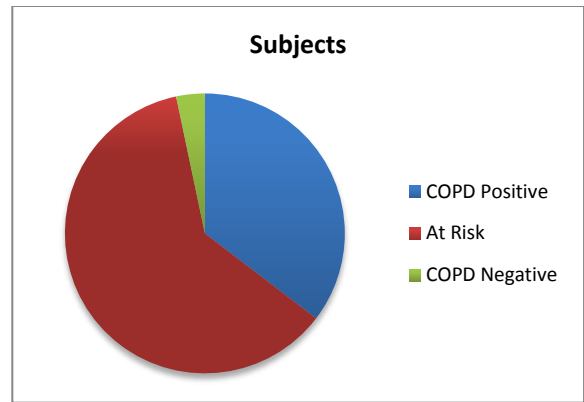
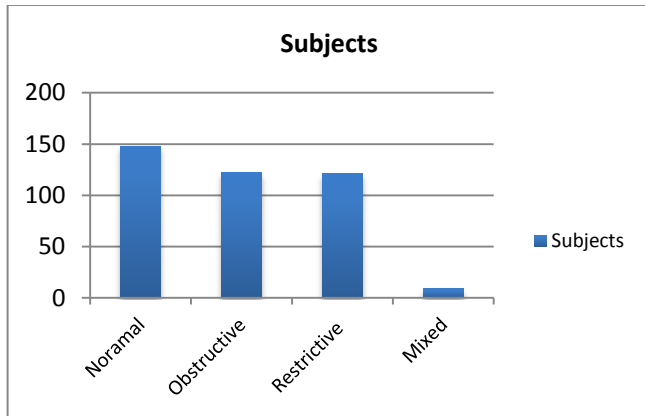## RESULTS
Table 1: Pulmonary Function Test

Spirometry Test	Subjects (n=400)
Normal	148
Obstructive Pattern	122
Restrictive Pattern	121
Mixed Pattern	9

Table and graph 1 shows the pulmonary function test performed by spirometry on 400 cases,148 subjects had normal spirometry , 122 had obstructive pattern, 121 restrictive pattern and 9 revealed mixed pattern. Those who revealed obstructive pattern on spirometry, only half of them revealed broncho-dialator reversibility test positive (graph 2).Thus out of 122 subjects having obstructive pattern,only 61 patients were diagnosed as COPD cases.

Out of 148 subjects with normal spirometry pattern, 105 subjects were at stage 0 COPD.Out of 400 subjects 15.2% were having COPD and 26.2% were at risk of development of COPD (graph 3).
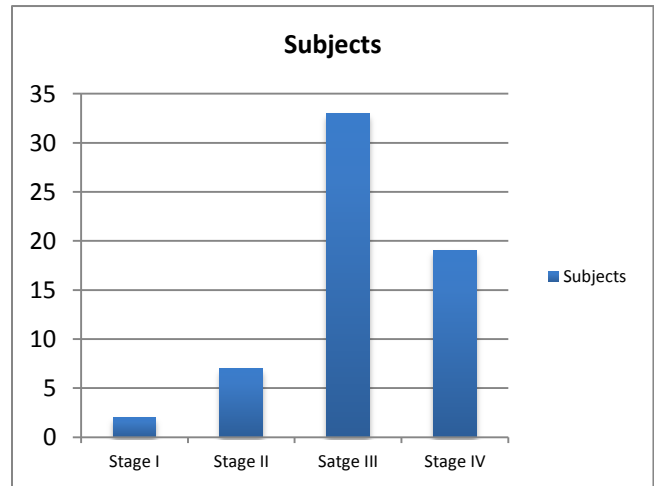
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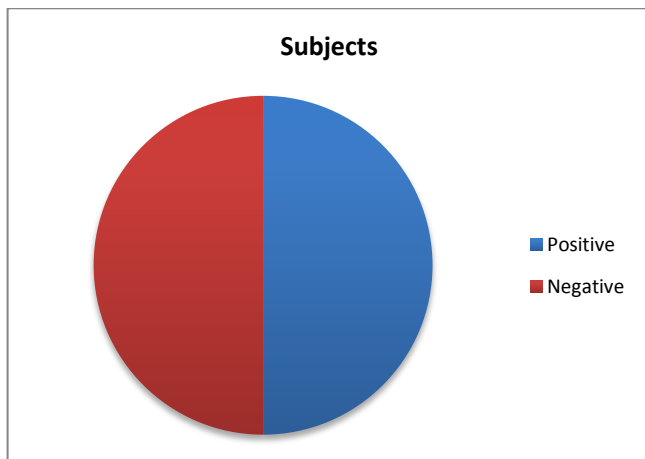

Graph 3: Distribution of subjects after performing PFT

Graph 1: Distribution of Subject according to PFT

Graph 4: Distribution of COPD Subjects in various stages

DISCUSSION

Chronic obstructive pulmonary disease is one of the major leading causes of morbidity and mortality worldwide. Smoking cigarettes is the major risk factor for development of COPD and also constitutes a risk factor for other serious illnesses such as cardiovascular diseases, stroke, and several malignant diseases.[10]

