Original Article

Pulmonary function changes in a diabetic lung

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Abstract

Background: Diabetes mellitus is a chronic metabolic disease characterised by hyperglycemia resulting from defects in insulin secretion, action or both. Based on etiopathogenesis it is divided into 2 types, Type 1 and 2. There are histopathological evidence suggestive of pulmonary microangiopathy in lungs of diabetics.. The present study was undertaken to evaluate the impact of Type 2 diabetes on pulmonary functions and compare the results with healthy age and sex matched individuals. **Aim:** To determine pulmonary function tests in Type 2 DM patients and compare with healthy age and sex matched individuals. **Methodology:** It is a prospective observational study with a total of 80 samples of which 40 are diabetics and 40 are controls. **Results:** There was a significant decrease in FEV1, FVC, PEFR and FEV_{25-75} in diabetic patients compared to controls. There was a significant increase in the FEV1/FVC ratio in diabetic patients compared to controls. **Conclusion:** There is a significant decrease in pulmonary function tests in a diabetic patient. Pulmonary function tests should be done routinely for diabetic patients as it is one of the target organs in diabetes.
Key Words: diabetic lung.

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INTRODUCTION

Diabetes mellitus is a chronic metabolic disease characterised by hyperglycemia resulting from defects in insulin secretion, action or both. Based on etiopathogenesis it is divided into 2 types, Type 1 and 2. In Type 1, there is absolute or near total deficiency of insulin secretion. Type 2 results from a combination of impaired pancreatic beta cells secretion, increased glucose production and peripheral tissue resistance to insulin. DM is accompanied by widespread biochemical, morphological and functional abnormalities which may precipitate various complications of renal, cardiovascular, neural systems etc. DM is a risk factor for precipitating micro vascular pathologies leading to autonomic neuropathy, nephropathy, retinopathy and macro vascular pathologies leading to coronary artery disease and cerebrovascular accidents. There are histopathological evidence suggestive of pulmonary microangiopathy in lungs of diabetics. Thickened alveolar epithelial cells and pulmonary capillary basal lamina leading to reduced elastic recoiling has been observed. There is impaired diffusion of gases due to reduced pulmonary capillary blood volume and thickening of basement membrane leading to reduced lung volumes and abnormal pulmonary function tests. Non enzymatic glycosylation induced alteration of lung connective tissue id the most likely mechanism. This indicates that lung is one of the target organs in DM although clinical implications related to it are still being investigated. The pulmonary functions in DM are not so extensively documented. The present study was undertaken to evaluate the impact of Type 2 diabetes on pulmonary functions and compare the results with healthy age and sex matched individuals.

MATERIAL AND METHODS

Study Design: prospective observational study conducted in Dr. D Y Patil Hospital Navi Mumbai
Duration: 1 year
Sampling: total sample size is 80 out of which 40 are type 2 diabetics and 40 controls (outpatient and inpatient)

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Inclusion Criteria For Study Group: History of type 2 DM for more than 2 year No history of smoking, hypertension, respiratory or cardiovascular diseases

Inclusion Criteria For Control Group: No history of DM, hypertension, respiratory or cardiovascular diseases

Exclusion Criteria: Smokers, h/o lung disease, respiratory tract infections at the time of test, admission in last 6 months for respiratory symptoms, h/o cardiovascular diseases, h/o HTN, unable to use spirometer, no consent given.

Study Methodlology: Detailed history and examination was done. They were then tested for FBS after 8 hrs of fasting, PPBS 2 hrs after breakfast and HbA1c levels. Reference values taken were FBS > 126 mg/dl, PPBS > 200 mg/dl and HbA1c > 6.5% to label the patient diabetic. All cases and controls were subjected to pulmonary function tests. Functions such as FEV1 (forced expiratory volume in one second), FVC (forced vital capacity) and FEV1/FVC ratio. FEV 25-75% and PEFR (peak expiratory flow rate) were measured my spirometer med graphics profiler. Spirometer was performed before and 15 mins after inhalation of 0.2 mg salbutamol at room temperature 19 to 24C. Best of 3 values of FEV1, FVC, PEF, FEV1/FVC and FEV25-75% were recorded. Highest value was taken for the study.

