

Research Article

A study of clinico-demographic profile and ventilatory pulmonary function tests in type 2 diabetes mellitus

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ABSTRACT

Background: Type 2 Diabetes Mellitus (DM) is a non-communicable disease. DM produces damage in small blood vessels characterized by morphologic and biochemical alterations of the capillary basal lamina. These abnormalities have been observed in several organs including the lung. As the prevalence of diabetes is rapidly increasing, it would be important to study pulmonary functions in this sub group.

Methods: The present observational study carried out at medicine department. It includes previously diagnosed type 2 DM patients between 31 to 50 years of age, non-smoker, non-pregnant with no major respiratory illness. Ventilatory Pulmonary Function Test (VPFT) which includes FVC, FEV1 and FEV1% were studied in all selected participants. VPFT categorized as per American Thoracic Society (ATS). All collected data analysed using Microsoft Excel 2010.

Results: The total of 55 previously diagnosed Type 2 DM cases was recruited. 26 (47.2 %) & 29 (52.7 %) were male & female respectively. 21 (38.2 %) has duration of DM more than 5. 11 (20 %) & 5 (9 %) had neuropathy and retinopathy respectively. 29 (52.7 %) had abnormal pulmonary function test. The Mean FVC (84.11 ± 14.94), Mean FEV1 (84 ± 13.72) & Mean FEV1% was (100.05 ± 7.32) among the study participants. 29 (100.0 %) were restrictive type of abnormality.

Conclusion: The reduced lung function is likely being a complication of diabetes mellitus. Lung functions needs to be checked periodically.

Keywords: Pulmonary function tests, Clinico-demographic profile, Diabetes mellitus

INTRODUCTION

This could be due to a genetic factor, unhealthy diet, lack of physical activity and obesity. The number of cases of diabetes worldwide is estimated to be around 150 million. This number is predicted to be double by 2025 (a prevalence rate of about 5.4%), with greatest number of cases being expected in China and India.¹ The population in India has an increased susceptibility to diabetes mellitus.

Diabetes mellitus produces damage in small blood vessels characterized by morphologic and biochemical

alterations of the capillary basal lamina. These abnormalities have been observed in several organs including the lung. Farina J *et al.*, found nodular fibrosis of the lungs of autopsied diabetic patients.² Ljubic S *et al.*, showed that diabetes could lead to the development of pulmonary complications due to collagen and elastic changes as well as microangiopathy.³ Lung Function Tests (PFTs) among diabetes investigated and suggested that the lung may be a target organ of diabetes.^{4,5} As the prevalence of diabetes is rapidly increasing, it would be important to study pulmonary functions in this subgroup. The present study was aimed to study ventilatory

pulmonary function tests (spirometry) in patients with type 2 diabetes mellitus.

METHODS

The present observational study was carried out in the Department of Medicine, at a tertiary care hospital located at Maharashtra from 1st December 2005 to 31st August 2007. Ethics Board Committee and Institutional Review board approved the protocol.

The study includes previously diagnosed type 2 diabetes mellitus patients between 31 to 50 yrs of age visiting Out Patient Department, irrespective of gender, non-smoker, non-pregnant, not suffering from major respiratory illness. Those cases < 30 or > 50 yrs, suffering or having evidence of respiratory, cardiac illness or cerebrovascular accidents, pregnancy, smokers and patients with major illness (> 10 days duration) or admission in hospital in last six months were excluded. Written Informed consent was obtained after the purpose of the study.

A detailed clinical history was recorded as per respiratory questionnaire.⁶ All patients underwent complete clinical examination, Glycated Hemoglobin level (HbA1c) and Ventilatory Pulmonary Function Test (VPFT) were studied in all selected participants VPFT was performed fixed at 10 am to 2 pm to avoid diurnal variation. FVC, FEV1 and FEV1% were selected as an outcome indicator and expressed as a percent of predicted normal values. The mean of three readings was considered. Cut-off values for three PFT parameters were set based on American Thoracic Society (ATS) criteria as follows – FEV1/FVC ratio (i.e. FEV1%) percentage predicted values of less than seventy (< 70 %) and FEV1 less than eighty (< 80 %) percentage predicted values may suggest an obstructive lung pathology and FVC percentage predicted values of less than eighty (< 80 %) may suggest a restrictive lung disease.^{7,8} Restrictive lung disease cases were further classified into three subgroups according to FVC% -Mild restriction – 60 to 80 %, Moderate restriction – 45 to 60 %, Severe restriction - < 45 %.

