Section: Physiology

Original Research Article

PULMONARY FUNCTION TESTS IN DIABETES MELLITUS TYPE 2: A CASE CONTROL STUDY IN A TERTIARY CARE CENTRE OF UTTAR PRADESH

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ABSTRACT

Background: Diabetes is a micro-macrovascular disorder with debilitating effects on many organs. Pulmonary complications in diabetes mellitus with the loss of pulmonary reserve may become clinically important. The relationship between DM and pulmonary function tests (PFTs) remains important because of potential epidemiological and clinical implications. **Aim of the Study:** The aim of this study was to measure pulmonary function tests (PFTs) in diabetes mellitus type 2(DMT2) subjects and to determine the correlation of glycosylated haemoglobin (HbA1c) with pulmonary function tests inDMT2 patients.

Materials and Methods: This study was conducted in the Department of Physiology, Subharti Medical College in collaboration with Department of Medicine, Chattrapati Shivaji Subharti Hospital, Meerut A total of 100 non-smoker subjects of either sex in the age group of 30-50 years were recruited. The subjects were divided into 2 groups -Group A: 50 having history ofDMT2 and Group B: 50 Normal controls. The selected patients were evaluated by taking detailed history and thorough clinical examination was done. Test for Plasma Glucose and HbA1c was done. Pulmonary function tests was done by Spirometry recording FVC, FEV1,FEV1/FVC ratio and PEFR. The data so collected was subjected to standard statistical analysis.

Results: Majority of subjects were between 40-50 years while only 6 were between 50-60 years of age. The sex distribution in both cases and controls was similar. All the respiratory parameters were lesser in subjects with diabetes than non- diabetics except FEV1/FVC ratio which showed slight increase in cases than control. Statistically significant decrease occurred in FVC, FEV1 ($P<0.05$) & PEFR ($P<0.000$) while increase in FEV1/FVC ratio was statistically insignificant giving an indication about probable deterioration in lung functions in asymptomatic diabetics.

Conclusion: Lung functions need to be checked periodically to assess the severity of impairment in DMT2 patients.

Keywords: Pulmonary Function Tests, Diabetes Mellitus Type 2, Glycosylated haemoglobin (HbA1c), complications.

INTRODUCTION

The World Health Organization estimates that more than 180 million people worldwide have diabetes, The global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014.[1] and by 2030 it is expected that this number will have doubled.[2] The number of adults with diabetes in the world will rise from 135 million in 1995 to 300 million in the year 2025. The major part of this numerical increase will occur in developing countries. There will be a 42% increase,

from 51 to 72 million, in the developed countries and a 170% increase, from 84 to 228 million, in the developing countries. Thus, by the year 2025, >75% of people with diabetes will reside in developing countries, as compared with 62% in 1995. The countries with the largest number of people with diabetes are, and will be in the year 2025, India, China, and the U.S. In India the prevalence of disease in adults was found to be 2.4% in rural & 4.0-11.6% in urban dwellers IDDM is most severe form and seen below 30 year of age, incidence is highest among 10-14 year of age but NIDDM is most common type.

Diabetes is a micro-macrovascular disorder,[3] with debilitating effects on many organs.[4]Pulmonary complications in diabetes mellitus have been poorly characterized with conflicting results. Several studies have suggested that diabetes is associated with impaired pulmonary function.[5-13] Pulmonary functions have been studied frequently in countries other than India.[14] while in our country there are few studies concerning relationship of pulmonary function with glycosylated haemoglobin (HbA1c) and duration of the disease.

Theoretically, several pathological changes may affect the lungs in patients with DM.[15]The important changes occurring in diabetes mellitus are reduced elastic recoil, reduced lung volume, diminished respiratory muscle performance, chronic lowgrade inflammation,[16,17] decrease in pulmonary diffusion capacity for carbon monoxide,[18] autonomic neuropathy involving respiratory muscles.[19]The concomitant pulmonary structural impact of these biochemical alterations, described to date, consist of a thickening of the alveolar epithelial basal lamina.[20] and a specific type of nodular fibrosis of the lung.[21]

The loss of pulmonary reserve may become clinically important. Despite the unclear nature, the relationship between DM and pulmonary function tests (PFTs) remains important because of potential epidemiological and clinical implications.

