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Impact of Obesity on Lung Volumes in Middle Aged People

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Abstract
The Pulmonary function tests in subjects with normal BMI and with obese individuals were done and correlated with the severity of obesity. Considering the PFT changes, normal study was present in 17%. But, remaining individuals showed proportionate decrease in both FEV1 and FVC values. These changes were independent of age, sex and blood pressure. So, the PFT changes are more of restrictive than obstructive pattern which can leads to decreased chest wall and lung compliance, respiratory muscle strength and endurance which ultimately ends in poor pulmonary ventilation.Hence, this non-invasive procedure may be utilized as a routine screening test for obese people for better medical care. Thus, obesity is associated with a wide variety of PFT abnormalities, many of which can be corrected by weight loss.
Keywords: *Pulmonary function tests, Obesity, FEV1, FVC.*

Introduction

Obesity is a chronic medical condition characterized by excessive accumulation of fat on human body that cause a generalized increase in body mass. Overweight and obesity has become a worldwide health concern. The prevalence of excess weight gain within populations forecasts an increase burden from several diseases, most notably cardiovascular, diabetes mellitus and cancer.(2) The environmental factors such as lifestyle preferences and cultural practices playing pivotal roles in the rising prevalence of obesity, India has now become the third most common country in the world as per the study conducted by Lancet. It is a major risk factor for many acute and chronic disorders, including cardiovascular, cerebrovascular disease and diabetes. It affects the respiratory system as well. It is associated with additional health conditions including carpal tunnel syndrome, deep vein thrombosis and poor wound healing.(6)

Obesity has profound effect on physiology of breathing. In brief it can lead to pulmonary compromise in a number of ways including impairment on pulmonary function testing , small airway dysfunction and expiratory flow limitation, alteration in respiratory mechanism, decreased chest wall and lung compliance, decreased respiratory muscle strength and endurance, decreased pulmonary gas exchange, lower control of breathing and limitation in exercise capacity. Severe obesity can lead to OHS and sleep apnea with decreased responsiveness to CO_2 and hypoxemia. BMI (Body mass index) is an attempt to quantify the amount of tissue mass in an individual and it is calculated as weight in kilogram divided by square of height in metres.(6)

WHO Classification	WHO BMI cut-off points for definition (kg/m^2)
Underweight	<18.5
Normal range	18.5-24.9
Overweight	>=25.0
Pre-Obese	25.0 – 29.9
Obese class I	30.0 - 34.9
Obese class II	35.0 – 39.9
Obese class III	>=40.0

Objectives

1. To find out the changes in lung volumes in middle aged individuals by performing PFT.
2. To determine effects of severity of obesity on lung volumes.

Materials and Methods

Selection of the Subjects

Obese individuals of about 30 people with BMI >30 of both sexes of age group between 30 -45 years were included in this study. The healthy volunteers, visitors or relatives of patients visiting Government Thiruvarur Medical College Hospital, Thiruvarur were taken as subjects and the study was conducted in department of Physiology, Government Thiruvarur Medical College, Thiruvarur after getting the Ethical committee approval. The subjects were informed about the study and written consent was obtained from them. The selection of obese individual is based on WHO BMI cut off points. Study group consists of obese subjects with BMI >30kg/m^2 without any confounding factors like age, sex and blood pressure and also without any comorbidities like hypertension, diabetes mellitus etc,(2,4,5). The control group consists of age and sex matched non obese subjects with BMI of 18.5 to 24.9kg/m^2. All participants have undergone PFT using spirometry.

Study Design: Cross-sectional study

Method

Spirometry is an objective, non-invasive and sensitive test which is easy to perform. Before performing the test, the patient was asked to take a deep breath and mouth piece is placed tightly in between the mouth and teeth. Then the patient was asked to completely blow out rapidly into the mouth piece. The parameters like Forced expiratory volume in 1 sec (FEV1), Forced vital capacity, Vital capacity, FEV1/FEC ratio, Forced expiratory flow were recorded.

Statistical Analysis

The data will be subjected to basic statistical analysis (SPSS 2016) and appropriate interpretations will be drawn.

