Original Research Article

Study of pulmonary function tests in patients with type 2 diabetes mellitus attending tertiary care centre, Raichur

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Abstract

Background: Diabetes mellitus could lead to loss of elasticity, altered perfusion characteristics and weakness of the respiratory muscles responsible for ventilation. The pulmonary complications of diabetes mellitus have been poorly characterised. **Aim:** To study the pulmonary function tests in patients with type 2 diabetes mellitus attending tertiary care centre, Raichur. **Material and Methods:** This cross-sectional observational study included 60 patients with type 2 Diabetes Mellitus in Navodaya Medical College and Hospital, Raichur. The spirometric and DLCO findings were studied along with fasting and post-prandial blood sugar level, HbA1C levels. **Results:** Out of 10 patients of well controlled diabetes group, 6 patients had reduction in FVC%. In moderately controlled group, 11 out of 21 patients had reduced FVC%. In poorly controlled group, 11 out of 33 patients had reduced FVC%. (p-value- 0.21). Out of 21 patients in moderately controlled group, 2 had reduction in FEV1/FVC%. In poorly controlled group 3 out of 33 patients had reduced FEV1/FVC%. There was a correlation between duration of diabetes and FVC%. **Conclusion:** The PFT should be essentially done in these patients for better management as pulmonary parameters are seem to be affected in patients of diabetes. The effect on the FVC was even more pronounced in diabetics who had duration of disease longer than 5 years.

Key Word: Diabetes mellitus, pulmonary function test, HbA1C, duration, FEV1/FVC%

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INTRODUCTION

The World Health Organization estimates that the number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014.Diabetes prevalence has been rising more rapidly in middle- and low-income countries.[1]India has more than 3 crores of persons with DM or one-fifth of the global burden earning ignominy diabetic capital.[2]The incidence of Type 2 diabetes has been steadily increasing in urban areas to 8.4%. The rapid urbanization, change in the lifestyle coupled with ethnic susceptibility has increased the incidence of diabetes mellitus. This globally important condition needs to be understood with a proper perspective to deliver effective strategies to the individual and also the population.[3] Practically every system is affected by complications of DM. Attention is usually paid to angiopathy (micro, macro), retinopathy and nephropathy, but one of the systems most neglected in DM is the respiratory system, except for the recognition of increased in infection prevalence like tuberculosis. Non -enzymatic glycosylation of connective tissue, especially collagen, which might be responsible for lung changes, diabetic myopathy and microvascular angiopathy. These could lead to loss of elasticity, altered perfusion characteristics and weakness of the respiratory muscles responsible for ventilation.[4,5] Ventilation may be affected by myopathy and altered elastic recoil of lung tissue. Perfusion may be affected by changes in basement membrane and microvascular angiopathy. All may contribute to altered lung function.[5] There are studies, which showed changes in lung function in DM, but the study number is not large. This study will help add to the growing literature on changes in lung function in diabetes mellitus. There is increasing interest in this area and few publications. However, the total number of studies with

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respect to lung function in type 2 DM is still very small and involved very small patient numbers. Hence this study was performed to add to the experience in this area.

MATERIAL AND METHODS

This cross sectional observational study included patients with type 2 Diabetes Mellitus in Navodaya Medical College andHospital, Raichur.

Inclusion criteria

- Type 2 Diabetes mellitus with age group of 30 – 60 years.
- Both males and females included.
- Who gives written informed consent.

Exclusion criteria

Patients with -

- Chronic obstructive pulmonary disease (COPD)
- Bronchial asthma
- History of pulmonary tuberculosis
- Smokers with regular smoking of 1 year or more.

Study Design: A clinical study with 60 patients of Type IIpatients was undertaken to study the lung function tests, ventilatory functions tests. The spirometric and DLCO findings were studied and all the patients were personally subjected to detailed history regarding name, age, sex, occupation, socioeconomic status, general physical examination, systemic examination. Laboratory investigations such as complete blood count, renal function test, fasting and post-prandial blood sugar level, HbA1C along with chest X-ray, ECG, USG abdomen were done.