The utility of glycosylated hemoglobin measurements in the management of patients with diabetes has been established for almost 40 years. Hemoglobin A1c (HbA1c) is the most abundant minor hemoglobin in normal red cells and is elevated as much as threefold in people with diabetes.[22-24]

This study was conducted to measure pulmonary function tests (PFTs) in diabetes

mellitus type 2(DMT2) subjects and to determine the correlation of glycosylated haemoglobin (HbA1c) with pulmonary function tests inDMT2 patients.

MATERIAL AND METHODS

This study was conducted in the Department of Physiology Subharti Medical College and in collaboration with Department of Medicine,Chattrapati Shivaji Subharti Hospital, Meerut

A total of 100 non-smoker subjects of either sex in the age group of 30-50 years were recruited. The subjects were divided into 2 groups –

Group A: 50 subjects were apparently healthy attending the OPD, having history of DMT2

Group B: 50 Normal control individual having no DMT2

The Criteria for diagnosis of Diabetes Mellitus was subjects having symptoms of diabetes plus random plasma glucose concentration ≥ 11.1mmol/L (200 mg/dl),Fasting plasma glucose ≥ 7.0 mmol/L(126 mg/dl),HbA1C 6.5% or Two hour plasma glucose ≥ 11.1 mmol/L (200 mg/dl) during an oral glucose tolerance test. (Adapted from American Diabetes Association 2011)

Patients not giving consent for the study, smokers,patients with respiratory disease as documented by history and physical examination,Chest X-ray,any special tests e.g. CT, patients with congestive cardiac failure or volume overload, patients who could not perform Spirometry as for example in stroke, or those not conforming to the adequacy parameters in sequential attempts or those individuals who had chronic complications like diabetic nephropathy, retinopathy, and peripheral neuropathy were excluded from the study.

The selected patients (after applying exclusion criteria) were evaluated by taking detailed history and thorough clinical examination both general and systemic.History including relevant past history was taken especially regarding of diabetes duration, any evidence of complication of diabetes. Special attention was given to any variable which may affect spirometric test results (e.g. any respiratory disease, congestive cardiac failure, volume overload, cerebro-vascular disease etc.). Test for Plasma Glucose was done in the selected subjects by using glucose oxidase method. Estimation of HbA1cwasalso done by ion exchange resin method by the diagnostic glycohaemoglobin kits of Asritha Diatech as per the guidelines provided. Pulmonary function tests was doneby Spirometry with the help of computerized Spirometer with patient in sitting posture wearing a nose clip and breathing through mouth piece (Recommendations of American Thoracic Society followed while performing Spirometry)

After recording age and sex following parameters were assessed FVC, FEV1,FEV1/FVC ratio, PEFR.

The subjects were made to sit comfortably on a chair and asked to take 3-4 normal breaths through the mouthpiece of Spirometer. Then they were asked to take slow & deep inspiration & then instructed to blowout forcefully & rapidly through the mouthpiece of Spirometer followed by deep & rapid inspiration. The test was performed with nose clip in position. After one or two practice trails, the highest of the three test readings was taken as final

reading. The data so collected was subjected to standard statistical analysis.

RESULTS

A total of 100 subjects were enrolled for the study, 50 cases of diabetes and 50 normal controls. The results were tabulated as follows.

Table 1 gives the idea about distribution of cases and controls studied. Out of 100 subjects 50 were Diabetics cases and 50 were non-diabetic controls. Majority of our subjects were middle-aged between 40-50 years of age while there were only six subjects between 50-60 years of age.

