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Original Research Article

Study of pulmonary functions in male current smokers and never smokers

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ABSTRACT

Background: Cigarettes smoking is the principal cause of preventable disease, disability, and premature death in the world. Tobacco smoking affects multiple organ systems resulting in numerous tobacco-related diseases. The study aimed to investigate interrelationship of pulmonary functions between current smokers and never smokers.
Methods: Asymptomatic, 50 males current tobacco smokers and 50 healthy never smokers aged between 25 to 50 years were selected as cases and controls. Detailed description of the subject's selection, data collection and methods used for performing the test.
Results: Maximum incidence was seen in >31 yrs of age with mean of 38.681±4.5. The study found that never smokers had significantly higher pulmonary functions as compared to current smokers:- FVC in liters (3.43±0.55 Vs 2.44±0.58; p<0.05); FEV1 in liters (2.86±0.57 Vs 1.76±0.32; p<0.05); FEV1/FVC in percentage (82.72±8.67 Vs 73.72±11.40; p<0.05); FEF 25-75 ratio in percentage (3.18±0.91 Vs 1.60±0.45; p<0.05); PEFR in liters per second (6.63±2.00 Vs 3.16±1.26; p<0.05); breath holding time in seconds (25.54±2.14 Vs 21.36±2.10; p<0.05); 40mm endurance test in seconds (22.36±1.58 Vs 17.70±2.01; p<0.05); MEP in mmHg (83.48±5.28 Vs 64.38±5.31; p<0.05) were found significant.
Conclusions: The strong relationship between cigarette smoking and respiratory disease has been seen independent of the other risk factors in a number of well-designated epidemiologic studies. Spirometry is an excellent screening test to detect chronic airflow obstruction, but may be useful in detecting restrictive disorders as well to study the effect of tobacco smoking on pulmonary functions.

Keywords: Current smokers, Never smoker, Pulmonary function tests

INTRODUCTION

Smoking is one of the most common forms of recreational drug use. Cigarette smoking is today by far the most popular form of smoking and is practiced by over one billion people in majority of all human societies. A 2007 report states that, each year, about 4.9 million people worldwide die as a result of smoking.[1] WHO August 2008 report stated that about 100 million people died in 20th century due to smoking related diseases. It also warned that the same could kill one billion people around the world in the current 21st century also.[2]

Currently 5.4 million people die every year and unless urgent action is taken, by 2030, there will be more than 9 million deaths every year.[3]

In India, smoking is a common habit prevalent in both urban and rural areas. It has extensive effects on respiratory function and is implicated in etiology of a number of respiratory diseases, particularly chronic bronchitis, emphysema, and bronchial carcinoma smoking causes many functional and structural changes in respiratory system.[4,5] It has been suggested that smoking- related diseases kill one half of all long term smokers but these diseases may also be contracted by never-smokers. However, chances of acquiring these diseases are much less in never smokers.

We performed this study to assess the effect of tobacco smoking on pulmonary functions, assess the difference in PFTs of smokers and never smokers. Pulmonary function tests, being a non-invasive tool, can become integral part in identifying early obstructive airway diseases in future, Therefore an attempt has been made to study the pulmonary functions among current smokers and never smoker's population.

METHODS

This study was retrospective study carried out in SSG hospital, Vadodara, Government Medical College, Baroda from August 2013 to February 2014.

Inclusion criteria

All symptomatic male current tobacco smokers aged between 25 to 50 years were included. Individuals with history of smoking for at least 10 years and who currently smoke every day or sometimes, were considered as current smokers. Adults who had never smoked tobacco till date in their entire life time were considered as never smokers (Centre for Disease control, Atlanta U.S.A.) were included.

Exclusion criteria

Females were not included in study, considering the low prevalence of tobacco smoking among females, lack of reporting and reluctance to admit. Persons with significant present or past h/o sickness in preceding 3 months particularly those of the respiratory system like cough, expectoration of sputum, chest pain, dyspnoea etc, prior to clinical examination and pulmonary function testing were excluded.

Current smokers as well as never smokers who were simultaneously exposed to the occupational hazards leading to pneumoconiosis, those never smokers who were exposed to passive smoking in the form of closed association with the smokers and never smokers who were exposed to smoke as an occupational hazard such as rickshaw drivers, traffic police, and vehicle mechanics were excluded. Persons suffering from allergic rhinitis and on active medications were also excluded from the study. A questionnaire form was filled to assess the general health and activity level. The subjects were explained the purpose and importance of the study. Only those, who consented and appeared to be motivated, were selected for the study.

