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A STUDY OF PULMONARY FUNCTION TESTS IN TYPE 2 DIABETES MELLITUS PATIENTS OF SUB-HIMALAYAN PLAIN AREA OF DARJEELING DISTRICT.

Physiology

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ABSTRACT

BACKGROUND: Diabetes mellitus is one of the most common endocrine and metabolic disorders. It is fifth in ranking as a leading cause of death worldwide and is responsible for almost 3 million deaths annually. Chronic hyperglycemia and related metabolic derangements are mainly associated with secondary damage in multiple organ systems, especially kidneys, eyes, nerves and blood vessels. Pulmonary functions in diabetes mellitus have been studied frequently in many countries other than India, while in our country, there are few studies concerning these abnormalities and their relationship with the disease.

OBJECTIVES: To determine and compare the lung function test between type 2 diabetic patients with normoglycemic control group.

MATERIALS AND METHODS: This is a prospective observational cross sectional study. This study was carried out in North Bengal Medical College and Hospital in Department of Physiology and Department of Medicine. A total number of 215 subjects were included in this study . Among them, 106 subjects who suffered from type 2 diabetes mellitus for >5 year duration were included in Group A (study group) and 109 normoglycemic subjects were included in Group B – (control group). The spirometer parameters (FVC, FEV1, PEFR, FEV1/FVC) of participants of both groups were evaluated and compared.

RESULTS: We have found that all of the spirometric parameters, except FEV1/FVC ratio were significantly lower in the type 2 diabetes mellitus patients than the control group. FEV1/FVC ratio was lower in study group than control group, but the reduction in study group was not statistically significant (P value >0.05).

CONCLUSION: The present study is revealing that, type 2 diabetes mellitus, being a systemic disease, also affects lungs and causes restrictive type of ventilatory changes on long duration hyperglycemia.

KEYWORDS

Diabetes mellitus, Pulmonary function, Macrovascular and Microvascular, Obstructive and Restrictve lung function.

INTRODUCTION:

Diabetes mellitus is one of the most common endocrine and metabolic disorder and It is fifth in ranking as a leading cause of death worldwide, is responsible for almost 3 million deaths annually.[1]The World Health Organization estimates that more than 180 million people worldwide have diabetes and by 2030 it is expected that this number will be doubled.[2] There is an alarming increase in the incidence and prevalence of diabetes mellitus (DM) in Asian Indians also.[3] The worldwide prevalence of diabetes is increasing rapidly because of changes in food habits and reduced physical activities among individuals , resulting in increased obesity and insulin resistance.

Diabetes mellitus is a condition characterized by a high blood glucose level resulting from the inadequate secretion of insulin or inability of tissues to respond to insulin.[4,5] Chronic hyperglycemia and related metabolic derangements is mainly associated with secondary damage in multiple organ systems, especially kidneys, eyes, nerves and blood vessels.

The possibility that the lung is also a target organ for diabetic complications was first suggested by Schuyler et al in 1976.[6] Since then there have been many studies on pulmonary function in diabetic patients with conflicting results. Many have suggested possible pathophysiological mechanisms also.

Pulmonary gas exchange occurs through the respiratory membrane that includes the alveolar basement membrane, interstitium and capillary endothelium. Any insult to the integrity of alveolo-capillary membrane of the lung will affect the alveolar gas exchange. Thus it can be hypothesized that alterations in pulmonary function, especially diminished alveolar gas exchange can occur in patients with diabetes mellitus.[7]

Pulmonary functions in diabetes mellitus have been studied frequently in many countries other than India, [8,9,10, 11] While in our country there are few studies concerning these abnormalities and their relationship with the disease.

Pulmonary function test (PFT) is a valuable tool for evaluating the respiratory system pathology adjunct to the patient history, clinical examination, investigations including various lung imaging studies, invasive testing such as bronchoscopy and open-lung biopsy etc. It evaluates one or more aspects of the respiratory system - respiratory mechanics, lung parenchymal function, gas exchange, cardiopulmonary interaction.[2,13]

MATERIALS AND METHODS

This is a prospective observational cross sectional study. After getting approval from Institutional Ethics Committee and approval of West Bengal University of Health Sciences This study was carried out in in Department of Physiology and Department of Medicine of North Bengal Medical College & Hospital.

