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Lung Functions in Type 2 Diabetes Mellitus.

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ABSTRACT

Diabetes is a metabolic disorder precipitating micro-vascular, macro-vascular complications and peripheral vascular diseases. It affects majority of the systems of the body. Less has been known about the effects on the lungs. The present study was carried out to know the lung dysfunction in Diabetes mellitus. To evaluate the lung functions in patients with Type 2 Diabetes mellitus and to compare the lung functions with non-diabetics. The study group consisted of 30 known diabetic patients attending the diabetic clinic of age 45-50 years of either sex. 30 subjects of similar age and BMI were selected as healthy controls. The PFT were measured by Medspiror. Data was analyzed and processed by using Student's t test. The study showed a statistically significant reduction in lung functions in Type 2 Diabetes patients as compared to controls. The FEV1/FVC ratio was found to be statistically increased in Type 2 diabetic patients. The present study concluded that Type 2 diabetes mellitus definitely impairs the pulmonary functions; the pattern of the impairment being primarily restrictive in nature.

Keywords: Type 2 Diabetes Mellitus, PFT, Lung Dysfunction

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INTRODUCTION

Diabetes mellitus is accompanied by widespread bio-chemical, morphological and functional abnormalities which may precipitate certain complications that may affect neural, cardiovascular, renal systems and also organs and tissues like skin, liver, collagen and elastic fibers. Thus diabetes is a multisystem disorder that affect many organs of the body [1]. Type 2 diabetes mellitus is characterized by persistent hyperglycemia and abnormal metabolisms of carbohydrates, proteins and lipids. These metabolic disorders result from impaired insulin secretion, and altered tissue sensitivity to insulin or coexistence of both these mechanisms. Type 2 diabetes is associated with dysfunction, failure of various organs mostly caused by micro-vascular and macro-vascular damages [2,3].

The pulmonary complications of diabetes have been poorly characterized. The quality of life of the affected individuals definitely imposes a heavy burden on health care systems. If diabetes is detected early and adequate steps are followed, it may be possible to significantly delay the occurrence of complications and their progression. A lot of research work is being carried out on the after effects of diabetes on pulmonary parameters; the studies in India are far less. Hence, the present study was undertaken to assess lung functions in patients of diabetes mellitus.

MATERIAL AND METHOD

The present study was cross sectional observational study. The subjects of the study included 30 Type 2 diabetes patients of age 45-60 years. 30 normal healthy subjects of similar age and BMI were selected as controls.

Persons with any condition which affected the lung functions were excluded from the study; viz the subjects with gross abnormalities of the vertebral column or thoracic cage, those with a known H/O acute or chronic respiratory infections, neuromuscular disease, malignancy and cardio-pulmonary disease.

Subjects with current or previous drug or tobacco addictions were also excluded.

Controls and diabetics both were assessed by using a proforma and informed written consents were obtained from them. The study was approved by Institutional ethical committee.

Spirometry was performed by using computerized electronic spirometer(RMS HELIOS)

All tests were carried out at a fixed time of the day to minimize the diurnal variations. The apparatus was calibrated daily and it was operated within ambient temperature range. The precise technique of executing various lung function tests were based on the operational manual of the instrument and the recommendations which were made by the American Thoracic Society for a standard technique of spirometry [4].

After taking the anthropometric data the subjects were informed about the whole procedure. They were uraged to practice before the test. The test was performed in sitting position by using a soft nose clip. The values of best procedure were taken and recorded.

Statistical Analysis

The data was recorded and was analyzed by SPSS graph pad software by using Student's t test. The level of significance was taken as p value of < 0.025.

OBSERVATIONS AND RESULTS

The study included 30 normal control and 30 diabetic patients with mean age47.3±8.21 years and 48.3±7.97 years respectively. The BMI of control group was 25.80±2.49 kg/m^2 and in diabetic group was 27.68±4.12 kg/m^2. The fasting blood sugar was 93.8±1.84mg/dl in control group and it was 159.11±2.57mg/dl in diabetic group. The post meal blood sugar was 117.4±1.93mg/dl in control group and was 247±17.06mg/dl in diabetic group. The blood sugar levels showed a significant increase in diabetic group as compared to

control group. The values are showed in Table 1.

The FVC was 3.53±0.12 lit in control group and was 2.11±0.11 lit in diabetic group. The FEV_1 was 2.90±0.10 lit in control and was 1.82±0.09 lit in diabetic group. The $FEF_{25\%-75\%}$ in control group was 3.53±0.12 lit and in diabetic group was 2.11±0.11 lit. The FVC, FEV_1 and FEF $_{25\%-75\%}$ were significantly decreased in Type II diabetes mellitus patients as compared to control group. The FEV_1/FVC ratio was 80.60±0.48 in control group and was 88.77±1.67 in diabetic group. The ratio showed a significant increase in our study. The values are shown in Table 2.

