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Original Research Article

Effect of Metabolic Syndrome on Pulmonary Function Tests

Rajan Mangla[1], Ravi Shanker[2], Mickey Patel[3], Ranjan Kumar[4]

[1,3]Post Graduate Resident, Department of General Medicine, Narayan Medical College and Hospital, Sasaram, Bihar, India

[2]Assistant Professor, Department of General Medicine Narayan, Medical College and Hospital, Sasaram, Bihar, India

[4]Professor, Department of General Medicine, Narayan Medical College and Hospital, Sasaram, Bihar, India

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Corresponding author: Dr. Ranjan Kumar

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Abstract:

Background & Aims: The link between impaired lung function and cardiovascular events and type 2 diabetes mellitus has been established but the link between impaired lung function and metabolic syndrome in Asian population has not been thoroughly investigated. Our study sought to investigate the relationship between poor lung function and metabolic syndrome in of male and female.

Materials and Methods: This research was carried out in the Department of Medicine at Narayan Medical College and Hospital in Jamuhar, Sasaram. After receiving Institutional Ethical Committee permission and getting informed consent 80 patients of 18 & above age falling in the category of metabolic syndrome attending medicine OPD were included based on inclusion and exclusion criteria, pulmonary function test were performed and recorded. Data was analyzed using t test and Annova and p=<0.05 was considered significant.

Results: SBP, DBP, waist circumference, serum glucose, and serum triglycerides were significantly higher in males and HDL-C was significantly lower in females. Pulmonary function tests like FEV1, FVC were significantly higher in males than females.

Conclusion: In our study means of FVC and FEV1 were significantly reduced among subjects, which indicate that subjects who are having 3 or more components of metabolic syndrome serve as a reason in the reduction of lung functions. Conclusion: obesity contributes to the development of lung function decline, as well as the relationship between metabolic syndrome and lung function.

Keywords: lung Function, Cardiovascular Events, Type 2 Diabetes Mellitus.

Introduction

Metabolic syndrome is described as having at least three of the five medical conditions listed below: central obesity (required) high blood pressure, high blood sugar, high serum triglycerides, and low serum high-density lipoprotein (HDL). Obesity has been linked to physiological impairments in the respiratory system. Fat accumulation in the mediastinum and abdominal cavities considerably modifies the mechanical properties of the lungs and chest wall, contributing to abnormalities in the lungs' normal physiology and function. [1]

Obesity is a significant risk factor and disease modifier for a variety of respiratory illnesses. Wheeze, dyspnea, and orthopnea are frequent respiratory symptoms associated with obesity. Airway hyper responsiveness rises in tandem with BMI. Conventional lung function measurements are unlikely to be sensitive or specific for identifying lung function problems caused by the respiratory system's reduced operational volume in obesity. Obesity-induced changes in lung function are complicated, involving mechanical changes as well as the impact of adipokines and inflammatory cytokines from adipose tissue. [2-4]

As a result, the current study is being done to assess the influence of metabolic syndrome on pulmonary function testing.

Material and Methods

This study was conducted in the Department of Medicine Narayan medical college and hospital Jamuhar, Sasaram. After obtaining Institutional ethical committee approval and taking informed consent on the basis of inclusion criteria which includes patients having metabolic syndrome and of 18 years, 80 patients attending medicine OPD included. A proper history was taken from the patients and other available sources. A thorough general physical and systemic examination was done and final diagnosis was made after doing all

the necessary investigations. The NDD spirometer was used to conduct pulmonary function tests in this study.

Metabolic syndrome was defined on the basis of IDF criteria which include waist circumference >90 cm in males, >80 cm in females and two or more of the following, a high triglyceride level (>150mg/dl) or on specific medication, a low high-density lipoprotein-cholesterol (HDL-C) level (< 40mg/dl for men and < 50 mg/dl for women) or on specific medication, high blood pressure (≥130/85 mm Hg) or on specific medication, and a high fasting plasma glucose concentration (>100 mg/dl) or on specific medication or previously diagnosed type 2 DM / Impaired fasting glucose/ impaired glucose tolerance. The anthropometric parameters, blood pressure, plasma glucose, and lipid levels, were also measured. [4] Patients having history of smoking, thoracic cage abnormalities, diaphragmatic paralysis, occupational exposure to substances like silica, asbestos, coal, beryllium and suffering from Asthma/COPD, myopathies were excluded.

Data was statistically analysed and p value <0.05 was taken statistically significant and expressed as mean with standard deviation (SD) for quantitative variables. Comparisons between groups were performed using Student's t-test

Results

A total of 80 participants (50 males and 30 females) were included in the study. The characteristics of the eligible subjects stratified by gender and the presence of metabolic syndrome. SBP, DBP, waist circumference, serum glucose, and serum triglycerides were significantly higher in males and HDL-C was significantly lower in females. Furthermore, pulmonary function tests like FEV1, FVC were significantly lower in those with metabolic syndrome. For both male and female, there was no statistically significant difference in the FEV1/FVC ratio.

