Original Research Article

A cross-sectional study of assessment of lung function tests by spirometry in smoker and non-smoker males

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Abstract

Background: Cigarette smoking is probably the most addictive and dependence producing form of object specific self-gratification known to human beings. Cigarette smoking is by far the most important risk factor for COPD and most important that tobacco contributes risk of COPD. In view of rising smoking behaviour among population this study was undertaken to assess lung function tests by spirometry in smoker and non-smoker males for a better understanding of the correlation between smoking and its effects on pulmonary functions. **Material and Methods:** Present study was conducted in male subjects from 30-50 years of age, normal BMI (18.5- 24.9 kg/m^2), no previous history of upper respiratory tract infection within 3 months, no family history of asthma, and no other clinically detected medical illness. willing to participate. Subjects were divided into non-smoker and smoker group. **Results:** According to inclusion and exclusion criteria, we selected 120 subjects for non-smoker and smoker group. Both groups were comparable in age distribution. Most common age group was 30-35 years in non-smoker (34 %) and smoker (33 %) group. PFT parameters were better in non-smoker group as compared to smoker group. A statistically significant difference between non-smoker group and smoker group was noted for all PFT parameters (FVC, FEV1, FEV 1%, PEFR and FEF$_{25-75\%}$). PFT was abnormal in 63 % of smokers. In smokers with pack year >15, abnormal PFT was noted in 79% subjects. **Conclusion:** Spirometry is useful for early identification of abnormalities in asymptomatic adults both smokers and non-smokers. PFTs should be performed early in smokers to detect reduction in lung volumes and air flow limitations.

Key Words: Smokers, Non-smokers, pulmonary function test, spirometry

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INTRODUCTION

Cigarette smoking is probably the most addictive and dependence producing form of object specific self-gratification known to human beings.[1] The factors found significant in leading to a higher tobacco consumption included lack of family supervision among hostels, peer influence, lack of awareness about the harmful effects of different tobacco products, no exposure to clinical cases of tobacco related disorders, and easy availability of these products.[2] Cigarette smoking is the most important risk factor for acceleration of lung function decline. Lung damage in smokers is characterized by inflammation and airway re modelling leading to airflow limitation and destruction of the lung parenchyma.[3] The underlying lung characteristics may vary; moreover, smokers differ in their susceptibility to emphysema or bronchitis.[4] The strongest and most consistent detrimental effect from smoking has been found in current smokers and has been shown to decrease over time after smoking cessation.[3] Spirometry is a physiological test that measures how an individual

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inhales or exhales volumes of air as a function of time, and it is invaluable as a screening test of general respiratory health. Pulmonary ailments can be detected by measuring a series of respiratory setpoints, namely, the vital capacity (VC), the tidal volume (TV), and the ratio of forced expiratory volume in one second (FEV1) to vital capacity (FEV1/VC). Cigarette smoking is by far the most important risk factor for COPD and most important that tobacco contributes risk of COPD. Smoking leads to rapid decline in pulmonary function test specially those indicating diameters of airways such as forced expiratory flow in one second (FEV).[5] In view of rising smoking behaviour among population this study was undertaken to assess lung function tests by spirometry in smoker and non-smoker males for a better understanding of the correlation between smoking and its effects on pulmonary functions.

MATERIAL AND METHODS

This study was conducted in Department of Physiology, Bidar Institute of Medical Sciences Bidar. Study duration was of 3 months (September 2019 to November 2019). Study design was cross-sectional, observational study. Prior permission to conduct this study was obtained from the Ethical committee. Volunteers working in medical college and hospital area were considered for present study.

Inclusion criteria: Male subjects from 30-50 years of age, normal BMI (18.5- 24.9 kg/m2), no previous history of upper respiratory tract infection within 3 months, no family history of asthma, and no other clinically detected medical illness. willing to participate

- Non-smoker subjects with no history of smoking
- Smokers with present history of 10 years of smoking.

Exclusion Criteria

- Subjects who have had history of respiratory disorders or diseases like tuberculosis, congenital cardiac disorders, history of myocardial infarction, hemoptysis of unknown origin, pneumothorax and musculoskeletal deformity of chest wall.
- All those who refuse to give consent, and the ex-smokers or past smokers.

Study procedure was explained and a written informed consent was taken from the participants before performing the pulmonary function tests. A detailed history taking of the subject like name, age, sex, weight, height occupation, education, smoking habits, housing, present illness like asthma and epilepsy, past illness like accidents and surgery, allergy and psychotic disorders was done. A complete general examination was done to rule out exclusion criteria.

Before performing pulmonary function test, following points were confirmed.

- Subject has not consumed alcohol within four hours.
- Has not smoked within one hour.
- Has worn comfortable clothing, not restricting chest and abdominal movements.
- Has not performed vigorous exercise within half an hour.

Spirometry was conducted in a comfortable room, in sitting position, during a fixed day time between 10 A.M. to 2 P.M, to avoid diurnal variations. Computerized spirometer, RMS Helios 701 was used.

