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RESEARCH ARTICLE

COMPARATIVE STUDY OF PATTERN OF PULMONARY FUNCTION TEST AMONG SMOKERS AND NON-SMOKERS AT TERTIARY CARE CENTER, JAIPUR RAJASTHAN

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Pulmonary Function Test (PFT), Smokers, Non-smokers Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), Peak Expiratory Flow Rate (PEFR)

Abstract

Background: Smoking is one of the most common preventable causes of morbidity and mortality in India. Tobacco smoking leads to development of carcinomas, cardiovascular disease and lung disease such as chronic obstructive pulmonary disease. The present study was designed to evaluate and compare the respiratory system changes in reference with PFT parameters in smokers and non-smokers done by the pulmonary functions test.

Material and Methods: This cross-sectional study was carried out at SMS Medical College Jaipur Rajasthan. A total of 140 subjects were selected. Apparently healthy subjects, 70 smokers and 70 non-smokers between age group of 18-25 years without any symptoms were included as study subjects. After taking proper history, clinical examination and height and weight were measured. Spirometry has to be done on selected subjects using ATS criteria (American Thoracic Society criteria).

Result: From this study the data indicates that smoking is strongly associated with abnormal pattern of pulmonary function test. Pulmonary function test parameters (FVC, FEV1, FVC/FEV1, PEFR) was significantly low in smokers as compared to non-smokers. 41.4% of the smokers had obstructive, 8.5% had normal, 30% had restrictive, and 20% had mixed pattern on spirometry. 78.5% of the non-smokers had normal, 17.1% had obstructive, 0% had restrictive and 42% had mixed pattern on spirometry. This association was statistically significant (p value < 0.05).

Conclusion: Pulmonary function test parameters were observed to be higher in non-smokers group. Obstructive pattern of pulmonary function test was common amongst the smokers. This differences in respiratory pattern in young adults of both groups suggesting that smoking has to impacts on lung functions. Spirometry is helpful in the early detection of respiratory dysfunctions in smoking and non-smoking persons who are asymptomatic.

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Introduction:-

Preface according to the World Health Organization (WHO), smoking triggered the deaths of 100 million people worldwide in the 20th century and presaged that smoking might be the cause of deaths around one billion people in the 21st century. The number death due to tobacco smoking would increase to approximately 10 million by the early 2030s. In India smoking is prevalent in both urban and rural areas with differences in manner of smoking such as, cigarettes, bidis, cigar, hookah etc. [1]

Tobacco smoking distresses the respiratory airways of young adults who smoke actively or are passively exposed on a regular basis and is associated with adversative health problems in the upper and lower respiratory tract, as well as smoking has been known to be the main cause of chronic obstructive pulmonary disease (COPD) and chronic respiratory symptoms such as chronic cough, increased production of phlegm, wheezing, and shortness of breath.[2]

The practice of tobacco leaf to generate and gratify nicotine addiction was introduced to Columbus by native Americans and spread rapidly to Europe. The use of tobacco is largely a twentieth century phenomenon, as is the epidemic of disease caused by this form of tobacco. [3]

Tobacco smoking is a foremost determining factor of morbidity and mortality worldwide. Tobacco smoke is a admixture of 4000 different composites, numerous of which are perilous or carcinogenic. Smoking is still mounting in India as well as low-income, middle-income and indeed high-income class countries.[4]

Tobacco smoking spoils virus-induced upregulation of the MHC class I antigen performance machinery system resulting in reduced activation of antiviral CD8⁺ T-cells. This may reduce viral clearance and increase predisposition to viral exacerbations in COPD. CD8⁺ plays a crucial role for immune surveillance and defence against infections and cancers. [5]

Spirometry is one of the utmost readily accessible and useful tests for pulmonary function. It measures the volume of air exhaled at specific time points during complete forceful exhalation, which is preceded by a maximal inhalation. The furthestmost significant variables assessing breathing pattern include total exhaled volume, known as the forced vital capacity (FVC), the volume exhaled in the first second, known as the forced expiratory volume in one second (FEV1), and their ratio (FEV1/FVC). These results are represented on a pneumographic charts and plotted as volumes and combinations of these volumes nominated as capacities. Pulmonary function test is a standard tool for diagnosing and tracking respiratory conditions. Additionally benefits of the PFT test are lower costs, non-invasive nature, reproducibility, and little uncomfortable effects on the subjects. Spirometric dimensions are based on height weight, sex, age and BMI.[6]

The objective of this study was to determine the influence of smoking on pulmonary function in young healthy adults aged 18–25 years in Jaipur, Rajasthan. The hypothesis is that early detection of pattern of pulmonary function test may have a beneficial effect on lung capacity in young adults among smokers.

