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Original Research Article

Study of pulmonary function test in asymptomatic smokers and non-smokers between 30-50 years of age in a tertiary care hospital

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ABSTRACT

Background: Tobacco smoking is widely prevalent all over the world and it continues to rise in developing countries. Smoking has a deleterious effect on pulmonary functions. Smoking is the single most significant risk factor contributing to the development of Chronic obstructive airway diseases (COPD). Spirometry by a trained health professional gives an indication of lung health by measuring airway abnormality. Objectives were to study pulmonary function test (PFT) in smokers and non-smokers between 30-50 years and to study the correlation of PFT with pack years.

Methods: Apparently healthy subjects, 50 smokers and 50 non-smokers between 30-50 years without any symptoms were included as subjects. Patients with uncontrolled hypertension, recent myocardial infarction and pulmonary TB were excluded. Ex-smokers were excluded from the study. Patients with acute respiratory illness, severe systemic illness, chest trauma and dementia were also excluded. After proper history taking and clinical examination, measuring height and weight (vitals, pulse rate, respiratory rate, blood pressure) the selected individual was subjected to spirometry using ATS criteria (American Thoracic Society criteria). Spirometry was performed using UNI-EM spirometer. Collected data was analyzed using Statistical Package for the Social Service (SPSS) software version 17.

Results: In this study 94 males and 6 females were enrolled as subjects. Maximum number of the patient 49 cases (49%) presented in the age group of 30-35 years, followed by 23 cases (23%) in 36-40 years age group. Of these 49 cases,15 were smokers while the rest 34 were non-smokers (P=0.0007). In 100 cases studied, 39% showed normal PFT and 61% shows abnormal PFT. Among smokers (out of total 50 cases) pulmonary function test (PFT) was abnormal in 36 cases (72%) while in non-smokers, 25 (50%) had abnormal PFT (P-value-0.024). This data indicates that smoking is highly associated with an abnormal PFT pattern. Out of 100 cases both smokers and non-smokers, 11 (73.33%) underweight cases with (BMI<18.4) showed abnormal PFT. In 50 smokers, maximum cases 29 (58%) had normal BMI (18.5-22.9) (P value 0.0002). Abnormal PFT was observed in 25 (50%) non-smokers (P=0.001). Abnormal PFT was seen in 30 (69.77%) smokers with pack years <15 and 6 smokers (85.6%) with pack years >15 (P-value 0.383).

Conclusions: Smoking is common in males between 30-35 years age group. Smoking is highly associated with an abnormal PFT. Cessation of smoking should be encouraged and PFTs from time to time in asymptomatic adults both smokers and non-smokers will be useful for early identification of abnormalities.

Keywords: COPD, PFT, Smoking

INTRODUCTION

Tobacco smoking is widely prevalent all over the world and it continues to rise in developing countries. Various forms of tobacco smoking practised in India, include chutta (reverse smoking), chillum (clay pipe), and hukku (hubble-bubble) with Cigarette and Beedi smoking being the commonest.[1]

Tobacco smoke contains more than 4000 chemicals and around 40 carcinogens.[2] Smoking has a deleterious effect on pulmonary functions. Accumulation of inflammatory cells such as CD8+ T-lymphocytes, B cells, neutrophils and macrophages, in response to irritants found in smoke inhalation, is responsible for an inflammatory reaction. Hence, the risk of respiratory mortality or morbidity is high with smoking.

Smokers have reduced lung functions when compared to non-smokers.[3] Smoking is the single most significant risk factor contributing to the development of COPD. On an average, cigarette smokers have a high annual rate of decline in FEV1 of about 50 ml, which is nearly double the average value of 30 ml annually present in non-smokers.

However, there is considerable variation in the decline in FEV1, with some smokers showing very rapid rate of decline.[4] Pulmonary function tests are useful because it is inexpensive, non-invasive and reproducible.[5]

PFT may serve as a tool to convince the patient to give up smoking. The smoking epidemic is so huge that every effort is needed to launch effective campaign to create awareness regarding the consequences of smoking. Spirometry by a trained health professional gives an indication of lung health by measuring airway abnormality. An attempt has been made to study the pulmonary function tests among asymptomatic smokers and non-smokers.