Subjects of either sex residing in plain area of Darjeeling District with history of type 2 diabetes mellitus for >5 years, age 30-70 years, who have attended the OPD of Department of medicine of North Bengal Medical College and Hospital were taken as study group. The subjects who were found with normal blood glucose level were taken as control group for the study. Subjects with history of long term smoking, COPD, active lung infection, upper airways structural alteration, having past or current history of chronic lung infection like TB, history of Heart disease, renal disease, lung carcinoma, long term medications like beta-blockers, bronchodilators, anti-cancer drugs etc were excluded from study.

230 patients attending Medicine OPD,were enrolled for this study within six months of data collection period from April 2016 –September 2016.The patients, fulfilling inclusion criteria and exclusion criteria, were included after obtaining written informed consent. Thus, total 215 subjects had been included in this study for pulmonary function test, consisting of 106 subjects, diagnosed with type 2 diabetic mellitus were included in group A (study group) and 109 normoglycemic subjects matched for age and socio-economic status were in Group B (control group).

Spirometer parameters (FVC, FEV1, FEV1/FVC & PEFR) were recorded with digital spirometer.

STATISTICALANALYSIS:

The result of the present study were tabulated in Microsoft excel work sheet. They were subjected to statistical analysis using Statistical Package for Social Sciences version 22.0 for Windows [IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.]. For parametric test:- test of homogeneity of variances have been done using ANOVA (Analysis of variance test- F test or Variance Ratio). In case of homogeneity of variance, we have applied t test (un-paired) assuming equal variances, in case of non-homogeneity of variance; we have applied t test (un-paired) assuming unequal variances. We have also applied nonparametric test (Mann-Whitney U test) for the same. The level of significance was set as $P<0.05$.

RESULTSANDANALYSIS:

Table-1: Demographic data of the two groups (control and study)

%Parameter	Study Group (n=106) Mean±SD	Control Group (n=109) Mean±SD	P value
Age(years)	55.292±3.7947	55.257 ± 3.4625	0.238
F/M*	35/71	35/74	0.887
Weight(Kg)	60.792 ± 6.2009	61.376 ± 5.8052	0.319
Height(cm)	162.943 ±4.7022	161.257 ± 5.0615	0.368

Categorical data expressed in numbers, analysis done by Pearson"s Chi-square test.
Rest is numerical data, expressed as mean ± SD, analysis done by student"s independent samples t test. P value < 0.05 is considered to be statistically significant.
Control group = normoglycemic subjects, Study group = type 2 diabetes mellitus

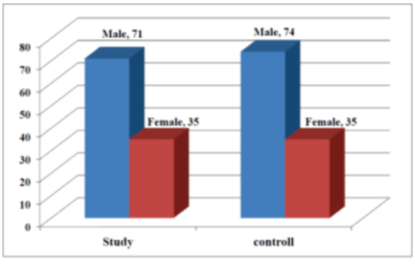


Figure 1 : Number of patients for control & study group sex wise

Bar diagram in figure 1 showing the number of male and female subjects in study and control groups. In study group there were 71 male and 35 female subjects where as in control group there were 74 male and 35 female subjects. No significant difference (P<0.05) have been found regarding distribution of male and female subjects in between two groups.

Table 2: Spirometry parameters of the male participants of both groups

Parameter	Study Group (n=106) Mean±SD	Control Group (n=109) Mean±SD	P value
FVC(L)	2.518±0.296	3.144±0.467	P<0.001
FVC%	74.415±5.976	95.330±7.482	0.026
FEV1(L)	1.976±0.290	2.453±0.399	0.018
FEV1%	73.453±5.751	93.532±9.804	0.005
FEV1/FVC	78.732±9.207	78.425±9.804	0.681
PEFR (L/s)	5.222±0.685	7.378±1.038	P<0.001
PEFR %	67.62±4.718	96.19±7.773	P<0.001

Numerical data, expressed as mean ± SD, analysis done by student"s independent
samples t test. P value < 0.05 is considered to be statistically significant.
Control group = normoglycemic subjects, Study group = type 2 diabetes mellitus patients

Table2 : shows the comparison of spirometric values of the male participants in between two groups. It demonstrates that all of the spirometric parameters were lower in the study group (diabetic group) than the control group. The differences of the FVC, FVC%, FEV1, FEV1%, PEFR, PEFR%, were highly significant in between male participants of two groups, but FEV1/FVC decrease is not significant.