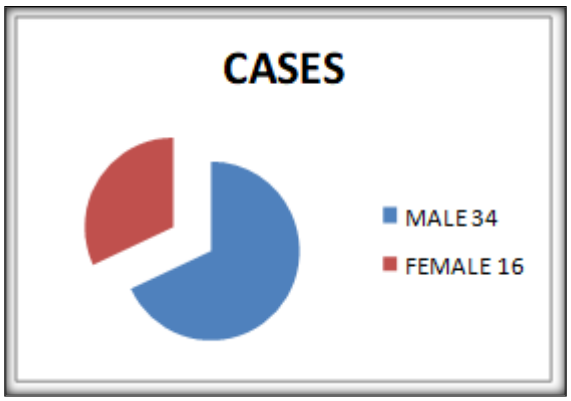

Figure 1: Sex distribution in cases

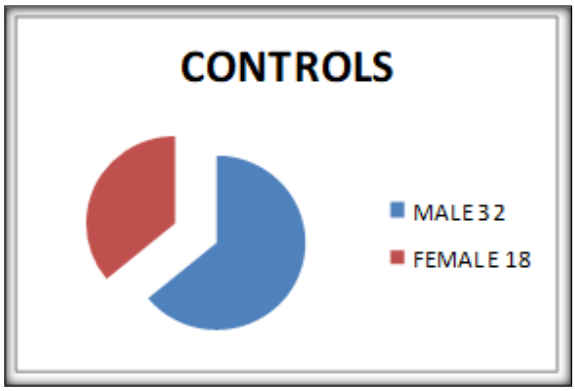

Figure 2: Sex distribution in controls

Figure 1, 2 give the idea about sex distribution of cases and controls. The sex distribution in both cases and controls was similar.

***All are significant**

Table 2 shows average values of respiratory parameters in cases and controls according to different age group. Using independent student T test mean difference between cases and controls in different age groups were calculated and all the differences were found to be significant at 5% level of significance.

Table 3 indicates the studied respiratory parameters in diabetics & non-diabetics (control). All the mean difference were found to be significant at 5% level of significance except FEV1 parameter.

It shows that the % predicted values of all respiratory parameters were greater in non- diabetics as compared to diabetics with significant reduction in some of the marked parameters. This gives an indication about probable deterioration in lung functions in asymptomatic diabetics. [Table 3]

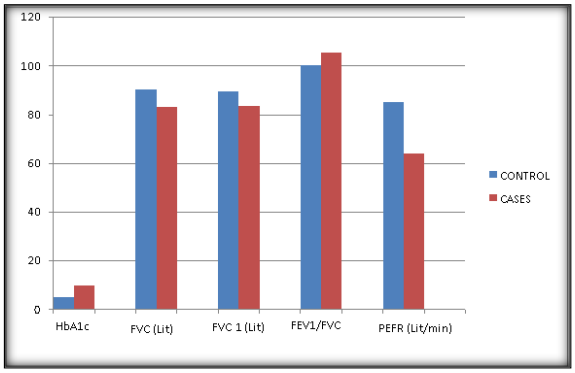

Figure 3: Average Respiratory Parameter Values in Cases and Controls

Figure 3 indicates the studied respiratory parameters in diabetics & non-diabetics (control). All the mean differences were found to be significant except FEV1 parameter

Table 1: Age Sex Distribution in Cases and Controls

	CASES		CONTROL		
AgeGroup(Years)	MALES	FEMALES	MALES	FEMALES	TOTAL
30-40	13	6	7	4	30
40-50	18	7	9	4	38
50-60	3	3	16	10	32
TOTAL	34	16	32	18	10

Table 2: Average values of respiratory parameters in cases andcontrols according to different age groups

Age(YEARS)	Controls				Cases			
	FEV1	FVC	FEV1/FVC	PEFR	FEV1	FVC	FEV1/FVC	PEFR
30-40	89.81	91.07	99.40	84.76	83.42	83.23	105.47	63.95
40-50	89.65	90.51	100.38	85.12	83.31	83.10	105.54	63.45
50-60	90.48	91.75	100.10	83.77	84.65	84.32	105.55	64.98