METHODS

This study was conducted in Department of Medicine, G.R. Medical College, Gwalior, Madhya Pradesh, India. Apparently healthy smokers were selected from among patients coming to OPD of Jaya Arogya Group of Hospitals, Gwalior, Madhya Pradesh, India.

Inclusion criteria

- Apparently healthy subjects, 50 smokers and 50 non-smokers between 30-50 years without any symptoms were included as subjects
- Smoker: Someone who, at the time of the study, smoked any tobacco products either daily or occasionally (bidi and cigarette only in this study)
- Non-smoker: someone who, at the time of the study, did not smoke at all.

Exclusion criteria

- Patients with uncontrolled hypertension, recent myocardial infarction and pulmonary TB were excluded
- Ex-smokers were excluded from study
- Patients with acute respiratory illness, severe systemic illness, chest trauma and dementia were excluded.

The pulmonary functions were done on a computerized spirometer in 100 male subjects comprising of 50 smokers and 50 non-smokers.

After proper history taking and clinical examination (vitals pulse rate, respiratory rate, blood pressure) the selected individual was subjected to spirometry using ATS criteria (American Thoracic Society). BMI (Body mass index) was also calculated as proposed by WHO (1998).

Spirometry was performed using UNI-EM spirometer.

Spirometric manoeuvre

Following activities were avoided prior to test, according to American thoracic society (ATS).

- Smoking with in 1 hour of testing
- Consuming alcohol within 4 hours of testing
- Performing vigorous exercise within 30 mins of testing
- Wearing clothing that substantially restricts full chest and abdominal expansion
- Eating a large meal within 2 hours of testing.

The spirometry was performed in sitting position. Subjects were explained and the procedure demonstrated prior to spirometry. Collected data were analyzed using Statistical Package for the Social Service (SPSS) software version 17.

RESULTS

In this study 94 males and 6 females were enrolled as subjects Table 1.

Table 1: Distribution of cases according to gender.

Gender	No. of cases	Percentage (%)
Male	94	94%
Female	06	06%
Total	100	100%

Table 1 shows 94% cases were males 6% females.

Maximum 49 cases (49%) were in the age group 30-35 years and 23 (23%) cases in the age group 36-40 years,13 cases (13%) in 41-45 age group and 15 cases (15%) in 46-50 years age group Table 2.

Table 2: Overall distribution of cases according to age group.

Age group (years)	No. of cases n=100	Percentage
30-35	49	49%
36-40	23	23%
41-45	13	13%
46-50	15	15%

Maximum cases were in the age group of 30-35 years.

Age wise distribution of smokers showed that 15 (30%) smokers were in the age group 30-35 years (P-0.0007) (Table 3).

Table 3: Age wise distribution of smokers.

Age group (years)	Smoker	
	Yes	No
30-35	15 (30%)	34 (68%)
36-40	13 (26%)	10 (20%)
41-45	10 (20%)	3 (6%)
46-50	12 (22%)	3 (6%)
Total (%)	50 (100%)	50 (100%)

P=0.0007. Maximum smokers were in the age group of 30-35 years.

In 100 cases studied, 39% showed normal PFT and 61% showed abnormal PFT (Table 4). Gender wise study in100 cases included 35 (37.23%) males who showed normal PFT and 59(62.76%) showed abnormal PFT. Whereas in females 4 (66.67%) showed normal PFT and 2 (33.3%) showed abnormal PFT (P value 0.232) Table 5.

Table 4: Distribution of cases according to pattern of pulmonary function test.

Pattern	No. of cases n=100	Percentage
Normal	39	39%
Obstructive	26	26%
Restrictive	0	0%
Mixed	35	35%
Total	100	100%

4 In 100 cases studied, 39% showed normal PFT, 61% showed abnormal PFT with mixed pattern being the commonest.

Table 5: PFT abnormality according to sex.

Sex n=100	Normal	Obstructive	Mixed	Total
Male	35 (37.23%)	26 (27.66%)	33 (35.1%)	94 100%
Female	4 (66.67%)	0	2 (33.33%)	6 100%
Total	39	26	35	100

P= 0.232, PFT according to sex shows that abnormalities were more common in males.