Total 50 smokers and 50 nonsmokers were included. Complete history was taken and thorough systemic examination was done. Anthropometric measurements and vital parameters were recorded. Standard Anthropometric measurements such as weight in kilogram (Kg) in indoor clothing without shoes, Standing height was measured in (cms) without shoes, body mass index was calculated by the formula of weight (in kg) and height (in meters). BMI = Weight (kg)/(height in m^2). Study participants were made to rest for 10 minutes and pulse rate and blood pressure systolic and diastolic were noted.

Name, age, sex, height, weight of each subject was filled in the computer. This data was used for obtaining age and height corrected predicted values of pulmonary function test {Knudson 1983 M. B. Jani}. Smoking status and nationality data were also filled. Medi::Spiro Digital spirometry system was used for measuring pulmonary function tests. Each pulmonary function test was fully explained and demonstrated to each subject. Once the subjects acknowledged understanding of the procedure, they were directed to rehearse before actual recording of test results began. The subject was instructed to breathe in fully by deep inspiration with nostrils closed and the lips sealed around the sterile mouthpiece of spirometer and expire the air out, as fast and as forcefully for 6 sec and then immediately inspire as forcefully and as fast as possible within the same mouthpiece. The subject performed the above maneuver three times and the best result among the three was selected.

We performed pulmonary function tests and compared different values such as FVC, FEV1, FEV1/FVC, FEV3, FEF25-FEF75, PEFR, and breath holding time, 40mm endurance test maximum expiratory pressure test among current smokers and never smokers and then statistically compared it.

The data were obtained through the computer printer. All the spirometric values were automatically corrected to BTPS. The study collected and compared the pulmonary function data of two groups of subjects. All the parameters were recorded throughout by the same instruments to avoid instrumental errors.

Computerised spirometry recorded the following:- forced vital capacity in liters (FVC), forced expiratory volume in 1 second in liters (FEV1), FEV1/FVC%, peak expiratory flow rates in liter per second (PEFR); forced expiratory flow (FEF) at 25%, 50% and 75% of expired volume in liter per second, FEF25-75% i.e. maximum flow rate during 25% to 75% of expired volume in liter per second (earlier termed as maximum mid expiratory flow rate-MMFER), predicted values were also obtained along with observed values. Remarks whether, flow volume and

flow rates were normal or suggestive of restrictive or obstructive defects were also printed.

The subject was asked to take deep inspiration and hold the breath as long as possible. The time for breath holding was recorded. The procedure was repeated twice and the average of the two recordings was taken as the breath holding time in seconds.

For 40 mmHg endurance test and maximum expiratory pressure test, the subject was instructed to take deep inspiration after applying nose clip and to blow continuously into the mercury manometer through a rubber tube to maintain a constant pressure at 40 mmHg. The maximum duration for which the subject could maintain the mercury column at 40 mmHg was noted in seconds. The duration was considered as 0 seconds when the subject could not raise the mercury column to 40 mmHg. The same procedure was repeated after two minutes rest. The highest level at which the subject could raise the mercury column was recorded in mmHg. This value corresponds to maximum expiratory pressure.

RESULTS

Age distribution was similar in the smoker and never smoker groups. Amongst smokers, majority were in age group 31-40 (58%), next common being age group was 41-50 (36%). Cumulatively maximum incidence was seen in >31 years of age. In never smoker group, majority were in age group 31-40 (54%), next common being age group was 41-50 (34%) (Table 1).

Table 1: Age distribution in smokers and never smokers.

Age group (in years)	Smokers (%)	Never smokers (%)
25 to 30	03 (6)	6 (12)
31-40	29 (58)	27 (54)
41-50	18 (36)	17 (34)
Total	50	50

The anthropometric measurements of the two groups like age, weight, height, body mass index were also similar. (Table 2).

Table 2: Anthropometric measurements.

Parameters	Never smoker group		Current smoker group	
	Mean	**S.D**	**Mean**	**SD**
Age (years)	38.68	4.50	37.46	5.65
Height (cm)	166.38	6.30	170.98	4.92
Weight (kg)	63.56	7.70	64.56	7.23
BMI (kg/m^2)	25.31	5.58	27.32	4.62

FVC, FEV1, PEF, FEF-25, FEF-50, FEV1/FVC, 40 mmHg endurance test, MEPT were significantly lower in smokers, with p value <0.05 which indicate that never smoker group had better lung function then the smoker group (Table 3).

Table 3: Pulmonary function tests.

