Early Detection of Chronic Obstructive Pulmonary Disease in Asymptomatic Smokers using Spirometry

MS Barthwal*, S Singh**

Abstract

Background: 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. 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.

Material and Methods: The selection of subjects was done by high risk population screening in various military institutions in and around Pune city of Maharashtra. Inclusion criteria included regular smokers, 30 years of age and above with no significant respiratory symptoms except for occasional cough and willing to undergo spirometry.

Results: A total of 460 individuals were evaluated by spirometry. Overall airway obstruction was seen in 58 (12.60%) subjects. Mild obstruction was seen in 40 (68.9%) and moderate obstruction in 18 (31%) subjects. Airway obstruction was seen in 24 (8.82%) individuals who were less than 40 years of age and in 34 (18%) who were more than 40 years of age (p<0.005). Obstruction was noticed in 42 (24.70%) out of 170 subject with smoking index >200 and 16 (5.51%) out of 290 subjects with smoking index of <200 (p<0.005). In smokers more than 40 years of age and with smoking index more than 200 (n=184), 48 (26%) had obstruction and in smokers less than 40 years of age and smoking index less than 200 (n=276), 15 (5.43%) had obstruction (p<0.005).

Conclusion: 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.

Introduction

Chronic obstructive pulmonary disease (COPD) is a major case of chronic morbidity and mortality throughout the world. The prevalence and burden of COPD are projected to increase in the coming decades due to continued exposure to COPD risk factors and the changing age structure of the world’s population, with more people living longer and thus reaching the age at which COPD normally develops.1 The global burden of disease study has projected that COPD which ranked sixth as the leading cause of death in 1990, will become the third leading cause of death by 2020.2,3 Meta-analysis of population based studies from India suggests prevalence of COPD to be 5% in males and 2.7% in females above 30 years of age.4

Worldwide tobacco smoking is the most commonly encountered risk factor for COPD, although in many countries air pollution resulting from the burning of wood and other biomass fuels has also been identified as a COPD risk factor. The early symptoms of COPD in the form of cough and sputum production are usually ignored by
the smoker and often by their physicians as normal for a smoker and no interventions are deemed necessary. Individuals seek medical attention when they become dyspnoeic on mild to moderate exertion, but by then half of the ventilatory reserves are lost irreversibly. Hence it seems logical to diagnose COPD early before development of significant symptoms. Since smoking cessation in early COPD is found to reduce rapid decline of ventilatory function in smokers, its early detection in asymptomatic smokers is also likely to motivate smokers to make an attempt to quit smoking thereby halting its progression to severe stage. Although spirometry does not fully capture the impact of COPD on a patient’s health, it remains the gold standard for diagnosing and monitoring its progression. It is the best standardised, most reproducible and most objective measurement of airflow limitation which is the hallmark of COPD.

The present study was undertaken for early detection of COPD in high risk population screening by using spirometry

Material and Methods

A cross-sectional descriptive study was done by high risk population screening among students and faculty of four military training institutions in and around Pune city of Maharashtra. These institutions are for officers, majority of them being males with insignificant number of female officers. Inclusion criteria included regular male smokers, 30 years of age and above with no significant respiratory symptoms except for occasional cough and willing to undergo spirometry. Subjects with smoking cessation for one year or more before enrolment, with history suggestive of bronchial asthma and on bronchodilators or inhaled corticosteroids were excluded from study. Presuming an average prevalence of 25.43% based on previous studies of early detection of COPD in asymptomatic smokers, sample size was calculated as per the formula \(4pq/l^2\) (where \(P\) being the prevalence, \(q=1-P\) and \(l=\) allowable error around the prevalence). Considering 5% error at 95% confidence interval, the required sample size was to be a minimum of 303. With 20% non response rate, it was estimated to be 363.6.

To start with, institutional heads were first briefed about the purpose of study and after they accorded their approval all willing subjects were given a lecture on smoking and COPD. They were first explained the harmful effects of smoking in causing COPD and how smoking cessation can halt the progression of disease with the help of modified graph of Fletcher and Peto. They were also explained how COPD goes undetected in the initial stage and how with the help of spirometry this disease can be detected at an early stage thereby halting its progression by smoking cessation. This education module was delivered by a team comprising of senior chest physician, junior chest physician and respiratory technician with the help of video presentations. The subjects were also given a booklet which contained information about harmful effects of smoking and COPD in Hindi and English.

The quantum of smoking exposure was calculated based on smoking index, which was calculated as the product of the average number of cigarettes or bidis smoked per day and the duration of smoking in years. In a country like ours where a pack of cigarette contains either ten or twenty cigarettes and the smoking habits include either cigarette or bidi smoking, smoking index is more appropriate than pack years. In comparative terms, 10 pack years is equivalent to smoking index of 200 (Smoking index=Pack years*20).

All these subjects were subjected to spirometry using portable spirometer (Spiro lab II manufactured by MIR of Italy). Spirometry was performed by an experienced respiratory technician as per the recommendations of American Thoracic Society. FVC, FEV1, and FEV1/% were measured after administration of 400 μg of salbutamol as per the guidelines given by GOLD. Based on spirometry, subjects were classified as having mild COPD (FEV1/FVC<0.70, FEV1>80% of predicted normal value), moderate COPD (FEV1/FVC<0.70, FEV1-30-50% of predicted normal value) and very severe COPD (FEV1/FVC <0.70, FEV1<30% of predicted normal value) as per GOLD guidelines. Subjects with abnormal spirometry were advised to report to our respiratory centre for further evaluation and joining smoking cessation programmes.

