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Comparison of FEF between Smokers and Non-Smokers

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Abstract

Introduction: The value of FEF 25%-75% has been both praised and condemned. The test has been recommended by Leuallen E. et al as an early index of airway obstruction. According to Gilbert R. et al. a normal value has poor specificity. It has been suggested by Voter K.Z that obstruction in peripheral airways can be discriminated from that in larger airways by a disproportionate decrease in FEF 25%-75% compared to FEV1. *Methodology:* First, case history is taken with special emphasis on personal habits. Then secondly the physical examination including the measurement of height and weight. All the tests are done at the same time of the day to avoid possible diurnal variation. Subject is allowed to sit comfortably on the stool. Instructions are given about the tests. *Results:* Non-smokers with normal weight is having mean FEF of 71.13 with a standard deviation of 20.15 and non-smokers with over weight the mean is 74.86 and standard deviation is 18.83. *Conclusion:* The effect of smoking on FEF is more affected in overweight group of subjects than the normal weight group of subjects.

Keywords: FEF; Smoking; Overweight.

Introduction

Wide spread smoking was a major stumbling block to a successful achievement of WHO's goal of 'health for all by the year 2000'. As a cause of death, smoking out numbers alcohol, cocaine, heroin, suicide, homicide, HIV/AIDS and road traffic accidents combined on an annual basis. Each year tobacco is responsible for the death of some 3.5million people or one death every nine seconds. Unless current trends are reversed this numbers will go on increasing [1]. In 1996 it was estimated that about 8.15 million males above 30 years and 4.21 millions females above 30 years are chronic smokers. In developed countries, about 30-40% of men and 20-40% women smoke. In developing countries like India between 2-10% of women smoke. In smoking the male to female ratio is 1.5:1. Smoking is also one of the main causes of premature death. It is estimated that in future smoking related deaths will increase from 3.5 million to 10 million per year at the end of 2025. Smoking adversely affects every single organ system in the body in one way or other. It greatly increases the risk of lung cancer, other respiratory diseases, coronary heart diseases, peripheral vascular disease and ulcers. Smoking is also responsible for the low birth weight babies and premature deaths. In women lung cancer increases dramatically following adaptation to smoking. It is also demonstrated that passive smoking causes several diseases including lung cancer. The epidemiological evidence suggests that cigarette smoking is the single major factor associated with respiratory diseases. The major respiratory diseases caused by cigarette smoking are lung cancer, chronic bronchitis, emphysema, chronic obstructive pulmonary diseases and lung failure. Inhalation of tobacco smoke first cause immediate rise in airway resistance. This change is a reflex response due to the deposition of dust particles upon the epithelium of respiratory tree and in not due to tobacco smoke. But ultimately tobacco smoke causes airway obstruction by damaging mucus secreting cells, cilia, bronchial muscles, small airways and alveoli. Mucosal glands undergo hypertrophic changes with excess mucus secretion. The above changes are slow. Only a minor

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proportion of cigarette smokers show progressive deterioration, but the knowledge of natural history is insufficient to identify those individuals who are at risk. These persons can be identified only by doing Pulmonary Function Tests (PFT) [Spirometry]. This test is the simplest, easiest and most reliable test. In chronic smokers all measures of pulmonary function tests decline especially Forced Expiratory Volume in one second. (FEV1) Obesity/Over weight is another major risk factors and which adversely affect health. It affects pulmonary system by reducing the pulmonary complaints and small airway caliber (Biring M.S et al, 1997, Ray et. al, 1983 & Berger et al, 2001) and is associated with a number of pulmonary abnormalities [2,3,4].

Forced Mid Expiratory Flow Rate (FEF 25%-75%) FEF 25%-75% is the mean forced expiratory flow during the middle half of the FVC. It was formerly called the maximal mid expiratory flow rate (MMEF). It was expressed in liters/sec. Locating the points on the volume time curve corresponding to 25% and 75% of the FVC and then passing a straight line through them determine the FEF 25%-75%. The slope of this line represents the average rate of airflow over the mid portion of the FVC. Normal values Males > 2.0L/sec, Females > 1.6L/sec. The value of FEF 25%-75% has been both praised and condemned. The test has been recommended by Leuallen E. et al (1955) as an early index of airway obstruction. According to Gilbert R. et al. a normal value has poor specificity. It has been suggested by Voter K. Z that obstruction in peripheral airways can be discriminated from that in larger airways by a disproportionate decrease in FEF 25%-75% compared to FEV1. But reliability of this interpretation has been questioned, primarily because of the large variability of this measurement. Others like Birath et al (1963) and Sobol et al (1965) have found PEF 15%-75% less useful than other measurements because of poor correlation with other ventilatory measurements and wide range of normal values.

Peak Expiratory Flow Rate (PEFR) It is the maximum flow, which can be sustained for a period of 10 milliseconds during expiration from a position of full inspiration. PEFR can be measured either from an MEFV (Maximum Expiratory Flow Volume) curve or by using portable peak flow meters. PEFR is a reflection of the status of the large airways and body and chest development (Mead j et al (1967). There is a definite correlation between FEV1 and PEFR in patients with asthma and COPD who are undergoing bronchodilator therapy (Shim C 1978,Kelly C.A et al 1988) [5,6].