Table3: Spirometric parameters of the female participants of both groups

Parameter	Study Group (n=71) M ean±SD	Control Group (n=71) Mean±SD	P value
FVC(L)	2.317±0.189	2.692±0.263	0.035
FVC%	77.486±5.575	95.429±7.461	0.032
FEV1(L)	1.764±0.186	2.148±0.270	0.038
FEV1%	73.229±6.408	94.00±8.664	0.151
FEV1/FVC	76.448±8.768	80.065±9.901	0.914
PEFR (L/s)	4.458±0.338	6.165±0.453	0.042
PEFR %	67.69±4.639	95.94±7.340	0.006

Numerical data, expressed as mean ± SD, analysis done by student"s independent Samples t test. P value < 0.05 is considered to be statistically significant.
Control group = normoglycemic subjects, Study group = type 2 diabetes mellitus Patients.

Table 3 shows the intergroup comparison of spirometric parameters of all female participants. It demonstrates that all of the spirometric parameters were lower in the female subjects of type 2 diabetes mellitus group than the female subjects of control group. The differences of the FVC, FVC %, FEV1, PEFR, PEFR% were highly significant in between female participants of two groups but FEV1% , FEV1/FVC differences are non-significant

DISCUSSION

Our study was conducted and designed to determine any change in pulmonary function tests in type 2 diabetes mellitus patients of a specific area that is the sub-Himalayan plain area of Darjeeling district. Microvascular and macrovascular complications due to chronic hyperglycemia in type 2 diabetes mellitus patients are well known, but the respiratory system involvement has also been proved by many researchers in previous years. The changes mainly found in pulmonary volume, diffusion and elastic properties of lungs in different studies.

For our study, we evaluated pulmonary function tests like forced vital capacity (FVC), forced expiratory volume in 1st second (FEV1), FEV1/FVC ratio, peak expiratory flow rate (PEFR) in 106 type 2 diabetes mellitus patients of > 5 years of duration and 109 normoglycemic subjects, then compared the values in between them. Lung function parameters in male and female subjects separately in between the study and control group are also compared.

Table 3 have shown the spirometric parameters of participants of both groups. In our study, we have found that the values for FVC and FEV1 were significantly lower in type 2 diabetes mellitus patients compared to normoglycemic subjects. In this study, we found that the values for FVC and FEV1 were significantly lower in type 2 diabetes mellitus patients compared to normoglycemic subjects. The mean values of FVC and FEV1 in type 2 diabetes mellitus group were 2.518L and 1.976L respectively, whereas that of in normoglycemic group was 3.144L and 2.453L.

Previous study showed that both insulin-dependent and non-insulin-dependent DM are associated with slightly reduced values of FEV1 and FVC, but the reduction of lung function is slightly more pronounced in diabetic subjects, who were treated with insulin than in diabetic subjects without insulin treatment and Pulmonary function(forced vital capacity (FVC), forced expiratory volume in 1s (FEV1), vital capacity (VC) and peak expiratory flow (PEF)) is reduced in type 2 diabetes and Diabetes duration seems a more important influence than glycaemic control.[14,15]

Studies showed that mild, duration-related abnormalities of lung elastic recoil and pulmonary diffusing capacity and a reduction in pulmonary capillary blood volume in insulin-dependent diabetes mellitus.[16]

Similarly, another study evaluated pulmonary functions in patients with diabetes mellitus and found that Diabetic patients showed impaired lung function independent of smoking. [17] Our study and previous another study showed that pulmonary function tests in diabetes group and control subjects a significant reduction in forced vital capacity (FVC) and forced expiratory volume in the first second (FEV1) relative to their matched controls.[18]

Limitations of the study

Certain limitations are observed during our study, which is worth to be

mentioned. Firstly, for a definite conclusion regarding the comparison of pulmonary function tests in between type 2 diabetes patients and control group a large number of patients would better to be included in our study. Second limitation of the study is that we can included only diabetic patient who have attended the medicine OPD of our hospital.

CONCLUSION

The results of the present study is revealing that, type 2 diabetes mellitus, being a systemic disease, also affects lungs and causes restrictive type of ventilatory changes on long duration hyperglycemia. All patients with type 2 diabetes mellitus of long duration should be evaluated for pulmonary function status with simple spirometry which will help in management of these patients in time.

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