Statistical analysis: Data was collected by using a structure proforma. Data entered in MS excel sheet and analyzed by using SPSS 19.0 version IBM USA. Qualitative data was expressed in terms of proportions. Quantitative data was expressed in terms of Mean and Standard deviation. Association between two qualitative variables was seen by using Chi square/ Fisher's exact test. A p value of <0.05 was considered as statistically significant whereas a p value <0.001 was considered as highly significant.

RESULTS

A total of 60 subjects were included in present study. Among 60 subjects, 34 (56.6%) were males and other 26(43.3%) were females. Highest 16 (26.6%) number of subjects were in age group 41-50 years followed by 13 (21.6%) patients in 61-70 years, 12 (20%) patients in 51-60 years and 11 (18.3%) patients in 31-40 years age group. Least number of subjects belonged to age group >70 years and 20-30 years age group about 4 (6.66%) of total each. Mean age was 52.31 years. Oldest subject among the group was 85 years and youngest was 20 years old. The range of BMI in subjects was 18.86 to 36.44 with mean value of 26.12. Standard deviation was 3.57. The duration of diabetes ranged from 6 months to 168 months, with mean duration of 67 months.FBS in subjects ranged from 96mg/dL to 288 mg/dL with mean value of 175.53 mg/dL and standard deviation of 48.86mg/dL.PPBS in subjects ranged from 158mg/dL to 398 mg/dL with mean value of 284.2 mg/dL and Standard deviation of 66.12 mg/dL. Overall, the glycemic control was poor among the subjects. Minimum HbA1c among the subjects was 6.1% and maximum was 9.2% with mean value of 7.98% and standard deviation of 0.73.

Table 1: Association of FVC% and FEV1/FVC with Sex

Sex	FVC%		FEV1/FVC	
	Reduced (<80%)	Normal (>80%)	Reduced (<70%)	Normal (>70%)
Male (N=34)	14	20	02	32
Female (N=26)	11	15	03	23
Total (N=60)	25	35	05	55

Out of 60 subjects, total of 25 (41.6%) subjects had reduced FVC% with males comprising of 14 (56%) and females 11 (44%).A total of 5 (8.33%) subjects had FEV1/FVC% of <70% and 55 subjects had FEV1/FVC% of >70%.

Table 2: Association of FVC and FEV1/FVC with Age

Age group	FVC%		FEV1/FVC	
	Reduced (<80%)	Normal (>80%)	Reduced (<70%)	Normal (>70%)
20-30 years	2	2	0	4
31-40 years	4	7	0	11
41-50 years	6	10	3	13
51-60 years	4	8	0	12
61-70 years	6	7	0	13
>70 years	2	2	1	3
Total	24	36	4	56
P value	0.002 (Significant)		0.000 (Significant)	

There was reduction in FVC% as the age increases. As the age progresses, there was reduction in FEV1/FVC%.

Table 3: Association of FVC and FEV1/FVC with duration of Diabetes

Duration of DM	FVC%		FEV1/FVC	
	Reduced (<80%)	Normal (>80%)	Reduced (<70%)	Normal (>70%)
Up to 5 yrs (n=26)	3	23	1	25
> 5 yrs to <10 yrs (n=27)	16	11	1	26
>10 yrs (n=7)	5	2	3	4
Total	24	36	5	55
p value	0.001 (Significant)		0.000 (Significant)	

As the duration of diabetes increases there is increasing trend in number of patients with reduced FVC% and FEV1/FVC%. Also as the duration of diabetes increases there was reduction in FVC% and FEV1/FVC%. Hence, there is correlation between duration of diabetes and FVC%. Also as the p-value is <0.05 it is statistically significant.

