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Original Research

Assessment of correlation of pulmonary abnormalities and metabolic syndrome

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ABSTRACT:
Background: The present study was undertaken for assessing the and comparing the Pulmonary functions in patients with metabolic syndrome and normal population. **Materials & methods:** 200 Individuals (100 cases, 100 controls) were enrolled in the present study. Informed consent was taken from all subjects. Detailed history and thorough clinical examination was carried out in each patient. Laboratory investigations were carried out in all the patients. Pulmonary Function Tests were conducted using computerized spirometer (Spiro Excel, Medicare Systems). All the findings were tabulated and statistically analysed using appropriate statistical tests. **Results:** Among the patients with metabolic syndrome, pulmonary abnormalities were found to be present in 51 percent of the patient population while normal ventilatory patterns were found to be present in 49 percent of the patients. Among these 51 patients with pulmonary abnormalities, restrictive pattern were found to be present in 34 percent of the patients, while obstructive and mixed pattern were observed in 13 percent and 2 percent of the patients. **Conclusion:** In patients with metabolic syndrome, changes in conductive pathways (airways) or flow-generating (respiratory muscles), probably daily activities are hampered by the lack of oxygen uptake for peripheral functions.
Key words: Pulmonary abnormalities, Metabolic syndrome

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INTRODUCTION
Metabolic syndrome (MetS), also variously known as syndrome X, Insulin resistance, etc. in the literature, is really not a single disease but a constellation of cardiovascular disease risk factors and had been defined slightly differently by various organizations.[1-3]The prevalence of obesity and metabolic syndrome is rapidly increasing in India and other South Asian countries, leading to increased mortality and morbidity due to CVD and T2DM. Approximately about one third of urban South Asians have evidence of the metabolic syndrome. Moreover, insulin resistance was observed to be there in nearly 30% of Asian Indian children and adolescents and many exhibit features of metabolic syndrome.[4-6]

The metabolic syndrome comprises a constellation of cardiometabolic abnormalities, including abdominal obesity, hypertriglyceridemia, low high-density lipoprotein–cholesterol (HDL-C), elevated blood pressure, and hyperglycemia.[7]

Evidence linking MetS and lung impairment continues to grow, and several mechanisms have been proposed to explain why these associations exist. These include the complex effects of insulin and insulin receptors on the lung and the airways, whose interplay begins early in life given their role for normal lung development. Fetal lung richly expresses insulin receptors during early development, while later they are suppressed; therefore maternal glycemic levels during the early gestational period may affect lung maturation. It is possible that maternal hyperglycemia leads to fetal hyperglycemia and hyperinsulinemia. Excess fetal insulin may affect insulin receptor expression and therefore disturb normal fetal lung maturation. However, the exact mechanism by which these receptors can influence the developing lung remains unclear.[8]Hence; under the light of above mentioned data, the present study was undertaken for assessing the and comparing the Pulmonary functions in patients with metabolic syndrome and normal population.

MATERIALS & METHODS

The present study was conducted for comparing the Pulmonary functions in patients with metabolic syndrome and normal population. 200 Individuals (100 cases, 100 controls) were enrolled in the present study. Informed consent was taken from all subjects. Detailed history and thorough clinical examination was carried out in each patient. Laboratory investigations were carried out in all the patients. Pulmonary Function Testswere conducted using computerized spirometer (Spiro Excel, Medicare Systems). All the findings were tabulated and statistically analysed using appropriate statistical tests.

RESULTS

A total of 100 patients with metabolic syndrome and 100 healthy controls were analyzed. Mean age of the patients with metabolic syndrome was 49.8 years, while mean age of the healthy control group was 48.1 years. Both the study groups were of comparable age.62 percent of the patients of the metabolic syndrome group and 57 percent of the patients of the control group were males while the remaining were females. Gender-wise distribution of the patients in both the study groups was comparable. In the present study, among the patients with metabolic syndrome, pulmonary abnormalities were found to be present in 51 percent of the patient population while normal ventilatory patterns were found to be present in 49 percent of the patients. Among these 51 patients with pulmonary abnormalities, restrictive pattern were found to be present in 34 percent of the patients, while obstructive and mixed pattern were observed in 13 percent and 2 percent of the patients.

Table 1: Type of pulmonary abnormality

Type of pulmonary abnormality	Metabolic syndrome		Controls	
	Number of patients	Percentage	Number of patients	Percentage
Normal	51	51	100	100
Mixed	2	2	0	0
Obstructive	13	13	0	0
Restrictive	34	34	0	0
Total	100	100	100	100