Parameters	Never smoker group (Mean±SD) (n=50)	Current smoker group (Mean±SD) (n=50)	Statistic t value	P value
FVC (l)	3.43±0.55	2.44±0.58	-8.67	<0.05
FEV1(l)	2.86±0.57	1.76±0.32	-11.73	<0.05
FEV3 (l)	3.35±0.54	2.33±0.53	-9.52	<0.05
FEV1/FVC (%)	82.72±8.67	73.72±11.40	-4.44	<0.05
FEF25-75 (l/s)	3.18±0.92	1.60±0.45	-10.92	<0.05
PEF (l/s)	6.63±2.00	3.16±1.26	-10.35	<0.05
FEF-25% (l/s)	5.85±1.78	2.71±0.92	-11.04	<0.05
FEF-50% (litres/s)	3.65±1.11	1.87±0.60	-9.90	<0.05
FEF-75% (litres/s)	1.49±0.43	0.82±0.30	-8.89	<0.05
BHT (s)	25.54±2.14	21.36±2.10	-9.84	<0.05
40endur (s)	22.36±1.58	17.70±2.01	-12.84	<0.05
MEPT (mmHg)	83.48±5.28	64.38±5.31	-18.02	<0.05

DISCUSSION

The habit of smoking tobacco in different forms is the most prevalent addiction in society since its dawn. Thousands of pharmacologically active substances are present in tobacco smoke with many direct and indirect effects. Its ill effects on vital organs and independent association with lung cancer and COPD are well known. Smokers have been shown to have increased plasma levels of Von Wille brand factor (a marker of endothelial dysfunction), raised plasma fibrinogen (the precursor of fibrin) and haematocrit, altered blood lipid and lipoprotein profiles and reduced circulating antioxidants all of which may contribute to the ill effects of smoking.[6-11] The different responses to smoking are related to the

type of exposure; active or passive. Respiratory risk has been shown to increase with increasing levels of blood pressure and/or serum cholesterol and diabetes mellitus and at each level of these three risk factors, the risk in active or passive smokers is greater than the risk in never smokers.[12]

In this study, mean values of most of the pulmonary function tests were significantly lower in **s**mokers as compared to the non-smokers. Many other workers have also reported that long term smokers have altered pulmonary function when compared to lifelong non-smokers (Toekmon et al, 1976; Fletcher et al, 1984). Millicent et al in 1993 also concluded that cigarette smoking was associated with reduced pulmonary function in elderly men.

Edelman et al in 1966 reported that mean values of VC and FEV1 are significantly lower in smokers which is observed in the present study also. Fletcher et al (1976), showed that some smokers have some special susceptibility to the effects of tobacco smoke and showed more pronounced effect as compared to others as was seen in our study. Similarly, numbers of subjects with FVC and FEV1/FVC % well below normal were also considerably higher in smokers. Values of FEV1/FEV % below 80% of predicted values were observed only in smokers group. Observations of Millicent et al (1993) was similar to ours in that age and height adjusted FEV1 means were significantly lower in current male smokers. The difference between the two groups reported by them is 23% whereas in the present study it is 10%. Mean values of FEV1 after adjustments for age and height are reported to be significantly reduced by other workers also (Bruist et al, 1995 and Cecil et al, 1997) but the difference observed was highly variable among these studies.

Stavem et al in 2005 showed that in stratified analyses among current and former smokers, forced expiratory volume in one second % of predicted value was a strong independent predictor of all-cause mortality and respiratory death among current smokers. Forced expiratory volume in one second % of predicted value is not associated with mortality among never-smokers.[13]

Johnson et al showed that smokers tend to have a greater reduction in FVC, FEV_1 and FEV_1/FVC relative to non-smokers which is similar to this study.[14,15] It was observed that showed all the three types of respiratory impairment (obstructive, restrictive and mixed) on PFT were more in current smokers than in never smoker.

This study has some limitations. Large sample size ideally required for the statically signicance of results, their implications and validity to extrapolate results and suggest recommendations on the basis of same. The study involves precise time interval hence long term prognosis can be more justified for prognostification. Current and non-smoker who are simultaneously exposed to the occupation that includes exposure to tobacco and nicotine such as “workers of tobacco processing plants were not included in the study.

CONCLUSION

Smoking results in significantly lower mean values on Pulmonary function tests which makes smokers more susceptible to pulmonary compromised chronic diseases and conditions affecting quality of life as well as life span. Never smokers maintain their pulmonary functions well above average values and hence they are at an advantage of better pulmonary reserve when they are affected by disease or other debilitating conditions.

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