Out of 100 cases both smokers and non-smokers, 11 (73.33%) underweight cases with (BMI<18.4) showed abnormal PFT, 32 (55.17%) and 8 (66.67%) cases showed abnormal PFT in normal group (BMI 18.5-22.9) and overweight group (BMI 23-24.9) respectively. In obese (BMI>25) 10 (66.6%) showed abnormal PFT (Table 6).

Table 6: PFT according to BMI.

BMI (kg/m²)	Normal	Mixed	Obstructive	Restrictive	Total
<18.4 under weight	4 (26.67%)	8 (53.33%)	3 (20%)	0	15 (100%)
18.5-22.9 normal weight	26 (44.82%)	16 (27.59%)	16 (27.59%)	0	58 (100%)
23-24.9 Over weight	4 (33.33%)	7 (58.33%)	1 (8.33%)	0	12 (100%)
>25 obese	5 (33.33%)	4 (26.67%)	6 (40%)	0	15 (100%)
Total	39	35	26	0	100

Table 6 shows 58 cases had normal BMI.

Table 7: Distribution of smokers according to BMI.

BMI (kg/m²)	Smokers n=50	Total (%)
<18.4	8	16%
18.5-22.9	29	58%
23-24.9	7	14%
>25	6	12%
Total	50	100%

P=0.0002; Maximum smokers (58%) had normal BMI.

Table 8: Correlation of smoking with PFT.

Smokers	Abnormal	Normal	Total
No	25 (50%)	25 (50%)	50 (100%)
Yes	36 (72%)	14 (28%)	50 (100%)
Total	61	39	100

P= 0.024, Abnormal PFT was significantly seen in smokers (72%).

In 50 smokers, maximum cases 29 (58%) had normal BMI (18.5-22.9) P-value=0.0002 which was significant (Table 7).

In smokers, out of 50 cases 14 (28%) showed normal PFT whereas 36 (72%) showed abnormal PFT. Abnormal PFT was significantly seen in smokers (72%) P-0.024 (Table 8). Amongst 50 smokers all were males. Amongst 50 non-smokers there were 44 males and 6 females (Table 9).

Table 9: Sex wise distribution of non-smokers.

Gender	Non-smokers	Percentage
Male	44	88%
Female	6	12%
Total	50	100%

Table 9 shows 44 males and 6 females were non-smokers.

Abnormal PFT was observed in 25 (50%) nonsmokers (P value 0.001) (Table 10). Abnormal PFT was seen in 30 (69.77%) smokers with pack years <15 and 6 smokers (85.6%) with pack years >15.In this study, abnormal PFT increased with increase in pack years (P value 0.383) (Table 11). Mean FEV1 was reduced in smokers (Table 12).

Table 10: Detailed PFT pattern of non-smokers.

PFT	Non-smokers n=50	Percentage
Normal	25	50%
Obstructive	11	22%
Restrictive	0	0
Mixed	14	28%
Total	50	100%

Table 10 shows 50% non-smokers had abnormal PFT.

Table 11: Correlation of PFT with pack years.

Smokers n=50	Pack year ≤15	Pack year >15
Normal PFT	13 (30.23%)	1 (14.29%)
Abnormal PFT	30 (69.77%)	6 (85.71%)
Total (%)	43 (100%)	7 (100%)

P=0.383, Table 11 showing abnormal PFT increased with increase in pack years.

Table 12: Mean FEV1, FVC and FEV/FVC in smokers.

PFT pattern		FEV1%	FVC%	FEV1/FVC
Mixed	Mean	52.08	62.40	82.39
	±SD	15.9	11.76	17.46
	N	21	21	21
Normal	Mean	87.24	93.58	93.98
	±SD	9.02	7.95	7.72
	N	14	14	14
Obstructive	Mean	60.26	101.73	59.82
	±SD	10.59	14.25	11.08
	N	15	15	15
Total	Mean	64.52	83.20	78.67
	±SD	19.44	20.98	18.97
	N	50	50	50

DISCUSSION

Spirometry is a frequently performed lung function test and an important tool in medical surveillance of pulmonary diseases. 100 cases 94 (94%) males and 6 (6%) females were enrolled as subjects.