All collected data entered cleaned and analysed with the Microsoft excel 2010. Proportions, Descriptive statistics arithmetic Mean and Standard Deviation calculated.

RESULTS

The total of 55 previously diagnosed Type 2 Diabetes Mellitus patients (cases), in the age group of 31-50 years were recruited in this study.

Clinico-demographic profile of the cases shows that age wise 23 (41.82 %) were from the age group 31-40 yrs & 32 (58 %) for 41-50 age group. 26 (47.2 %) were male as compare to 29 (52.7 %) were female. 34 (61.8 %) & 21 (38.2 %) has duration of diabetes more than 5 and less than 5 yrs respectively. 36 (65.4 %) had BMI less than 25

as compared to 19 (34.5 %) had BMI more than 25. 71 % had no any microvascular retinopathy while 11 (20 %) & 5 (9 %) had neuropathy and retinopathy respectively. 31 (56.4 %) having poor glycemic control as compared to 24 (43.6 %) having good glycemic control. 29 (52.7 %) had abnormal (restrictive) type of pulmonary function test as compared to 26 (47.3 %) had normal PFT (Table 1).

Table 1: Clinico-demographic profile of the type 2 diabetes mellitus cases during the study period.

Sr. No	Variables	Numbers	Percentage (%)	Mean ± S.D.
1	Age (Yrs)			
	31 – 40	23	41.82	42.95 ± 5.82
41 – 50	32	58.18		
2	Sex			--
	Male	26	47.27	
	Female	29	52.73	
3	Height (cms)	--	--	157.27 ± 8.29
4	Weight (kg)	--	--	56.84 ± 11.62
5	BMI			22.91 ± 3.92*
	< 25	36	65.45	
	> 25	19	34.55	
6	Duration of Diabetes			4.23 ± 1.29
	<5 yrs	34	61.82	
	>5 yrs	21	38.18	
7	Microvascular complication			--
	Retinopathy	5	9.09	
	Nephropathy	11	20	
	No Complication	39	70.91	
8	Glycemic Control			8.29 ± 2.84
	Good (< 7)	24	43.64	
	Poor (≥ 7)	31	56.36	
9	Ventilatory PFT			--
	Normal	26	47.3	
	Abnormal	29	52.7	

(-- Not Applicable)

Table 2 shows the Mean FVC (84.11 ± 14.94), Mean FEV1 (84 ± 13.72) & Mean FEV1% was (100.05 ± 7.32) among the study participants.

Table 2: Ventilatory Pulmonary Function Parameters (As percentage of predicted normal values) among the diabetes mellitus cases.

Study Participants	FVC (Mean ± S.D.)	FEV ₁ (Mean ± S.D.)	FEV ₁ % (Mean ± S.D.)
Cases (n=55)	84.11 ± 14.94	84 ± 13.72	100.05 ± 7.32

In our study, out of total 55 cases, 29 (52.7 %) cases shown abnormal PFT as compared to 26 (47.3 %) shown normal PFT. Out of 29 abnormal PFT, 29 (100.0 %) were restrictive type of abnormality while (0 %) had obstructive type of abnormality. Out of 29 abnormal i.e. restrictive type of abnormality, 28 (96.5 %) & 1 (3.5 %) were mild and moderate type of restrictive abnormality. Among 31-40 age groups pulmonary function test results were normal among 11 (47.8 %) whereas mild restrictive abnormality was seen in 12 (52.2 %) cases. While in 41-50 age group, abnormal (restrictive) pulmonary function test results were seen in 17 (53.1 %) as compared to 15 (46.9 %) shown normal PFT. Out of 17 abnormal PFT, 16 (94.1 %) & 1 (5.9 %) were shown mild & moderate restrictive pattern respectively (Table 3). Pulmonary function abnormalities observed in the form of restrictive pattern were not reversible in any of the patient after inhaled β_2 agonists (i.e. inhaled Salbutamol 200 μ gm, 2 puffs).

Table 3: Age and sex wise distribution of the ventilator pulmonary function test (PFT) results among the type 2 DM cases

Ventilatory Pulmonary Function Test (VPFT)	31 – 40 yrs age group		41 – 50 yrs age group		Total	Percentage
	Male	Female	Male	Female		
Normal	5	6	7	8	26	47.3
Obstructive	0	0	0	0	0	0.0
Restrictive Mild	6	6	8	8	28	50.9
Restrictive Moderate	0	0	0	1	01	1.8
Restrictive Severe	0	0	0	0	0	0.0
Total	11	12	15	17	55	100.0