The present study was undertaken to evaluate the role of spirometry in early detection of chronic obstructive pulmonary disease in smokers and results revealed that COPD case detection rate by performing spirometric screening in high risk cigarette smokers was significantly higher as compared to its prevalence in general population. Hence, the large number of hidden COPD cases deserving medical intervention, thus detected, can be offered appropriate management and also prevented from slipping in to much more grave stages of the disease. Additionally, the observed proportionate hike in occurrence of COPD with increasing smoking index reflects that the subjects

Graph 2: Distribution of subjects having Obstructive pattern according to reversibility to bronchodilator

who continue smoking carry a definite high risk of developing the disease in coming years. Therefore, by early detection of at risk COPD cases, they can be averted from progressing in to frank COPD cases by employing the preventive modalities in them. The strong co-relationship between progression of COPD and the amount of smoking has also been highlighted by Zeilinski et al[11] and other workers.[12]Various studies[11,13] have concluded that early detection of COPD in smokers by performing spirometry is essential to halt the progression of disease by cessation of smoking at early stages.

Thus, it may be concluded that the endeavor for detection of COPD in its earlier stages using spirometric screening in the moderate or heavy smokers is highly rewarding and may be recommended in appropriate settings.

Barthwal MS et al[1] carried out spirometry evaluation in smokers more than 40 years of age and with smoking index more than 200, 26% had obstruction and in smokers less than 40 years of age and smoking index less than 200, 5.43% had obstruction (p < 0.005), the study revealed that the early detection of COPD by spirometry especially in smokers more than 40 years of age and with smoking index of more than 200 is likely to reduce the overall burden of disease.Zielinski L et al[11] evaluated the efficacy of mass spirometry use for the detection of airflow obstruction in a high-risk population and found thatin smokers aged ≥ 40 years who had a smoking history of > 10 pack-years, airway obstruction was found in 30.6%. Airway obstruction was present in 8.3% of smokers < 40 years of age who had a smoking history of < 10 pack-years. Of the 2,200 subjects who had never smoked in their lives, airway obstruction was found in 14.4%. and concluded that Mass spirometry in high-risk groups is an effective and easy method for the early detection of COPD.

Stratelis G et al[10] carried out a study to find that whether a combination of spirometry and brief smoking cessation advice to smokers with COPD and in this study, intervention was performed by annual spirometry, brief smoking cessation advice by the nurse, and a personal letter from the physician regarding lung function during the three years. The point prevalence abstinence after 3 years was significantly higher in smokers with diagnosed COPD than in smokers with normal lung function (29% and 14%, respectively).

Scanlon PD et al[14]conducted a study to find relationship among smoking cessation and lung function in mild-to-moderate chronic obstructive pulmonary disease, in which authors measured lung function annually for 5 yr. Participants who stopped smoking experienced an improvement in FEV1 in the year after quitting (an average of 47 ml or 2%). The subsequent rate of decline in FEV1 among sustained quitters was half the rate among continuing smokers, 31 ± 48 versus 62 ± 55 ml (mean ± SD), comparable to that of never-smokers. Predictors of change in lung function included responsiveness to β - agonist, baseline FEV1, methacholine reactivity, age, sex, race, and baseline smoking rate. Respiratory symptoms were not predictive of changes in lung function. Smokers with airflow obstruction benefit from quitting despite previous heavy smoking, advanced age, poor baseline lung function, or airway hyper-responsiveness.

Young RP et al[15]proposedthat spirometry has broad utility in identifying smokers who are at greatest risk of cardiorespiratory complications and greatest benefit from targeted preventive strategies, such as smoking cessation, prioritised screening and effective pharmacotherapy. Reduced FEV1 identifies undiagnosed COPD, has comparable utility to that of serum cholesterol in assessing cardiovascular risk and defines those smokers at greatest risk of lung cancer. As such, reduced FEV1 should be considered a marker that identifies smokers at greatest need of medical intervention. Smoking cessation has been shown to attenuate FEV1 decline and, if achieved before the age of 45–50 yrs, may not only preserve FEV1 within normal values but substantially reduce cardiorespiratory complications of smoking.[15]

Since smoking cessation in early COPD is found to reduce rapid decline of ventilatory function in smokers, its early detection in asymptomatic smokers is likely to motivate smokers to make an attempt to quit smoking thereby halting its progression to more advanced stage.[1]

CONCLUSION

Spirometric screening of smokers was found to be a very useful tool to detect COPD in early stages among the subjects included in the present study. It is anticipated that smokers understand better the risks associated with smoking after knowing their lung functions with spirometry. This study demonstrated that spirometry in general practice is feasible and sufficiently accurate. Thus, it may be concluded that the endeavor for detection of COPD in its earlier stages using spirometric screening in the moderate or heavy smokers is highly rewarding and may be recommended in appropriate settings.

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