Table 3: Respiratory parameters in cases and controls

PARAMETERS	CONTROL^(n=50)	CASES^(n=50)	T value	p-value
HbA1c	5.16±0.46	10.03±1.10	-29.46	**0.000***
FVC	90.51±14.33	83.36±17.59	2.38	**0.019***

FEV_1	89.65±13.52	83.73±19.06	1.86	**0.065***
FEV_1/FVC	100.38±9.11	105.54±8.95	-2.80	0.006*
PEFR	85.12±17.41	64.24±19.43	5.60	0.000*

*** p<0.05**

HbA1c-Glycosylated Hemoglobin; FVC- Forced Vital Capacity; FEV1-Forced Expiratory Volume in 1 Sec; PEFR- peak Expiratory Flow

DISCUSSION

Diabetes is the most common metabolic disorder & its prevalence is increasing in several parts of the world, especially in developing countries like India. Western acculturation has lead to loss in physical activity & changes in food pattern from traditional unprocessed natural ingredients to highly refined energy dense fatty & sugary fast foods. These two factors are responsible for high incidence of diabetics in years to come.

Now it is being recognized that, Diabetes both type 1 & 2 also effects the respiratory system. The reported alteration in pulmonary function tests in diabetics is still conflicting. Diabetes is a progressive disease & parameters to study its progress should be easily repeatable. This is also an important reason why various researchers have studied lung functions in diabetes by Spirometry.

A total of 100 subjects were included in the present study 50 cases & 50 controls.

Table1 gives us idea about distribution of cases and control studied. Majority of our subjects are middle aged between 40-50 year of age. Since all those who had a respiratory compromise (due to lung disease or as a consequence of heart disease i.e. congestive heart failure, or volume overload due to renal failure) were excluded, and moreover patient included has to be nonsmokers, this may be the reason of getting maximum patients in the age group of 40-50 years.Males(66) outnumber the females(34) in our study which is in line with more prevalence of diabetes in males in South-East Asia

Table 2 shows average values of respiratory parameters in cases and controls according to different age group, and all the differences were found significant.Yamini Singh and Sumitra Kumari (2015),[25] [studied 25 diabetics and compared them to 25 healthy subjects and they had also found the same results. Rajani M (2013),[26] had also found the same results.

Table 3 gives an idea about various respiratory parameters in diabetes and non-diabetes (controls). It shows that respiratory parameters in cases are comparatively lower than in controls with Significant decrease is observed in FVC; FEV1 (p<0.05) and PEFR (p-0.000). Yoshihide Asanuma et al (1985),[13] observed a highly significant fall (p<0.005) in FVC and FEV1 in Diabetic subjects. Singh et al (1995),[27] found a significant reduction in FVC (p<0.001), MVV (p<0.01) but no significant fall in FEV1 and PEFR in twenty diabetic subjects. Litonjua AA et al (2005),[28] observed that cases has lower FEV1, FVC than control but he observed no difference in FEV1/FVC ratio in cases and controls. Our study showed significant difference in some parameter which is not coinciding with other study. It may be due to lesser no. of cases in our study or some ethnic and regional variation.

CONCLUSION

In the present study the following conclusions were drawn. Majority of subjects were middle-aged between 40-50 years of age.All the respiratory parameters were lesser in subjects with diabetes than non- diabetics except FEV1/FVC ratio which showed slight increase in cases than control. Statistically significant decrease occurred in FVC, FEV1 (P<0.05) & PEFR (P<0.000) while increase in FEV1/FVC ratio was statistically insignificant.

The early recognition and appropriate follow up of the Pulmonary Function Tests may be beneficial in the DMT2 as reduced lung functions is likely to be a chronic complication of DMT2. Therefore, lung functions need to be checked periodically to assess the severity of impairment.

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