

Research Article

A prospective study of pulmonary function test in obese patients

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ABSTRACT

Background: Obesity is considered to affect the respiratory functions. The objective was to study the pulmonary function test and its correlation with smoking, hypertension and diabetes in obese patients with Body Mass Index (BMI) ≥ 30 kg/m²

Methods: A cross sectional study was done on 100 patients with age >18 years and Body Mass Index (BMI) ≥ 30 kg/m² in the Department of Medicine, GR Medical College, Gwalior during the period between July 2013 to November 2014. After thorough history and clinical examination of all the selected patients, they were subjected to routine investigation and spirometry (Pulmonary function test). Pulmonary Function Test (PFT) was performed by using UNI-EM spirometer.

Results: Out of 100 patients, 37% were in the age group of 41-50 years followed by 27% in 31-40 years and there was a female predominance (53%). Abnormal PFT was found in 58% patients, out of which the commonest pattern was restrictive (32%) followed by mixed pattern (26%). Among females with abnormal PFT restrictive and mixed type pattern were seen in 32% and 18.9% respectively whereas among males 32% and 34% had restrictive and mixed pattern of abnormal PFT respectively. It was found that abnormal PFT pattern was directly proportional to increase in BMI. The mean Forced Vital Capacity (FVC) was 77.76 ± 15.56 L, mean Forced Expiratory Volume in one second (FEV1) was 77.97 ± 17.40 L while mean FEV1/FVC ratio was 105.44 ± 7.85 in the study population. Most common PFT pattern seen in smokers was mixed type (55%). Among hypertensive patients 42.1% had normal PFT.

Conclusions: More than half of obese patients were having abnormal PFT in our study, and the increase in BMI was associated with increase in abnormal PFT pattern. The most common abnormal function was restrictive pattern as reflected by decreased mean FVC, FEV1 and increased FEV1/FVC ratio. There was no correlation between hypertension and pulmonary function test in obese; similarly no correlation was seen between diabetes and PFT in obese.

Keywords: Pulmonary function test, Obese, Body mass index, Smoking

INTRODUCTION

The prevalence of obesity is increasing worldwide due to changes in lifestyle.¹ Obesity is a chronic condition and defined as abnormal or excessive accumulation of fat that may impair health of a person.² Obesity is one of the

significant global health risk and has been associated with an increased incidence of cardiovascular diseases, metabolic disorders, hypertension, pulmonary dysfunction and some cancers.³ Obesity has many deleterious effects on respiratory functions, due to changes in the respiratory mechanics, decrease in

respiratory muscle effectiveness, decrease in pulmonary gas exchange and restriction in pulmonary function tests.³

It has been reported that in obese patients there is decrease in Functional Residual Capacity (FRC) and Expiratory Reserve Volume (ERV). High BMI has been reported to elevate pulmonary arterial pressure.⁴ Impaired respiratory function in obesity is associated with increased morbidity and mortality.⁵

The Pulmonary Function Tests (PFTs) are the main tests that are used to evaluate the physiological respiratory efficiency of an individual.⁵ Different factors that can affect the values of PFT are age, gender, height, weight, race or ethnicity, and various diseases.⁶

The present study aimed to evaluate the effect of obesity on PFT by spirometry, as it is the initial screening tool for pulmonary diseases and is most widely used, economic, and easy to conduct.

METHODS

A cross sectional study was done on 100 patients with age >18 years and Body Mass Index (BMI) ≥ 30 kg/m² in the Department of Medicine, GR Medical College, Gwalior during the period between July 2013 to November 2014. Patients with acute Myocardial Infarction (MI), acute respiratory illness, any chest injury and neuromuscular disorders were excluded from the study.

Informed consent from all the patients and the approval of institutional ethics committee was taken.

After detailed history and clinical examination of all the selected patients, routine investigations and spirometry (Pulmonary function test) were performed. Pulmonary Function Test (PFT) was performed by using UNI-EM spirometer.

RESULTS

The Out of 100 patients, 37% were in the age group of 41-50 years followed by 27% in the age group of 31-40 years and there was females (53%) outnumbered the

males. 76% patients had BMI between 30-35 kg/m² whereas 24% had BMI more than 35 kg/m². Abnormal PFT was seen in 58% patients (Table 1). In those with abnormal PFT, the commonest pattern was restrictive (32%) followed by mixed pattern (26%). Among females 32% and 18.9% had restrictive and mixed pattern respectively whereas among males 32% and 34% had restrictive and mixed pattern of PFT respectively.

The mean BMI of patients was 34.22 ± 3.067 kg/m². The mean of FEV1, FVC and FEV1/FVC of all the patients is shown in Table 2.

At higher BMI the no of patients with abnormal PFT was increased (Table 3).

