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Original Research Article

A Retrospective Study on the Correlation between BMI and Restrictive Lung Pattern in Middle Aged Males Using Computerized Spirometry

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Abstract:

Introduction: In the present scenario, BMI denotes the normal functioning of various systems in the body. Particularly lung function test gets altered with obesity. Now the exact relationship between BMI and restrictive lung pattern was not studied much. So the purpose of the present study is to estimate the effects of BMI on restrictive lung pattern.

Objectives: Primary Objective: To analyse the correlation between BMI and restrictive lung pattern. Secondary Objective: To propagate the result among general public about the correlation between restrictive lung pattern and obesity (High BMI)

Methodology: The pulmonary function test data was randomly selected. There is no clinical risk in this study, as the pulmonary function test data was obtained retrospectively from the procedure performed for the diagnosis of the patient's treatment.

Justification of Study: It is still not known whether high BMI alone represent appropriate predictor of altered lung function in the general public. So this study was done retrospectively with about 40 Spirometric values. The values were obtained from respiratory medicine OPD at PSGIMS & R. Coimbatore. The data collected were subjected to SPSS (Statistical Package for Social Sciences) for Statistical Analysis. P<0.05 was considered to be statistically significant. The data will not be revealed to any of the other patients, other doctors or other paramedical staff. It will be preserved for about 3 years confidentially in the departmental library.

Result: Obesity is found to decrease the lung volumes and capacities by decreasing both lung and chest wall compliance. There is also an increase in resistance to out flow of air through the airways. There was no statistically significant correlation between BMI and FVC&FEV_1.There was statistically significant correlation between FVC and FEV_1(r=0.762,p value = <0.001) and FEV1&FEV_1 /FVC.(r=0.648/p=< 0.001) There was weakly positive correlation between BMI and FEV_1 / FVC. There was no statistically significant association between BMI and FVC, FEV_1/FVC in linear regression.

Conclusion: BMI could be an early predictor of restrictive lung disease. A reduction of BMI might reduce the rate of incidence of restrictive lung disease and the monitoring of BMI could possibly be a tool for preventing restrictive lung disease in general public. Ultimately a greater understanding of the effects of obesity on the respiratory disease and the provision of adequate health care resources is vital in order to care for increasingly important patient population.

Keywords: FVC, $FEV_1$$FEV_1$/FVC, Categorical variable, continuous variable, restrictive lung pattern, Spirometer.

Introduction

There is a major epidemiology of obesity. Obesity is one of the most important public health problems facing the world today.

Global estimate suggest that over 2.3 billion children & adults worldwide are overweight, of which 400 million are obese. If the current epidemic continues, 2.7 billion adults could be living with overweight or obesity by 2025.

Increase in BMI is associated with decrease in lung volumes and capacities. The adiposity on the anterior wall as a result of obesity reduces chest wall compliance and endurance of the respiratory muscles. So the purpose of the present study is to estimate the effect of BMI on restrictive lung pattern. Hence much can be done in the treatment and prevention of obesity to reduce and minimize many medical and respiratory complications.

Methodology

Patients were instructed to sit comfortably and breathe normally three times and then take a deep breath and breathe out forcibly. All steps were

repeated three times and the best results according to their predicted values were selected and recorded.

Subjects were stratified by BMI ranges as per WHO.

Classification

- Healthy weight - 18.5 to <25 BMI
- Over weight - 25 to 30 BMI
- Obesity - >30 BMI

About 40 Spirometric values were selected randomly from the respiratory Clinics (OPD) of PSGIMS& R, for the period from 01.05.2023 to 31.07.2023 (3 months). The data was collected retrospectively with computerized spirometry. So the correlation between BMI & restrictive lung pattern was analyzed and summarized.
There was no clinical risk involved in the study, as the pulmonary function test data were obtained retrospectively from the procedure performed for the diagnosis of the patient.

Analysis

The data was entered in Excel and analyzed using IBM SPSS version 28. In Descriptive statistics categorical variable were presented as frequency and percentage. Continuous variable were presented as mean ±SD. Pearson Correlation coefficient analysis was done. P value <0.05 was considered statistically significant.