Table 1: Anthropometric and Biochemical parameters in Type 2 Diabetes and Control group

Parameter	Type 2 Diabetes n=30	Control n=30	P value
Age (years)	48.3±7.97	47.3±8.21	
BMI (Kg/m2)	27.68±4.12	25.80±2.49	
Fasting blood glucose(mg/dl)	159.1±12.57	93.8±1.84	≤0.0001
Postmeal blood glucose(mg/dl)	247±17.06	117.4±1.93	≤0.0001

Table 2: Spirometric parameters in Type 2 Diabetes and Control group

Parameter	Type 2 Diabetes n=30	Control n=30	P value
FVC (Lit)	2.11±0.11	3.53±0.12	≤0.0001
FEV1 (Lit)	1.82±0.09	2.90±0.10	≤0.0001
FEV1/FVC %	88.77±1.67	80.60±0.48	≤0.0001
FEF 25%-75% (Lit/sec)	2.37±0.13	3.65±0.11	≤0.0001
MVV (Lit)	73.30±5.25	123.27±4.98	≤0.0001

DISCUSSION

The present study was done to study the hypothesis that type 2 diabetes mellitus was associated with reduced lung functions. This study clearly showed a highly significant p value when the lung functions were compared between type 2 diabetics and controls. The reduction in all lung functions was observed in our study except FEV1/FVC ratio which showed an statistically significant increase.

The result of our study were consistent with previous studies [5-9]. Some studies also have shown an increase in FEV1/FVC or restrictive pattern in type 2 diabetes mellitus [10,11]. Meta-analysis by Van den Borst et al showed that diabetes is associated with statistically significant impaired pulmonary functions in a restrictive pattern. Moreover, these results were irrespective of body mass index, smoking, diabetes duration and HbA1c levels [12].

On the contrary, Benbassat [13] showed that FVC and FEV_1 were within the predicted values in type 2 diabetics. The most probable reason for this contradiction was that he had studied pulmonary functions in a group of patients with type 2 diabetes but had not compared with control group. Small sample size in the study might be one of the reasons for their observation.

Lange et al ; indicated that the type 2 diabetes patients are associated with a slight reduction in FVC and that it was because of impaired defenses against environmental challenges such as smoking and airway infections in diabetes [14,15]. Similar observations were observed in some studies [14-18].

The FEV_1/FVC was increased in type 2 diabetes as compared to that in the controls which was statistically significant. The increased FEV_1/FVC suggested that of the impairment of pulmonary functions in type 2 diabetes mellitus was primarily restrictive in nature. Robert E Walter found that this ratio was increased by 1.5% in diabetics which was statistically significant [16].

FEF $_{25\%-75\%}$ is the average flow rate during middle 50% of FVC. It indicates patency of the small airways. FEF $_{25\%-75\%}$ depends on non-broncho pulmonary factors like neuromuscular factors and mechanical factors. The thickening of the alveolar wall due to the increased collagen and elastin in basal lamina results in micro angiopathy. There was a significant reduction in FEF $_{25\%-75\%}$ among diabetics compared to controls;

shows a lower airway caliber and higher airway resistance. This findings was in consistent with Aparna A [19]. and Malcom Sandler et al [20]. The pulmonary complications are more prevalent than recognized. The lungs are affected bydiabetic micro angiopathy. This is evidenced by autopsy findings in human diabetic subjects which show thickening of alveolar epithelia, pulmonary capillary basal lamina, centrilobular emphysema and pulmonary microangiopathy [21]. The potential mechanisms of decreased lung functions is explained by non-enzymatic glycosylation of proteins,such as collagens in the lung and chest wall. This glycosylation leads to irreverisible collagen cross linking, rendering to decreased proteolysis and accumulation of collagen in lung connective tissue [22]. The glycosylation process occurs in the early stages of diabetes, when hyperglycemia is more pronounced until new equilibrium is reached at lower turnover rate of collagen. Chronic hyperglycemia causes fibrous tissue formation in the chest wall and bronchial tree protein by non enzymatic glycation. This may cause compliance of lungs and chronic airflow obstruction. Diabetes mellitus is associated with poor skeletal muscle strength due to increased protein catabolism. The respiratory muscle endurance decreases in diabetes mellitus [23].

CONCLUSION

The findings of the study conclude that type 2 diabetes diabetes adversely affects the pulmonary functions and the impairment is primarily restrictive type. It concluded that lung is the target organ for damage in diabetesand lung dysfunction may be one of the earliest and easily measurable non metabolic alterations in diabetes mellitus. Thus the patients with diabetes mellitus are suggested to undergo pulmonary function testing along with other investigations. It is advisable therefore, that diabetic patients should undergo routine spirometry tests to assess the severity of lung function impairment. This will help in preventing lung damage at an initial stage and prevent morbidity in diabetes.

Limitations

The limitations of present study is it's small sample size. Co-relation with different durations of disease might have given a clear focus on patho physiology of lung function impairment.

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