Table 4: Association of FVC and FEV1/FVC withHbA1c

HbA1C level	FVC%		FEV1/FVC	
	Reduced (<80%)	Normal (>80%)	Reduced (<70%)	Normal (>70%)
<6.9 (well controlled)	0	8	1	7
7.0-7.9 (moderately controlled)	5	16	0	21
>8.0 (poorly controlled)	20	11	4	27
Total	25	35	5	55
p value	0.21 (Not Significant)		0.000 (Significant)	

Out of 10 patients of well controlled group 6 patients had reduction in FVC%. In moderately controlled group 11 out of 21 patients had reduced FVC%. In poorly controlled group 11 out of 33 patients had reduced FVC%. (p-value- 0.21). Out of 21 patients in moderately controlled group, 2 had reduction in FEV1/FVC%. In poorly controlled group 3 out of 33 patients had reduced FEV1/FVC%.

DISCUSSION

Present study was undertaken to assess pulmonary function abnormalities in patients with type 2 diabetes mellitus. Few studies have focused on the relationship between pulmonary function and diabetes. Most such studies have been conducted on subjects with type 1 diabetes. When duration of diseases was compared with all parameters the following was observed:

1. There was a tendency of all parameters to fall with longer duration of diabetes.
2. Poor glycemic control was associated with reducing pulmonary functions.
3. Also patients with diabetic retinopathy had more pronounced reduction in pulmonary functions compared to diabetic patients with normal fundus study.

In the study of Guzzi *et al*,[6] absolute values and percentage of predicted normal values of FEV1, MVV, vital capacity and total lung capacity were reduced in NIDDM group. In Lange *et al* study,[7] the diabetic subjects had slightly smaller height adjusted FEV1 andFVC compare values of non-diabetic subjects, their regression analysis also, showed association between raised values of plasma glucose and reduction of the lung function was highly significant. Ozmen *et al*[8]reported abnormal pulmonary function tests in their diabetic patients that were mild and unlikely to be of clinical significance. The most likely explanation is that single breath method may not be sensitive enough to detect pulmonary vascular microangiopathy. Low pulmonary vascular pressures determine only minor changes in pulmonary capillaries of diabetes mellitus subjects, and so the commonly used method of DLco might not discriminate between diabetics mellitus and normal subjects. In our study, we did not look at diffusing capacity. However, a similar explanation may account for our observation that the spirometric abnormalities though being consistently noted in diabetics, did not reach levels of statistical significance as expected. Diabetes mellitus may involve the lung apart from kidneys, eyes and nerves since the pulmonary microvascular circulation is extensive and has abundant connective tissue.[9]The pulmonary complications of diabetes mellitus have been poorly characterized. Although some authors have reported normal pulmonary function, others found abnormalities in lung volumes, pulmonary mechanics, and diffusing capacity.[10] Uchida *et al* found that there was decreased pulmonary diffusing capacity in patients with diabetes with perfusion defect on ventilation perfusion scintigrams.[11]Ehrlich *et al* showed that patients with type 2 DM were at increased risk of several pulmonary condition like - asthma, Chronic Obstructive Pulmonary Disease (COPD), fibrosis, and pneumonia.[12] Alveolar capillary membrane begins to thicken with longer diabetes duration, and this reflects itself both on

ventilation functions and ventilation perfusion parameters.The study of Weynand *et al*[13] shows basal lamina thickening of capillaries and epithelia in lungs and kidneys in a couple of diabetic patients. However, whereas basal lamina thickening of renal capillaries correlated well with the duration of diabetes, the pulmonary lesions did not. Weynand *et al* did not discuss the discrepancy of their results in detail. The discrepancy can be explained by functional differences or by differences in vascular pressure between the kidney and the lung.[13]In a study by Walter *et al* there was a progressive decrease in mean FVC values by 109 ml/year.[14]In study done by Kanya Kumari *et al*[15] there was a progressive decrease in mean FVC values in diabetic patients. In a study by Shah *et al*, the PFTs were significantly decreased in diabetic patients compared with the healthy controls except FEV_1/FVC. There was no correlation found between FVC and FEV_1 and duration of illness as well as HbA1c.In our study there is decrease in pulmonary functions as duration of diabetes increases.

CONCLUSION

The PFT should be essentially done in these patients for better management as pulmonary parameters are seem to be effected in patients of diabetes. The effect on the FVC was even more pronounced in diabetics who had duration of disease longer than 5 years, and the effect was not explained by the difference in age alone.

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