DISCUSSION

A total of 100 patients with metabolic syndrome and 100 healthy controls were analyzed. Mean age of the patients with metabolic syndrome was 49.8 years, while mean age of the healthy control group was 48.1 years. Both the study groups were of comparable age.62 percent of the patients of the metabolic syndrome group and 57 percent of the patients of the control group were males while the remaining were females. Gender-wise distribution of the patients in both the study groups was comparable. Negm MFanalyzed the effect of MS on ventilatory pulmonary functions. This study included 60 participants. They were divided to two groups − group A included 45 patients with MS, and group B included 15 apparently healthy participants as a control group. All of them were subjected to the following: complete history taking and physical examination (blood pressure, BMI, and waist circumference), laboratory investigations for fasting blood glucose, lipid profile (triglyceride and high-density lipoprotein), C-reactive protein, and HbA1C, and spirometry [forced vital capacity (FVC), forced expiratory volume in first second (FEV1), and FEV1/FVC]. Among MS participants (n=45), 28 (63%) had the restrictive ventilatory pattern, three (6%) had the obstructive pattern, nine (20%) were normal, and five (11%) had a mixed pattern. Pulmonary functions were impaired more among MS cases. FVC% predicted of group A was 61.49±17.56%, whereas in group B it was 85.73±5.24%. FEV1% predicted of group A was 66.22±18.7%, whereas in group B it was 87.73±7.98%. The differences were statistically highly significant. Pulmonary function impairment was more prominent among males than among females. After examining the association between metabolic components and both FVC% predicted and FEV1% predicted, the results revealed that there was a strong linear decrease in FVC% predicted and FEV1% predicted as the number of components of MS increased. The β coefficients of FVC% predicted for those with 1, 2, 3, 4, and 5 features of MS were 0.011, −0.018, −0.023, −0.035, and −0.048 in men and 0.020, −0.029, −0.035, −0.047, and −0.068 in women, respectively. The β coefficients of FEV1% predicted for those with 1, 2, 3, 4, and 5 features of MS were 0.009, −0.015, −0.026, −0.041, and −0.051 in men and 0.004, −0.009, −0.017, −0.029, and −0.038 in women, respectively. They concluded that pulmonary function impairment (mainly restrictive pattern) is commonly associated with MS. FVC and FEV1 are inversely associated with the accumulation of elements of MS and also associated independently with each element of MS, especially waist circumference.[10]Kim CY et al evaluated the incidence of MetS in subjects with airway obstruction using data from a community-based cohort. Data representing 4 years of follow-up from the Ansung–Ansan cohort were analyzed; a total of 6,184 adults, who were ≥40 years of age and underwent spirometry, were enrolled in this study. Airway obstruction was defined as forced expiratory volume in 1 s/forced vital capacity ratio <70%, and MetS was determined according to the National Cholesterol Education Program Adult Treatment Panel III guidelines. A total of 419 patients were newly diagnosed with MetS, based on the National Cholesterol Education Program Adult Treatment Panel III guidelines, during follow-up. MetS was more frequent in COPD subjects, relative to non-COPD subjects, in both sexes (14.7% vs 11.0% [men] and 14.7% vs 11.8% [women]). In men subjects, the risk for MetS was higher in subjects with airflow obstruction than in subjects without obstruction, after adjusting for age, body mass index, and smoking status. They concluded that the incidence of MetS was higher in men with airflow obstruction than in healthy subjects.[11]

In the present study, among the patients with metabolic syndrome, pulmonary abnormalities were found to be present in 51 percent of the patient population while normal ventilatory patterns were found to be present in 49 percent of the patients. Among these 51 patients with pulmonary abnormalities, restrictive pattern were found to be present in 34 percent of the patients, while obstructive and mixed pattern were observed in 13 percent and 2 percent of the patients.Vito Liotino et al evaluated the relationship between metabolic parameters and lung function in patients with COPD, MetS or both diseases. They recruited 95 outpatients with MetS and 118 outpatients with COPD. After medical history collection, physical examination, routine analysis and spirometric evaluation all patients were divided into three groups: MetS (n=74, group 1), COPD (n=48, group 2), COPD+MetS (n= 91, group 3). T-student test, Anova test and linear regression were used. The MetS prevalence among COPD patients was 59%, while 21% of patients with MetS had COPD. Group 3 patients exhibited significantly higher C-peptide levels compared to group 1 and group 2 ($p<0,05$). In all patients, vitamin D and C-peptide levels were inversely related ($R=-0,232$; $p=0,001$). A negative association between C-peptide and both FEV1 and forced vital capacity (FVC) ($R=-0,26$; $p=0,018$ and $R=-0,3$; $p=0,005$, respectively), as well as a positive correlation between vitamin D and both FEV1 and FVC ($R=0,26$; $p=0,01$ and $R=0,23$; $p=0,03$, respectively) were observed in COPD+MetS patients. Also, we found a positive correlation between vitamin D levels and inspiratory capacity values in all subjects ($R=0,24$; $p=0,001$), in particular in COPD patients (group 2 + group 3). These results pointed out the relationship between insulin resistance, low vitamin D levels and lung function impairment in patients affected by both pathologies, suggesting a synergic effect of COPD and MetS.[12]

CONCLUSION

In patients with metabolic syndrome, changes in conductive pathways (airways) or flow-generating (respiratory muscles), probably daily activities are hampered by the lack of oxygen uptake for peripheral functions.

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