Methods:-

This study was conducted in the Department of Physiology, SMS Medical College, and attached Hospitals Jaipur Rajasthan, Ethical approval was obtained from the Institutional Ethical committee with Ethical clearance Number 1385 MC/EC/2015. Informed consent was obtained from the study participants before performing the pulmonary function tests.

Apparently healthy smokers were selected from OPD of Respiratory Medicine of SMS Hospital Jaipur, Rajasthan India. Young healthy adults total of 140 subjects among 70 smokers and 70 non-smokers between the age group of 18-25 years without any symptoms were included as study subjects. Smokers: Subjects, who, at the time of the study, smoked any tobacco products either daily or occasionally (bidi and cigarette only in this study), Non-smoker: subjects who, at the time of the study, did not smoke at all, were included in our study protocol.

Those subjects who did not give consent, Recent myocardial infarction less than one month old, Asthma and COPD subjects, Chronic infections such as tuberculosis or other infections of lungs, Subjects with respiratory symptoms such as cough, Haemoptysis of unknown origin (forced expiratory manoeuvre may aggravate the underlying condition), Pneumothorax, Thoracic, abdominal, or cerebral aneurysms, Presence of an acute disease

that might interfere with test performance (e.g. nausea, vomiting), Previous accidents or surgery involving thorax and abdomen were excluded from study.).

Spirometry was performed using computerised RMS-MED spirometer. The pulmonary functions tests were done on a computerized spirometer a total of 140 subjects encompassing of 70 smokers and 70 non-smokers. After proper history taking and clinical examination (vitals pulse rate, respiratory rate, blood pressure) subjects were selected to spirometry using ATS criteria (American Thoracic Society). and the subjects were instructed to take deep inspiration with closed nostrils, lips have to stuck down around the sterile mouthpiece of the spirometer followed by the forceful expiration. The three consecutive interpretations were recorded and best of the three was used for the study. According to American thoracic society (ATS) following activities were restricted prior to performing test. Smoking with in 1 hour of testing, Consuming alcohol within 4 hours of testing, performing vigorous exercise within 30 mins of testing, Eating a large meal within 2 hours of testing. The spirometry was performed in sitting position. Subjects were explained and demonstrated the test procedure preceding to spirometry. Data was collected and analysed using with Statistical Package for the Social Service (SPSS) for windows version 22 software.

Results:-

In this study a total of 140 subjects 70 smokers and 70 non-smokers were enrolled in which 124 males and 16 females were selected as study subjects. All the PFT parameters (FVC, FEV1, FEV1/FVC, PEFR,) were show the subordinate values in smokers as compared to non-smokers and this difference was statistically significant.

Table 1:- Distribution of smokers and non-smokers according to pattern of pulmonary function test.

Pattern	Smokers		Nonsmokers		Total	
	N	%	N	%	N	%
Normal	6	8.5	55	78.5	61	43.5
Obstructive	29	41.4	12	17.1	41	29.2
Restrictive	21	30	0	0	21	15
Mixed	14	20	3	4.2	17	12.1

Table 1: shows 8.5% (6 out of 70) of smokers had normal pattern, 41.4% (29 out of 70) of the smokers had obstructive, 30 % (21 out of 70) had restrictive, and 20 % (14 out of 70) had mixed pattern in spirometry. 78.5 % (55 out of 70) of the non-smokers had normal pattern, 17.1% (12 out of 70) had obstructive and 0 % (0 out of 70) had restrictive pattern in spirometry that means non-smokers does not show restrictive pattern of pulmonary function test in our study. Whereas in non-smokers percentage of mixed pattern is of 4.2% (3 out of 70).