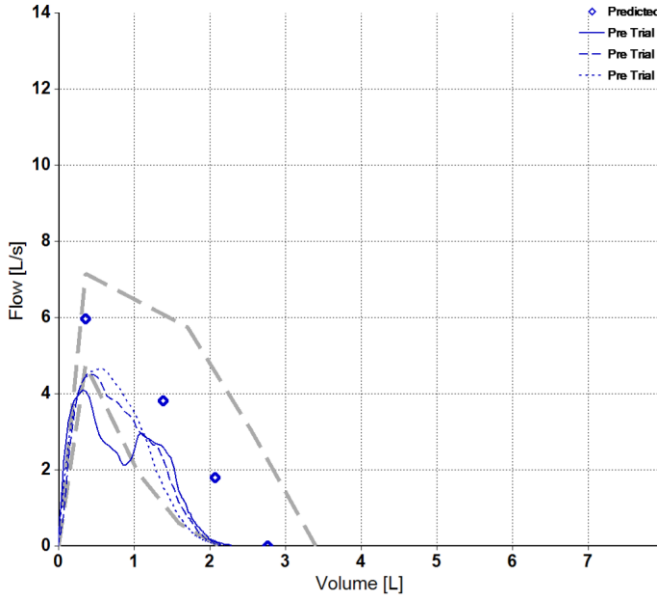
BMI:

Parameter	Sample size	Mean	Standard deviation	t value	P value
BMI	N_1-30	23.133	3.259	10.3773	0.0001***
	N_2-26	32.508	3.497		

***Extremely statistically significant

Parameter	Sample size	Mean	Standard deviation	t value	P value
FVC	N_1-30	2.7033	0.6214	2.0082	0.0496**
	N_2-26	2.3535	0.6821		
FEV1	N_1-30	2.2233	0.5112	2.1672	0.0347**
	N_2-26	1.9212	0.5309		
FEV1/FVC ratio	N_1-30	0.81437	0.07350	0.5150	0.6087
	N_2-26	0.82462	0.07517		
FEF 25-75%	N_1-30	2.4493	0.9738	1.1002	0.2761*
	N_2-26	2.1654	0.9508		
PEFR	N_1-30	5.0770	1.6737	1.3282	0.1897*
	N_2-26	4.4846	1.6539		
FET	N_1-30	5.983	1.019	0.1322	0.8953*
	N_2-26	6.031	1.579		

* not statistically significant
**Statistically significant



Discussion

All the obese people included in the present study had not have the PFT changes; some had normal pulmonary function tests (17%). The mean age of obese individuals included in the study was 38.81 years who ranged from 30 to 46 years. But, the earlier studies were carried out only in the older patients (with the mean age of 64 and above who might have had the age-related PFT changes which was not, hither to, ruled out[1]. Therefore, it could be stated from this study that the obesity is more prevalent in the individuals of middle age groups and the PFT changes noticed in these people are obesity-driven rather than age-related.

Our aim of the study is to evaluate PFT abnormalities with varying degrees of obesity. The mean BMI was 33.80 with the range of 30-40. Considering the PFT changes, normal study was present in 17%. But, remaining individuals showed proportionate decrease in both FEV1 and FVC values. These changes were independent of age, sex and blood pressure. So, the PFT changes are more of restrictive than obstructive pattern which leads to severe restriction of pulmonary gas exchange. These changes must be considered when evaluating both baseline Pulmonary function studies in obese patients and the changes seen during weight reduction. Many of these PFT abnormalities are reversible with substantial weight loss. Thus, obesity is associated with restrictive pattern of pulmonary abnormalities, many of which can be corrected by weight loss.[3]

Conclusion

The influence of obesity causing the restrictive pulmonary dysfunction is proved beyond doubt, from the significant PFT changes. So, this noninvasive procedure may be utilized as a routine screening test for obese people for better medical care. In addition, the results necessitate further study to evaluate this medical condition thoroughly as a potential risk factor for pulmonary dysfunction.

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