DISCUSSION

The present study was undertaken among 55 cases with Type 2 Diabetes Mellitus. The detailed history with clinical examination findings were recorded in predesigned Proforma. To assess the pulmonary status, the ventilatory pulmonary function test was carried out. Cases were divided into age range 31-40 yrs and 41-50 yrs with 23 (41.82 %) & 32 (58.18 %) cases respectively. Pinar Celik *et al.*,⁴ evaluated 30 nonsmoking diabetics (cases) in the age group of 23 to 74 yrs. Age group of 31 to 50 years was selected to minimize the chance of patients from Coronary Artery Disease, cerebrovascular accidents or COPD. 29 (52.73 %) were females as

compared to 26 (47.27 %) males. Benbassat CA *et al.*,⁹ studied pulmonary functions among 27 cases [17 (63%) males and 10 (37 %) females] while Sanjeev Sinha *et al.*,¹⁰ evaluated pulmonary functions including respiratory muscle strength in predominantly male type 2 diabetes mellitus patients. However authors did not given explanations for exclusive male gender inclusion in their study. Ratio of males and females was adequately matched to avoid sex bias.

Near about 36 (65.45 %) & 19 (34.55 %) cases have the BMI <25 kg/m² & \geq 25 kg/m². Pinar Celik *et al.*,⁴ evaluated pulmonary functions variations by dividing patients (cases) according to BMI into 3 subgroups as BMI < 25 kg/m², BMI 26-26.9 kg/m², BMI > 27 kg/m². Mean duration of diabetes was 4.23 with more than 30 % has diabetes more than 5 yrs. 39 (70.91 %) cases did not have any vascular complications while 11 (20 %) & 5 (9.09 %) found nephropathy & retinopathy respectively. However, Pinar Celik *et al.*,⁴ observed 13 cases of retinopathy and 9 cases of nephropathy out of total 30 cases. While Sanjeev Sinha *et al.*, observed 7 cases of retinopathy, 4 cases of nephropathy and 8 cases of peripheral neuropathy out of total 29 cases.¹⁰ 31 (56.36 %) had poor glycemic control with HbA1c \geq 7 %.

A pulmonary Function test result shows 29 (52.7 %) abnormality. Pulmonary function abnormalities observed in the present study were nearly equally distributed in both genders [i.e. males (n=14) and females (n=15)]. FVC and FEV₁ mean percentage predicted values were 84.11 \pm 14.94 and 84 \pm 13.72, respectively. Whereas observed mean FEV₁% was 100.05 \pm 7.32. The pattern of abnormal pulmonary function observed in our study, low FVC and preserved FEV₁/FVC ratio, is suggestive of restrictive type of lung disease according to American Thoracic Society (ATS) criteria.⁷ All 29 cases were of restrictive type as compared to no case of obstructive abnormality. Jhanwar R *et al.*,¹⁵ observed that diabetics showed a restrictive type of ventilatory dysfunction, indicated by significant decline in FVC and FEV₁ with insignificant changes in FEV₁/ FVC. Benbassat C.A. *et al.*, observed that FVC, FEV₁, FEV₁/FVC were within the percentage predicted normal values in cases.⁹ Small number of subjects precluded any conclusion and also explained for differences among various studies on the basis of bias in selected populations.

Pednekar Sj *et al.*, observed VPFT among the 30 cases, found 1 (3.3 %) restrictive type of abnormality while 25 (83.3 %) cases found obstructive type of abnormality with significant reversibility.¹¹ while we found 52.7 % of restrictive abnormality with no significant reversibility after inhaled β_2 agonists in any of the patient. Other studies found restrictive patterns of PFT among diabetes cases.^{10,12,13} Whereas, mixed restrictive and obstructive pattern was observed by Sharma B *et al.*¹⁴

Although reduced spirometric measurements do not identify a specific underlying pathology, but there have

been preliminary reports of histopathologic changes in the lungs of diabetic patients. This can be explained as non-enzymatic glycosylation has been shown to occur in human lung parenchymal tissue.¹⁶ It therefore appears that non-enzymatic glycosylation-induced alteration of lung connective tissue is probably the most possible pathogenic mechanism underlying mechanical pulmonary dysfunction in human diabetes mellitus.¹⁷ Both collagen and microvascular abnormalities have been proposed as the underlying defects rendering diabetic patients susceptible to respiratory dysfunction.^{9,18}

CONCLUSION

The study concludes the reduced pulmonary function among the diabetes mellitus is complication because of hyperglycemias. The periodic screening of the DM patient for PFT needs to be followed. Further prospective studies needs to be carried out to find the association of other factors with the impaired PFT among the diabetes mellitus cases.

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