Maximum number of cases 49 (49%) presented in the age group of 30 -35 years, followed by 23 cases (23%) in 36-40 years age group. Of these 49 cases, 15 subjects were smokers while the rest 34 subjects were non-smokers (P-value=0.0007) (Table 4). Bano R et al reported that maximum number of smokers were in the age group of 41-50 years (44.0%).[6] In present study maximum smokers were in the age group 30-35 years which was significant (P-value=0.0007).

Overall 61 (61%) subjects had abnormal PFT while the rest 39 (39.0%) had normal PFT.

In 50 (100%) smokers pulmonary function test (PFT) was abnormal in 36 cases (72%) while in non-smokers, 25 cases (50%) had abnormal PFT. P value (0.024). This data indicates that smoking is highly associated with an abnormal PFT pattern (Table 8). Similar findings were observed by Rubeena et al.[6]

In 100 cases studied 11 cases out of 15 (73.3%) with BMI<18.4 had abnormal PFT (Table 6). Abnormal PFT was more common in those who were underweight. In 50 smokers, maximum cases 29 (58 %) had normal BMI (18.5-22.9) P-value=0.0002 which was significant (Table 7).

Mean Fev1% was reduced in smokers (Table 12). Similar findings were observed by Harita et al. Mean FEV1 was significantly lower in smokers.[7] Cigarette smoking is associated with airflow limitation and that smoking cessation has a beneficial effect on FEV1 decline. Provision of a smoking cessation program for smokers should be considered to avoid impairment in lung function.[8]

Smoking cessation reduces decline in forced expiratory volume in one second, which indicates that important inflammatory and or re-modelling processes are positively affected.[9]

Mixed pattern was the most common abnormality in PFT observed in 35 cases (35.0%).

Gender wise study in 100 cases showed normal PFT in 35 (37.23%) males and abnormal PFT in 59 (62.76%) males. Whereas in females 4 (66.67%) showed normal PFT and 2 (33.33%) showed abnormal PFT. P=0.232 was not significant (Table 10). The role of gender on expression of COPD is not clear. Apart from tobacco smoke, indoor air pollution, mainly from biomass fuel may play an important role in development of COPD in women.[10]

In present study, we observed that abnormal PFT was present in 6 (85.71%) cases with pack years >15 as compared to 30 (69.77%) cases with pack year <15 Abnormal PFT increased with pack years. (P value 0.383 was not significant) (Table 11). This could be because of limited age group selected for study and small sample size.

Abnormal PFT was found to be present in 50 % nonsmokers. PFT detects changes at the earliest. Due to the advent of PFTs, physicians do not have to wait for the subject to become symptomatic. It is worthwhile to conduct these tests at the earliest in all adults.

It is a fact that pulmonary function values are influenced by many factors like race, age, sex, other unknown variables having a wide range of normal values. The role of smoking in the impairment of ventilatory functions is true but the same is potentially reversible.[11]

Another issue which needs clarity is whether the PFT parameters return back to normal once a smoker quits smoking. A study showed considerable deterioration of PFT parameters in smokers and indications of recovery in ex-smokers.[11] Performing a spirometry test and providing information on pulmonary function may increase awareness among smokers who are asymptomatic or have few symptoms and make them decide to quit. Quitting smoking has a favourable effect but it is more pronounced in earlier quitters.[12]

Provision of a smoking cessation program for all smokers, should be considered as an important strategy to prevent progression of COPD.[8]

Limitations of this study was that sample size was small. Smokers included both bidi smoker as well as cigarette smoker. Further study in a large sample will enlighten us further regarding the impact of smoking on health.

CONCLUSION

Smoking is common in males between 30-35 years age group. Smoking is highly associated with an abnormal PFT. PFTs are useful for early identification of abnormalities in asymptomatic adults both smokers and non-smokers. All adults should have their pulmonary function test done from time to time in order to identify any abnormality which in the early stages may be dealt with adequately. PFTs should be performed early in smokers to detect reduction in lung volumes and air flow limitations. Cessation of smoking should be encouraged in order to prevent further decline of pulmonary function in smokers.

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