Inclusion Criteria:

- Obesity (BMI above 30 Kg/$m^{2)}$
- 30 to 55 years of age
- sedentary patients
- male patients

Exclusion Criteria:

- Female patients
- smokers
- Diabetes Mellitus
- Pulmonary Diseases
- Cardiac diseases
- Psychiatry diseases
- Other systemic diseases
- Surgery within last 6 months

Result

There was no statistically significant correlation between BMI and FVC & FEV_1. There was weakly positive correlation between BMI and FEV1 / FVC. There was a statistically significant association between FEV_1&FVC and FEV_1&FEV1/FVC.

There was no statistically significant association between BMI and FVC, FEV_1 in linear regression. The BMI values were categorized and study was done.

Table 1:

	Age (Years)	Weight (Kg)	Height (M)	BMI- Kg/ m^2= (Weight in Kg/ Height in Meter)	FVC (%Predicted)	FEV_1 (% Predicted)	FEV_1/FVC (% Predicted)
Mean	53.6	71.4	1.6	25.1	57.9	50.9	88.2
Std.Deviation	8.6	13.3	0.07	3.7	11.7	13.5	15.9

Correlations

Table 2:

BMI Kg/m^2=(Weight in Kg/ Height in Meter)		BMI Kg/m^2= (Weight in Kg/ Height in Meter	FVC (% Predicted)	FEV_1 (% Predicted)	FEV_1/FVC (% Predicted)
FVC(% Predicted)	Pearson Correlation	-0.29	1	0.76	0.27
	Sig.(2- tailed)	0.10	1	<.0.001	0.88
FEV_1 (%Predicted)	Pearson Correlation	0.02	0.76	1	0.64
	Sig.(2- tailed)	0.91	<0.001	1	<0.001
FEV_1/FVC (%Predicted)	Pearson Correlation	0.31	0.02	0.64	1
	Sig.(2- tailed)	<0.001	0.88	<0.001	1

Discussion

Obesity causes substantial changes to the mechanics of lungs and chest wall. Morbid obesity adversely affects respiratory physiology; leading to decrease in lung volumes, decrease in lung compliance, V/P mismatch and impairment of ventilatory control. BMI is routinely evaluated in the clinical setting. So an association between BMI and restrictive lung pattern can be made out. BMI could be an early predictor of restrictive lung diseases. In an article on obesity and respiratory diseases, the mechanical effects of obesity were studied. [1] Ultimately a greater understanding of effects of obesity on restrictive respiratory disease was obtained.

In another study, "Study of BMI correlation with FEV1/FVC in a population (with a relatively low prevalence of obesity) was studied. [2] BMI was found to be positively correlated with FEV1/FVC values in males.

In a Indian study conducted by J.Banerjee et al. in 2014, the association of BMI with various lung function parameters in non - asthmatics was evaluated by using spirometry. [3] The result was that there was a significant association between BMI and lung parameters in obese female but not in obese males.

In a observational study of the effects of obesity on lung volumes, the work of breathing in obese subjects was increased due to dramatically reduced FRC and ERV.[4]

In a similar study titled the effects of BMI on lung volumes, Jones et al, concluded that BMI has significant effects on all the lung volumes and the greatest effects were on FRC and ERV which occurred at BMI values >30 Kg/m^2.[5]

In a American article by Murugan AT et al, the respiratory diseases associated with obesity were found to be obstructive sleep apnea (OS), Asthma, pneumonia and venous thromboembolism.[6] Weight reduction has been shown to be effective in improving the symptoms and severity of several respiratory diseases.

A reduction of BMI might reduce the rate of incidence of restrictive lung diseases and the monitoring of BMI could possibly be a tool for preventing restrictive lung diseases in the general public.

Ultimately, a greater understanding of the effects of obesity on the respiratory disease and the provision of adequate health care resources is vital in order to care for this increasingly important patient population.

Though BMI is a very simple and convenient method to classify the severity of obesity, its main weaknesses are that they are limited specifically since it does not distinguish between fat mass and lean (muscle) mass. Obesity affects the thorax, diaphragm and abdominal muscles.

Conclusion

Higher BMI seems to be associated with a restrictive pattern on spirometry. Extreme obesity is with a reduction in FVC, FEV1, FEV1/FVC values.

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