Table 1: Mean± standard deviation of all parameters in male and female

	Male	Female	P Value
Age (years)	45±20.9	38±15.2	<0.05
BMI (kg/m^2)	30.3±4.7	28.3±3.7	<0.05
SBP (mmHg)	150.8±15.0	146±10.8	0.023
DBP (mmHg)	90±11.6	85±10.8	<0.05
Waist circumference (cm)	92.3±14.6	90.4±10.3	<0.05
Serum triglycerides (mg/dL)	172.5±7.6	155±6.7	<0.05
HDL-C (mg/dL)	32±7.8	39.2±6.7	<0.05
Serum glucose (mg/dl)	112.3±34.5	109.2±35.6	<0.05
FEV1 (L)	2.68± 4.45	2.45±3.70	<0.05
FVC (L)	2.9±10.78	3.02±2.3	<0.05
FEV1/FVC	0.92±0.09	0.81±0.09	0.08

Table 1 showing the Mean±SD of age, Body mass index, Systolic and diastolic blood pressure, waist circumference, serum triglycerides, high density lipoprotein-C, serum glucose, forced vital capacity, forced expiratory volume in 1 second and ration FEV1/FVC and comparison of all parameters in male and female with p=<0.05 as significant.

Discussion

This study was conducted in the department of medicine, Narayan medical college and hospital Jamuhar, Sasaram. Patients who satisfied the IDF criteria for metabolic syndrome were included in the study, and patients who met three out of five criteria were judged to have metabolic syndrome. In our study the age range of patients are between 20-65 within a mean of age in male and females are 45±20.9 and 38±15.2 respectively. There were total 80 subjects out of which 50 are males and 30 are females. Similar pattern of sex distribution are seen in a study conducted by Chaudhary et al in which majority of participants were male. [5] The mean BMI in males and females are 30.3±4.7 and 28.3±3.7, which shows that it is higher in males than in females. Waist circumference is higher in males as compared to females in our study. A study conducted by Kobo O also shows the similar pattern as of our study with increased BMI and waist circumference [6] whereas as contrary to study conducted by Adeyeye et al in which females had a higher BMI as compared to males. [7]

In our study the systolic and diastolic blood pressure in both males and females are higher but as comparison to females it more higher than males. Similar study by Tanaka M showed that higher blood pressure serves as a component for metabolic syndrome. [8]

In our study the serum glucose levels are higher in both males and females but as comparison to females it is higher in males. Another crucial factor, low HDL-C, was linked to poor pulmonary function in our study in both males (32±7.8) and females (39.2±6.7). In line with this conclusion, one investigation discovered that serum HDL-C exhibited an inverse relationship with reduced FEV1 and FVC. [9] The aetiology behind this link is unknown. Because of its role in reverse

cholesterol transport and anti-inflammation, low HDL-C levels are linked to the development of coronary heart disease. It is tempting to speculate that serum HDL-C levels serve as a predictor of lung function decline, owing to its pleiotropic properties, which include antioxidative function, inhibition of cytokine-induced expression of endothelial cell adhesion molecules, and suppression of monocyte and lymphocyte chemotactic activity. [10-11] this finding suggested that inflammation may be an early event in the deterioration of pulmonary function in people with low HDL-C.

In our study serum glucose level of males and females are 112.3±34.5 and 109.2±35.6 respectively. One of the study conducted by Tesema DG concludes that increase in the level serum glucose level increase the risk of diabetes that may be attributed to the thickening of the alveolar epithelium and the pulmonary capillary basal lamina and also due to the reduced recoiling of the lung which prevents lung expansion, so the volume and elastic recoil of the lung were reduced. [12]

In our study means of FVC and FEV1 were significantly reduced among subjects, which indicate that subjects who are having 3 or more components of metabolic syndrome serve as a reason in the reduction of lung functions. Previous research shown that greater abdominal obesity was substantially linked with pulmonary function impairment in both men and women. [13-14] the etiology of metabolic syndrome is thought to revolve around abdominal obesity. [15]

The existing evidence supports a link between metabolic syndrome and decreased pulmonary function, primarily through belly fat. However, further research is needed to determine the definitive pathway and the precise pathophysiological mechanism underlying this association. One possible explanation is that increasing abdominal obesity reduces lung function by directly affecting thoracic and diaphragm compliance. [16]

However, in one study, waist circumference was only found to be significantly related to poor lung function in men. [17] Furthermore, many studies have found a link between waist circumference and pulmonary function. Given that different distributions of abdominal and visceral fat accumulation were observed in different race populations and genders, 15 our belief that the weight of each component varies across races was confirmed. Another theory for reduced pulmonary function caused by abdominal obesity is that visceral fat is a more specific marker. [18]

Conclusion

Our research sheds light on how obesity contributes to the development of lung function decline, as well as the relationship between metabolic syndrome and lung function. Patients with metabolic syndrome exhibit considerable lung function impairment, with the restrictive pattern being the most common. Pulmonary functions are both inversely related to metabolic syndrome component accumulation and independently related to each component of metabolic syndrome. As a result, this relationship may garner increased attention and possibly prompt action on metabolic components in the context of poor pulmonary function.

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