Out of these 100 obese patients, 38 were hypertensive and 29 were diabetic, their baseline characteristics and PFT patterns are shown in Table 4. Out of 22 smokers 12 patients had abnormal PFT. Most of the smokers (55%) showed mixed type PFT pattern.

Table 1: Distribution of normal and abnormal PFT according to BMI.

BMI	Normal PFT*	Abnormal PFT*	Total
30-35	34 (44.7)	42 (55.3)	76 (100)
36-40	8 (38)	13 (62)	21 (100)
41-45	0 (0)	3 (100)	3 (100)
Total	42 (42)	58 (58)	100 (100)

*Pulmonary Function Test, Values are expressed in number of patients (%). Body mass index; BMI

Table 2: Mean FEV1, FVC and FEV/FVC ratio in types of PFT.

Values	PFT pattern		
	Normal (N=42)*	Mixed (N=26)*	Restrictive (N=32)*
FEV1 (L)	92.9 \pm 11.0	57.9 \pm 11.9	74.7 \pm 6.5
FVC (L)	91.6 \pm 9.0	59.3 \pm 10.8	74.6 \pm 4.4
FEV1/FVC	106.9 \pm 5.5	102.6 \pm 9.6	105.8 \pm 8.5

*Values are expressed in mean \pm SD

Table 3: Distribution of mean of FEV1, FVC and FEV/FVC ratio according to BMI.

BMI	N [#]	FEV1 (L)*	FVC (L)*	FEV1/FVC*
30-35	76	78.3 \pm 16.3	77.9 \pm 14.5	105.6 \pm 7.8
36-40	21	78.5 \pm 21.1	78.5 \pm 19.2	105.6 \pm 8.2
41-45	3	65.2 \pm 18.3	68.6 \pm 16.7	99.9 \pm 5.7
Total	100	78.0 \pm 17.4	77.8 \pm 15.6	105.4 \pm 7.9

*Values are expressed in mean \pm SD, [#]number of patients. Liter; L, Body mass index; BMI

Table 4: Correlation of different variable among study population.

Variable		Non diabetic	Diabetes	Non hypertensive	Hypertensive
Age (years)	21-30	11	0	11	0
	31-40	24	3	24	3
	41-50	15	22	17	20
	51-60	18	3	9	12
	61-70	2	1	1	2
	>70	1	0	0	1
Gender	Female	37	16	30	23
	Male	34	13	32	15
BMI (kg/m ²)	30-35	50	20	45	25
	35-40	18	8	15	11
	>40	3	1	2	2
PFT	Normal	31	11	26	16
	Abnormal	40	18	36	22
PFT pattern	Normal	31	11	26	16
	Mixed	18	8	17	9
	Restrictive	22	10	19	13
Total		71	29	62	38

DISCUSSION

Obesity is one of the significant global health risk.³ The present study demonstrated the relationship of pulmonary function with BMI in a group of 100 patients and found a decrease in lung function with increase in BMI, which supports the finding of many previous studies.^{3,5}

In present study dynamic lung functions like FVC and FEV1 were decreased, which is consistent with findings of Schoenberg et al where they reported that increase in BMI was associated with decrease in pulmonary function.⁷ It was found that mean FVC, FEV1 were decreased while ratio FEV1/FVC was increased with an increase in BMI and the alterations in these parameters were more marked with the increase in BMI similar to the previous work.⁸ Morgan et al., has reported that mild, moderate and severe obesity were all associated with an incremental reduction in both FVC and FEV1 as is seen in our study.⁹

The mean FVC and FEV1 were reduced with a significant increase in FEV1/FVC ratio suggesting restrictive pattern. This finding was similar to the previous workers who have reported restrictive ventilatory defect in obesity.⁹ The basis of this can be that accumulation of fat mechanically affects expansion of diaphragm due to encroachment of fat in to the chest wall and diaphragm.

The abnormal PFT in patients with BMI between 30-35 kg/m², 36-40 kg/m² and more than 40 kg/m² were seen in 55.3%, 62% and 100% respectively. Hence, it is quite evident that as BMI increases, there was an associated increase in abnormality in PFT pattern, similar to the

other workers. We found abnormal PFT pattern more amongst male subjects as compared to females. Rationale behind this finding can be that central obesity in males has greater effect to exert, on diaphragm and respiratory mechanism as compared to peripheral (thighs, breasts, buttocks) obesity in females. We did not observe any correlation between hypertension, diabetes, smoking and pulmonary function test in obese.

Obesity is a major public health problem and predisposes to various diseases. It was found that obesity alters the PFT and more the BMI more are the chances of abnormal PFT. The most common abnormality seen was the restrictive pattern. However, a large sample size and longitudinal study is required in predicting the relationship between PFT and BMI.

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