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Original Research Paper

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PULMONARY FUNCTION TESTS IN DIABETIC PATIENTS IN RELATION TO GLYCEMIC CONTROL

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ABSTRACT The spirometric measurements were done in 20 patients with type 2 diabetes mellitus without complications (10 each were controlled and uncontrolled diabetes) and compared with age, sex, height, body weight matched 10 healthy controls. The results showed significant restrictive ventilatory impairment in diabetic patients more so in uncontrolled diabetes.

KEYWORDS : Spirometry, Type 2 Diabetes, Glycemic Control

INTRODUCTION

Diabetes Mellitus is a heterogeneous metabolic disorder characterized by common features of chronic hyperglycemia with disturbance of carbohydrate, fat and protein metabolism. Many organ systems are the targets in diabetes like cardiovascular system, eyes, kidney and nervous system. The possibility that the lung is also a target organ for diabetic complications was first suggested by Schuyler et al in 1976 [1]. Since that time there have been many studies of pulmonary function in diabetic patients with conflicting results. Many have suggested plausible patho-physiological mechanisms also. Major consequences of hyperglycemia are excessive non enzymatic glycosylation of various body proteins including hemoglobin, albumin, collagen and elastin [2,3,4,5,6]. Glycosylation leads to irreversible changes in the chemical structure of tissue proteins. These chemical changes have been implicated in producing long term complications of diabetes. Reduced elastic recoil of the lungs because of increased glycosylation of connective tissues is one of the long term effects of diabetes on the respiratory system [2,7]. Restrictive type of ventilator impairment has been described in diabetes [8].

MATERIAL AND METHODS

The present study was conducted at JLN Medical College and Hospital, Ajmer. The patients were selected from those attending diabetic clinic, medical outdoor and admitted in various medical wards. The subjects selected for study were grouped as follows viz.:

1. Group I (Healthy controls; n = 10)
2. Group II (Controlled diabetes; n = 10) - glycosylated haemoglobin < 8%).
3. Group III (Uncontrolled diabetes; n = 10) - glycosylated haemoglobin > 8%).

The age, sex, height and body weight matched in all the groups. The patients with type 2 diabetes mellitus[9] who were non-smokers, non-obese, free from any evident respiratory chest wall disorder or cardiac disease and without history of allergic and auto immune disease were included in the present study.

After detailed history and physical examination, routine investigations were done followed by blood sugar (fasting and post prandial), glycosylated haemoglobin (ion exchange chromatography method), The Spirometery was done by computerized Cosmed Pony Spirometer. The subjects were made to sit comfortably in a chair and were asked to breath through the mouth piece of spirometer. They were allowed 3 to 4 trials of maximal inspiration and expiratory efforts and only the highest readings were taken

The measurement of forced vital capacity (FVC) and forced expiratory volume in one second (FEV_1) done by Spirometery. The recommendations of the American Thoracic Society were followed. The parameters of ventilation functions were compared and analysed statistically.

RESULTS :

There was no significant difference in mean age, height, body weight, body mass index and waist hip ratio between group I, II and III (Table I).

TABLE I :
AGE AND ANTHOPOMETRIC MEASUREMENT IN VARIOUS GROUPS

Parameters (Mean ± S.D.)	Healthy Control (Group I)	Controlled diabetes (Group II)	Uncontrolled diabetes (Group III)
Age (years	36.20±10.70	45.10±13.02	36.10±15.60
Height (cms)	163.70±7.20	158.10±9.23	157.80±7.49
Body weight (kg)	59.71±8.65	57.60±8.23	53.85±7.49
Body mass index (kg/m^2)	21.84±3.25	23.02±2.60	21.56±5.00
Waist : Hip ratio	0.81±0.09	0.81±.0.03	0.86±0.10

There was no significant difference in above parameters statistically (P > 0.05 NS).

Fasting, post prandial blood sugar and glycosylated haemoglobin were significantly higher in uncontrolled diabetes as compared to controlled diabetics (Table II).

TABLE II :
GLYCEMIC STATUS OF VARIOUS GROUPS

Parameters (Mean ± S.D.)	Healthy Control (Group I)	Controlled diabetes (Group II)	Uncontrolled diabetes (Group III)
Fasting blood sugar (mg%)	85.30±14.35	102.42±19.32	153.60±41.18
Post prandial blood sugar (mg%)	114.80±18.04	146.78±18.88	263.63±44.40
Glycosylated haemoglobin	5.17±0.41	7.15±0.31	12.12±1.90

P value : Group I vs II < 0.001 HS
Group II vs III < 0.001 HS

The forced vital capacity (FVC) and forced expiratory volume in one second (FEV_1) were decreased significantly in group II and III in comparison to group I more so in uncontrolled diabetic patients.However, the ratio of FEV_1/FVC was normal in all the groups (Table III).

TABLE III :
FLOW VOLUMES AND DIABETIC CONTROL

GROUP	FVC (% of predicted)	FVC_1 (% of predicted)	FEV_1/FVC
Group I	69.74±8.19	77.70±7.10	87.75±10.04
Group II	52.07±10.89	68.00±9.85	95.88±11.97
Group III	34.68±10.07	42.50±10.80	96.27±10.93

P value :

Group I v/s II, III	<0.0001 HS	Group I v/s II	<0.05S
Group I v/s II	<0.01VS	Group I v/s III	<0.001HS
		Group II v/s III	<0.001HS

DISCUSSION:

The present study has assessed that type 2 diabetes was associated with reduced lung functions, by doing forced Spirometric Pulmonary Function Tests. This study clearly showed a highly statistically significant p value when the lung function tests (FVC, FEV1) were compared between type 2 diabetics and controls (age, sex and BMI matched).In our study done in J.L.N. medical college hospital, about 30 participants were studied of which 20 are having type 2 diabetes mellitus are cases and 10 without diabetes mellitus are controls and the males are 19 and females are 11 in number. Pulmonary function test has been conducted in all the persons. There is statistically significant value in correlation between HBA1c and pulmonary function test results were noted and the p value is <0.0001.The FEV1 and FVC both are reduced in type2 diabetic patients and the FEV1/FVC remains normal.

The pattern of lung disease is mostly restrictive pattern in patients having type 2 diabetes mellitus. And the p value is <0.0001 is statistically significant.

So it is clear that type 2 diabetes mellitus affect the lung and lung may the target organ for damage and the pattern of disease is restrictive in nature[10,13,14,15]Although the underlying mechanisms which relate type 2 diabetes to reduced lung functions remains unclear, previous studies have suggested several possible explanations, which include glycosylation of chest wall and bronchial tree proteins and increased cross-linkage formation between polypeptides of collagen in pulmonary connective tissue, which decrease Forced vital capacity,basal lamina thickening, and increased susceptibility to respiratoryinfections10,12,15,. Thus hyperglycaemia may contribute to obstruction of airways.The lungs are affected by diabetic microangiopathy20,21. This was evidenced autopsy findings in human diabetic subjects, which showed pulmonary microangiopathy, thickening of alveolar epithelia, pulmonary capillary basal lamina thickening, centrilobular emphysema, and , thickening of alveolar epithelia. Type 2 Diabetes mellitus can cause the development of pulmonary complications due to collagen and elastin changes as well as microangiopathy[10,11,21,22].decrease in FVC may be because of impaired immunity against envionmental challenges. Impairment of lung function is demonstrated with long duration of diabetes[23] and impaired glycemic control[24]

The Present study showed significant restrictive ventilator dysfunction in uncontrolled diabetic patients compared to controlled diabetic and control subjects.

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