Methodology

At first a thorough physical examination was carried out and also make sure that patient had not taken cigarette or heavy meals at least an hour prior to the test.

Selection of Tests: When choosing tests for lung function a number of criteria should he taken into account.

1. The tests should be safe, simple and should not be inconvenient to the subjects.
2. The information, which it is intended to be obtained from a tests, should ideally be independent of both the motivation and extent of emotional participation of the subjects and personality of the operator.
3. The tests should be repeatable.
4. The tests of lung function should be appropriate to circumstances for which they are required. So the tests were selected with a view for pointing information on different aspects of function.

Procedure: First, case history is taken with special emphasis on personal habits. Then secondly the physical examination including the measurement of height and weight. All the tests are done at the same time of the day to avoid possible diurnal variation. Subject is allowed to sit comfortably on the stool. Instructions are given about the tests. A very enthusiastic demonstration by the operator is required. So that a maximum effort is made by the subject when carrying out the forced expiratory test. Subjects who has not previously examined on spirometry should have two or more practice attempts until it appears that maximum effort is being obtained. A disposable mouthpiece should be used in each subject. The mouthpiece was positioned so that the subject's chin was slightly elevated and neck extended. After the insertion of mouth piece a careful check was made to ensure that there was no air leak present. The subject was asked to make maxima! effort for each test and was closely watched to ensure that he maintained an airtight seal between the lips and the mouthpiece of the instrument. First the subject data was entered as name, age, sex, height, weight, address, occupation, addiction etc. Then the required measurement was called up from menu. Forced Vital Capacity (FVC) The subject is made comfortable and the nose clip kept in place to close the nostril to prevent air entry through the nose. Then the mouthpiece is placed in the mouth and which is connected to pneumotach. Then the

subject is asked to breach via, the mouthpiece. After a brief period of quiet normal breathing subject is asked to breathe in and completely as possible then suddenly breathe out forcefully, rapidly and completely as much as possible. The performance of the maneuver was evaluated by inspecting the graphic output of flow volume curve and the subject was reinstructed if necessary. Repeat it for 2 to 3 times. Measurement was taken from the best of the three tests.

Results

The statistical analysis in smokers in relation to body mass index showed that there is reduction of FEF in obese smokers, which denotes that there is statistically significant difference of FEF in over weight smokers.

As per the Table 1 non-smokers with normal weight is having mean FEF of 71.13 with a standard deviation of 20.15 and non-smokers with over weight the mean is 74.86 and standard deviation is 18.83. This values are tested using chi-square test and it is found that the difference actually observed does not have significance since the p value is more than 0.05. In smokers, the smokers with normal weight the mean is 54.34 and the standard deviation is 27.52. In smokers with overweight the mean is 51.75 and the standard deviation is 24.07. When this values are tested using chi-square test, it is found that there is significant difference, according to the chi-square test the P value is less than 0.05 and it shows that the effect of smoking on FEF is more affected in overweight group of subjects than the normal weight group of subjects.

Table 1: Statistical analysis of FEF

Category	Mean	Std Deviation
Non Smokers Normal Wt.	71.13	20.15
Non Smokers Over Wt.	74.86	18.83
Smokers Normal Wt.	54.34	27.52
Smokers Over Wt.	51.75	24.7

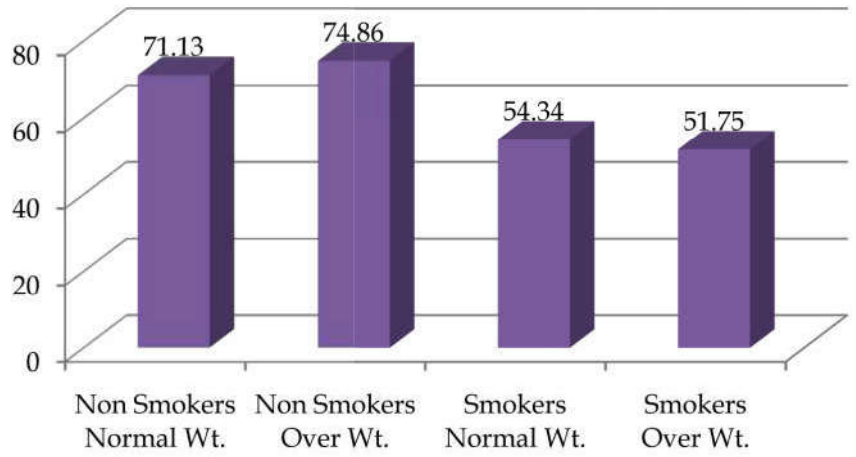

Fig. 1: Comparison of FEF

Discussion

The adverse effect of cigarette smoking on Spirometric indices have been well documented. Tobacco smoke contains a number of substances which may exert their effects upon the body; they include particles of dust which disturb the function of the airways, tar which exerts an irritant effect; pon the bronchial epithelium and nicotine which increase heart rate and elevates systemic Blood Pressure [Cotes, 1968]. Cigarette smoking affects pulmonary function soon after it is started (Seely 3.E, 1971). The inhalation of tobacco smoke causes an immediate rise in airway resistance, which persists for at least an hour. Early changes are mild and reversible following cessation of smoking or modification of smoking habits (Buist As 1976, McCarthy Ds, 1976). PFT in Smokers Cigarette smoking has been identified as a single most significant cause of preventable morbidity (McGinnis 3M 1993). One of the two continuing smokers wily die of a smoking related diseases [7]. (Thun M 3, 1995