Table 2:- Distribution of pattern of pulmonary function test according to sex among smokers and non-smokers.

Pattern	Male		Female	
	N	%	N	%
Normal	55	44.35	6	37.5
Obstructive	39	31.45	4	25
Restrictive	19	15.32	1	6.25
Mixed	11	8.87	5	31.25

Table 3:- Distribution of pattern of pulmonary function test in both study subjects (smokers plus non-smokers).

PFT	Smokers	Non-smokers	Total	
			N	%
Normal	6	55	61	43.57
Abnormal	64	15	79	56.42

Table 3: exhibits total of 140 subjects (smokers +non-smokers) studied, 61 (43.57 %) was found normal pattern of PFT and 79(56.42 %) showed abnormal pattern of PFT.

Discussion:-

Spirometry is a frequently performed lung function test and an important tool in medical surveillance of respiratory diseases.

Pulmonary function tests (PFTs) is helpful instrument for clinicians to evaluate the respiratory functions of their patients in many clinical conditions and when risk factors for pulmonary disease, occupational exposures and lung carcinomas. National guidelines for the dimensions and interpretation of PFT are regularly updated, and the most recent guidelines developed by the international joint Task force from the European Respiratory Society and the American Thoracic Society (EUR/ATS) were published in 2022.[7]

The results of the PFTs are affected by the effort of the subject. Results should be combined with relevant past and present history, physical examinations, and laboratory investigations to help reach a proper judgement. [8]

Pulmonary function test is used as marker of respiratory disease. Smoking exhibits harmful effects to human respiratory system and due to this sign and symptoms develop [9].

Normal outcomes of pulmonary function test are FEV1/FVC ratio of greater than 0.70 and both FEV1 and FVC more than 80% of the predicted value. The occurrence of natural fluctuations in lung function with time are significant indicator of the healthiness status of the lungs. In non-smokers, FEV1 normally decreases by approximately 30 mL per year. Conventionally annual 10% change in standard value of FEV1 in healthy individuals is considered significant clinically. However, changes in FEV1 and FVC over time depend on subject demographics such as age, sex, BMI and standard lung function [10]

An obstructive defect is a disproportionately reduction in maximum expiratory effort from the lung (FEV1) relative to the maximum capacity (FVC). In practical terms, an FEV1/FVC ratio of less than 0.70 expresses an obstructive pattern of PFT. Restrictive pattern of PFT is characterized by a normal FEV1/FVC ratio (>0.70) and a reduction in TLC below 80% of the predicted value. They can be suspected if the FVC is reduced (less than 80%), FEV1/FVC is increased (0.70), Mixed pattern of PFT is characterized by obstructive and restrictive defects, and make a diagnosis when both FEV1/FVC ratio less than 0.70 and TLC less than 80% predicted value.[11]

In this cross-sectional study, we assessed and compare the pattern of PFT between smoking and non-smoking status in young adults age groups between 18-25 years. Our findings suggested that an obstructive as well as restrictive pattern of PFT are most commonly present in smokers. From the study of Yoon and Lee et al also states that tobacco smoking causes long-lasting harm to lung function and indicates the significance of the prevention of smoking [12]

Cigarette smoking is associated with airflow restriction and that smoking cessation has a beneficial effect on FEV1 deterioration. Provision of a smoking cessation program for smokers should be started for better lung health. [13].

Compactly, to hand by using a pulmonary function test parameters can assist to recognize lung function impairment in asymptomatic smokers. Timely recognition with appropriate counselling for smoking cessation can stop expected morbidity and mortality.

Conclusion:-

On the basis of results and observations obtained from study we concluded that pulmonary function test parameters were significantly reduced in smokers compared to non-smokers and is most commonly associated with obstructive pattern in routine spirometry. Spirometry is the most constantly performed pulmonary function test and is an essential tool for the diagnosis and follow-up of respiratory ailments. This study emphasized the significance of spirometry in primary care, as a screening tool for the early detection of obstructive as well as restrictive pulmonary disease. Hence, pulmonary function tests should be carried out at appropriate time in smokers to recognize respiratory impairment and termination of smoking must be persuaded and alleviate the probabilities of diseases related with the smoking behaviours.

Conflict Of Interest-

Nil.

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