RESULTS

Table 1:

Parameters	Cases (N=40)	Control(N=40)	P-Value	Significance
Mean Age	48.4	48.2	0.85	Ns
Male Gender	52.5	52.5	1	Ns
Female Gender	47.5	47.5	1	Ns
BMI (Kg/M^2)	24.10+/-2.97	23.72+/-2.52	.53	Ns

Table 2:

Variable	Group	N	Mean	Std. Deviation	P-Value
FVC (L/Sec)	Diabetic	40	2.81	0.76	0.23
	Control	40	2.98	0.44	
Predicted FVC	Diabetic	40	3.337	0.50	0.99
	Control	40	3.342	0.48	

Table 3:

Variable	Group	N	Mean	Std. Deviation	P-Value
FEV1 (L/Sec)	Diabetics	40	2.19	0.59	<0.05
	Control	40	2.46	0.35	
Predicted FEV1	Diabetics	40	2.77	0.39	0.86
	Control	40	2.75	0.37	

Table 4:

Variable	Group	N	Mean	Std Deviation	P-Value
Fev1/FVC (L/Sec)	Diabetics	40	82.84	5.49	<0.05
	Control	40	78.46	7.32	
Predicted Fev1/FVC	Diabetics	40	83.07	1.91	0.27
	Control	40	82.54	2.27	

Table 5:

Variable	Group	N	Mean	Std Deviation	P-Value
Fev_{25-75}(L/Sec)	Diabetics	40	2.33	0.93	<0.05
	Control	40	2.92	0.63	
Predicted Fev_{25-75}	Diabetics	40	3.74	0.44	0.34
	Control	40	3.64	0.43	

Table 6:

Variable	Group	N	Mean	Std Deviation	P-Value
PEFR(L/Sec)	Diabetics	40	6.66	2.23	<0.05
	Control	40	7.69	1.83	
Predicted PEFR	Diabetics	40	7.71	1.23	0.68
	Control	40	7.60	1.25	

DISCUSSION

A prospective observational study conducted in our hospital with the objective of determining pulmonary function tests in Type 2 diabetics. The mean age of the subjects in case and control groups was 48.4 and 48.2 respectively. Both the groups were matched on the basis of gender distribution with 52.5% males and 47.5% in each group. Mean BMI of cases and controls was 24.1 and 23.7 Kg/m2 respectively. (Table 1). In a study by Gurathi *et al* it was found that majority of patients (64.33%)were in age group between 40 to 50 yrs.[4]

FVC: In our study FVC was lower in type 2 diabetics compared to controls though the difference was not significant. There was a decrease of 15.8% (3.337 to 2.81 L/sec) in predicted FVC of diabetics compared to controls. (Table 2)

FEV1: In our study there was a statistically significant decrease in levels of FEV1 in type 2 diabetics compared to controls. There was a decrease in 20.9% (2.77 to 2.19 L/sec) of the predicted FEV1 value in diabetic patients. (Table 3)

FEV1/FVC: Statistically significant increase in the level of ratio of FEV1/FVC was observed in diabetics as compared to controls (82.84 vs 78.46). (Table 4). The present study correlates with Robert WE *et al* [1] who studied the relation between diabetes and pulmonary function and showed 1.5% increase in the FEV1/FVC ratio with a p value <. 05 which is significant, suggesting a restrictive pattern.

FEV 25-75%: In this study the level of FEV between 25 to 75 % FVC was lower by 0.6L/sec in diabetics

compared to controls. (Table 5). In a similar study by Sreeja CK *et al*[2] observed decreased FEV 25-75 levels in diabetic group (2.45+/- 0.55) compared to controls (2.82+/- 0.70).

PEFR: Study shows statistically significant decrease in level of PEFR (14.2% of predicted).(Table 6). The reduced flow rate is due to reduction force generating capacity of expiratory muscles, higher airway resistance, reduced recoiling nature of lungs and decrease in muscle strength[3]

CONCLUSION

We thus conclude that pulmonary functions are reduced in type 2 diabetes patients. Restrictive pattern of lung disease was observed in these patients. Lung is a target organ that is involved in diabetes and should be routinely evaluated in diabetics. Hence it is important to analyse pulmonary function tests in diabetic patients to diagnose the type of respiratory dysfunction and treat accordingly.

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