and Boll R & Peter 1994). Half of all cigarette smokers will eventually be killed by their habit (Boll R & Peter 1994). The death may be due to Lung cancer, chronic bronchitis & emphysema, corpulmonale, ischemic heart disease and cerebero vascular accident (Royal College of Physicians, 1997). The annual excess mortality is nearly 440, 000, out of these majorities will die prematurely (Centers for control and prevention of disease, U.S, 1984). Coronary heart disease, cancer and various respiratory diseases account for the majority of excess mortality related to cigarette smoking (Center of Control and Prevention of Diseases, U.S, 1993). From cancer death 29% where from lung cancer and 83% of these death were attributed to smoking (Center for Control and Prevention, U.S., 1993 and Rock ville 1990). COPD such as chronic bronchitis and emphysema account for another percentage of death annually by smoking (Centre for Control and Preventing, 1'13) [8].

It has been estimated that an average of 7 minutes of life is lost for each cigarette smoked. This estimated in based on an average reduction in life expectancy for cigarette smokers of 6.6 years (LEW E.A 1987). Smoking one pack per day (20 cigarettes), the reduction of life in average 4.6 years (Public Health Service, Washington, 1979). Smoking was also associated with irreversible obstructive changes in the airways in some subjects (Fleature C., 1997). Cigarette smoking is usually regarded as the dominant risk factor for developing COPD (U.S. Dept of Health, 1979). Smoking related lung damage occurs as a result of inflammation and eventual scarring of the small or peripheral airways. It was suggested that smokers those who are susceptible to COPD can identified by PFT in early middle age (Burrows .B., 1991). It is by FEV1 and in smokers FEV1 declines by twice compared with non smokers (Sandrik L. et al, 1995 and Marcus E.B. et al., 1995). Cigarette smoking affects pulmonary function soon after it is started (Seely 3E. 1971). Tobacco smoke causes an immediate rise in airway resistance (Buist AS. 1976 and McCarthy D.S.,1976). Walter and Richard in 1991 proved that smoking in adolescents and early aoulthood diminishes the airway growth. Previously by Lebowitz et al. 1987 [9].

In smokers, PFT shows reduced FEVI and it is the early sign to stop smoking (Tager IB., et. al., 1988). On average, cigarette smokers have a high annual rate of decline in FEV1 of about 50 ml which 30 ml annually in nonsmokers. In some smokers, there is rapid decline in FEV1 and this may be early sign of COPD (Tager. IB. et. al., 1988). Stopping cigarette smoking does not produce a substantial improvement in FEV1, but the subsequent rate of decline in decreased (Authonisen NR et. al. 1994 and Fletcher et.al 1976) The rate of decline of FEVI can be used to assess susceptibility in cigarette smokers, progression of the disease and reversibility of the airway obstruction (ATS 1995, Siafakas NM et al 1995 and British Thoracic Society, 1997).

In some smokers PFT shows low or normal FVC. If PVC is low it is the early sign of restrictive respiratory diseases but it can be lower in other respiratory diseases also (ATS 1995 and BTS 1997). The FEV1/ FVC also decline in smokers, which is the early sign of COPD, but less sensitive than FEVI. (Brain N Legere et al., 1993) FEF 25-75% is a useful measure meant to detect airflow limitation. In smokers it fall less than 50% of predicted value. This is considered to be an indicator of small airway function, but probably provide no more clinical useful information than measurement of FEVI (ATS, 1991) Smokers show low FEF than predicted. This can be measured directly from the flow volume loop or measured with a hand-held peak flow meter. This is an inferior measurement of airway obstruction compared to FEVI (Detels R., et al., 1982) The pulmonary function values of the smokers found lower than those of the non smokers such as VC, IRV, IC, FVC, FEVI, MMEF, PEF, FEF, FEV 25- 75% and MW. FEVI, PEF are sensitive indicator of large way resistance and WIEF, FEF and FEF 25-75% are sensitive indicator of small airway resistance [10]. The ventilatory function tests carried out in smokers showed there is significant lowering of the following parameters VC, IRV, IC, FVC, FEV, FEF, PEF, MMEF, FEF 25-75% and MW. This showed there is definite tendency to narrowing of both the large and small airways.

Conclusion

The statistical analysis in smokers in relation to body mass index showed that there is reduction of FEF in obese smokers, which denotes that there is statistically significant difference of FEF in over weight smokers.

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