Data was entered in Microsoft excel sheet and analyzed with help of SPSS version 23. Independent sample *t*-test was used for the parameters TV, VC, FEV1, and FEV1/VC in comparison with sex and smoking status. p value less than 0.05 was considered as statistically significant.

RESULTS

According to inclusion and exclusion criteria, we selected 120 subjects for non-smoker and smoker group. Both groups were comparable in age distribution. Most common age group was 30-35 years in non-smoker (34 %) and smoker (33 %) group. All subjects were males.

Table 1: Age distribution of subjects

Age group (years)	Non-smoker No. of cases (Percentage)	Smoker No. of cases (Percentage)	Total No. of cases (Percentage)
30-35	41 (34%)	39 (33%)	80 (33%)
36-40	34 (28%)	37 (31%)	71 (30%)
41-45	27 (23%)	23 (19%)	50 (21%)
46-50	18 (15%)	21 (18%)	39 (16%)

PFT parameters were better in non-smoker group as compared to smoker group. A statistically significant difference between non-smoker group and smoker group was noted for all PFT parameters (FVC, FEV1, FEV 1%, PEFR and FEF25-75%).

Table 2: Comparison of PFT in non-smokers and smoker population.

PFT	Non-smoker (mean ± SD)	Smoker (mean ± SD)	p value
FVC	3.10 ± 0.71	2.61 ± 0.80	<0.05 (significant)
FEV1	2.61 ± 0.65	1.93 ± 0.79	<0.05 (significant)
FEV1%	93.87 ± 6.93	78.13 ± 15.22	<0.05 (significant)
PEFR	7.49 ± 1.83	6.02 ± 2.10	<0.05 (significant)
$FEF_{25-75\%}$	4.11 ± 1.02	3.15 ± 1.13	<0.05 (significant)

PFT was abnormal in 63 % of smokers. In smokers with pack year >15, abnormal PFT was noted in 79% subjects.

Table 3: Correlation of PFT with pack years.

Smokers	Pack year ≤15 (n=92)	Pack year >15 (n=28)	Total (n=120)
Normal PFT	38 (41 %)	6 (21 %)	44 (37 %)
Abnormal PFT	54 (59 %)	22 (79 %)	76 (63 %)
Total	**92**	**28**	

DISCUSSION

Despite the extensive media publicity on the harmful effects of tobacco, the rules and regulations that aim to reduce smoking, and the extensive research documenting the side effects of second-hand smoke (SHS) exposure among nonsmoking adults, the number of smokers is steadily rising in different parts of the world.[6,7,8] Cigarette smoking produces inflammatory changes in small airways, especially in respiratory bronchioles. This leads to dilatation and destruction of small airways, characterized as emphysema.[9] The pulmonary damage induced by smoking acts slowly and may show no symptoms until pulmonary functions are lost.[10] Reduction in the lung function parameters among adolescences who smoke or are exposed to second-hand smoke and more susceptibility for both groups to develop respiratory problems including cough, phlegm, asthma, and wheezing is noted.[11,12] Spirometry, as a part of PFTs, is an important tool in the investigation and monitoring of general respiratory health. Spirometric tests are useful not only for estimating the severity of airway obstruction but also for assessing the functional degradation of the pulmonary system and evaluating the results of various therapeutic regimens. At any given time in adulthood, FEV1 is determined by three factors as the maximally attained level of lung function during early adulthood; the onset of decline of lung function and the rate of decline of lung function and cigarette smoking affects all these three factors that determine the level of FEV1 at any given time. The effects of smoking on lung function are not evident at a younger age but become prominent with the increasing age and increasing pack years of smoking. The decline of FEV1 is seen maximum in current smokers. It is intermediate in former smokers and is least in nonsmokers.[13] In study by Abhishek Biswas, smokers from had a decreased value of FVC and FEV1 values as compared to non–smokers.[14] A study conducted in a rural area between smokers and non-smokers by Rubeena *et al.* revealed a decrease in PFT values among the smokers who were having low to moderate nicotine dependence.[15] Similar findings were noted in present study. Vaidya *et al.*,[16] noted a lower pulmonary function parameter in smokers as compared to nonsmokers, while in ex- smokers, the PFT values were better than in smokers but less than nonsmokers. Cigarette smokers have a higher prevalence of respiratory symptoms and lung function abnormalities, greater annual rate of decline in FEV1 and a greater COPD mortality rate than non-smokers.[17] Smoking cessation reduces decline in forced expiratory volume in one second, which indicates that important inflammatory and or re-modelling processes are positively affected.[18] Cessation of smoking should be encouraged in order to prevent further decline of pulmonary function in smokers.

CONCLUSION

Spirometry is useful for early identification of abnormalities in asymptomatic adults both smokers and non-smokers. PFTs should be performed early in smokers to detect reduction in lung volumes and air flow limitations.

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