Statistical Analysis

Descriptive statistics were calculated using means ± SD. The chi-square test was applied for categorized data to find out the significance.

Results

A total of 460 individuals who met the inclusion criteria were evaluated by spirometry. All the subjects were male with mean (± SD) age of 39.72 ± 8.76. 188 subjects (40.8%) were more than 40 years of age and 272 (59.1%) were less than 40 years. All subjects were cigarette smokers with smoking index of 452.59 ± 289.61 in individuals (n=170(36.9%) more than 40 years of age and 213.88±106.19 in individuals (n=290(63%) less than 40 years of age (Table 1).

Overall airway obstruction was seen in 58 (12.60%) subjects. Mild obstruction (GOLD Stage 1) was seen in 40 (68.9%) and moderate obstruction (GOLD Stage
Airway obstruction was seen in 24 (8.82%) individuals (n=272) who were less than 40 years of age and in 34 (18%) who were more than 40 years of age (n=188) (p<0.005) (Figure 2). Obstruction was noticed in 42 (24.70%) out of 170 subjects with smoking index >200 and 16 (5.51%) out of 290 subjects with smoking index of <200 (p<0.005) (Figure 3). In smokers more than 40 years of age and with smoking index more than 200 (n=184), 48 (26%) had obstruction and in smokers less than 40 years of age and smoking index less than 200 (n=276), 15 (5.43%) had obstruction (p<0.005) (Figure 3).

**Discussion**

Early diagnosis of COPD with spirometry should provide support for smoking cessation initiatives and lead to reduction of the societal burden of disease, but there are no confirmative data available for the same. However, in Finland, a national prevention and treatment programme for chronic bronchitis and COPD was launched in 1998 in which early diagnosis of COPD was made possible with spirometry followed by management in smoking cessation clinics. By 2003, decline in smoking prevalence and admissions for COPD were recorded providing evidence of the effect of early diagnosis on natural history and burden of COPD. High risk population screening for COPD was made possible with spirometry followed by management in smoking cessation clinics. By 2003, decline in smoking prevalence and admissions for COPD were recorded providing evidence of the effect of early diagnosis on natural history and burden of COPD.

The overall prevalence of COPD in adults is estimated at 4-10%. However, a prevalence of 30-50% has been reported in high risk population such as long-term smokers, depending on the characteristics of the population under study and on the spirometry criteria used for diagnosis. Previous studies have used two methods for early detection of COPD: high risk population screening and case finding. Both methods have their advantages and disadvantages making them complimentary. We chose the high risk population screening method because of better infrastructure and resources in armed forces.

In the present study, airflow obstruction was seen in 12.6% of total subjects with 18.8% in above 40 years of age and 8.82% in below 40 years of age. In Lung health study (LHS), a multi-centric study conducted in Canada and USA, spirometry screening of more than 73,000 smokers aged 35 to 60 years was performed in 10 centers. Airway obstruction was seen in 21.8% to 35.7% (mean 25%) cases and severe
obstruction (FEV1 < 50% of predicted) was seen in 5% of total cases. The lower prevalence of airflow obstruction in our study was because of inclusion of only asymptomatic smokers whereas in LHS study symptomatic smokers were also included.

Stralelis G, et al31 in a study to evaluate a method to detect COPD at an early stage conducted spirometry in 512 smokers, aged 40-55 years with pack-years more than 30 yrs (equivalent to smoking index of 600) and found obstruction in 27% cases. Similarly in our study smokers above 40 years and with smoking index above 200 showed obstruction in 26% on spirometry.

Zielinski et al of “Know the age of your lung study group” evaluated the efficacy of mass spirometry above 200 showed obstruction in 26% on spirometry. study smokers above 40 years and with smoking index and found obstruction in 27% cases. Similarly in our more than 30 yrs (equivalent to smoking index of 600) detect COPD at an early stage conducted spirometry, especially in smokers above 40 years of age with smoking history of more than 10 pack years (equivalent to smoking index >200) as compared to 8.3% of smokers below 40 years of age and having smoking history of less than 10 pack years (equivalent to smoking index <200). The same correlation was observed in our study, i.e. airway obstruction was seen in 26% subjects above 40 years and having smoking index > 200 compared to only 5.43% of subjects below 40 years with smoking index < 200.

Conclusion

The present study shows that early detection yield of COPD increases with increasing age and quantum of smoking making the screening method more cost effective in symptomatic than in asymptomatic smokers. Since early diagnosis provides an excellent opportunity to implement various smoking cessation measures and the earlier the smoker quits the larger the benefits for lung function,24 by delaying the diagnostic screening one may lose out on the health benefits of smoking cessation. At present we do not have confirmatory evidence in support of the assertion that early diagnosis of COPD may improve the smoking cessation but in view of not so significant impact of primary prevention of COPD in the form of smoking cessation, the early diagnosis 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 and outweighs the draining of resources used for screening programmes. One way to reduce the cost of such screening programmes is to link spirometry with other screening programmes like detection of diabetes, hypertension and cervical cancer and mammography in women.

References


