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Original Research

Effect Of Type 2 Diabetes-Mellitus On Forced Vital Capacity

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ABSTRACT

Diabetes mellitus type 2 is a multi-organ chronic disease that is characterized by high blood glucose in the context of insulin resistance and impaired insulin secretion, and increased glucose production. This study describes the association of type 2 diabetes-mellitus (NIDDM) with lung function. A case-control study was conducted on 50 type 2 diabetes mellitus patients and age; sex matched 50 controls at Department of Physiology, Jhalawar medical college, Jhalawar. Cases were recruited at Department of Medicine, Jhalawar medical college & hospital, Jhalawar, who were diagnosed to have type 2 diabetes mellitus by physician according to WHO criteria. These patients and normal control group was subjected to pulmonary function test (PFT) by using computerized "MIR Spirolab III". In the present study difference in means of Forced Vital Capacity was found highly significant in both the group in this study.

Keyword: Diabetes mellitus, pulmonary function test, forced vital capacity

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INTRODUCTION

Diabetes mellitus type 2 is a metabolic disorder that is characterized by high blood glucose in the context of insulin resistance and impaired insulin secretion, and increased glucose production. [1] It is associated with wide spread hormonal, metabolic and microvascular and, cardiovascular functional abnormalities which may precipitate certain complications that may affect neural, renal systems and also organs and tissues like skin, liver, collagen and elastic fibers. Thus diabetes is a multisystem disorders that affect many organs of the body. [2] According to WHO (World Health Organization) 346 million people worldwide currently have diabetes with more than 80% of diabetes deaths occurring in low and middle income countries. It is projected that this will double between 2005 and 2030. [3] Diabetes currently affects more than 62million Indians, which is more than 7.1% of the adult population. [4] According to the Indian heart association, India is projected to be home to 109 million individuals with diabetes by 2035. [5] The most probable reason of this high incidence of diabetes in India is the rapid

economical development over the last 20 years; this has resulted in the adaptation of western life style, nutritional habits and physical activity, which results in a high incidence of diabetes-mellitus. These core factors are responsible for the high incidence of diabetes in the years to come. [6]

MATERIAL AND METHODS

In this perspective the present study was conducted at the Jhalawar Medical College and associated hospital, Jhalawar, (Rajasthan) India. A case-control study was conducted on 50 type 2 diabetes mellitus patients and age; sex matched 50 controls at Department of Physiology, Jhalawar medical college, Jhalawar. Cases were recruited at Department of Medicine, Jhalawar medical college & hospital, Jhalawar, who were diagnosed to have type 2 diabetes mellitus by physician according to WHO criteria. Diabetes is defined when fasting blood glucose ≥ 126 mg /dl, Mild -140mg/dl to 180mg/dl, moderate- 180 to 250 mg/dl, severe >250mg/dl.

DATA COLLECTION PROCEDURE-

Inclusion criteria:

- Age : 30 to 70 years.
- Male and female both the subjects having type 2 diabetes mellitus included in the study group.
- Normal healthy individual between 30 and 70 years of age will be taken as controls.
- Non-smoker and free from any acute/chronic pulmonary disease
- Who gives written informed consent.

Exclusion criteria:

- Extremes of ages were also excluded i.e. <30 years and >70 Years.
- Subjects between 30-70 years of age who were suffering from any diseases which directly or indirectly affects the lung functions of the subjects.
- Patients with acute complications of diabetes-mellitus like diabetic-keto acidosis, non-ketotic hyper-osmolar coma and hypoglycemia.
- Subjects with gross abnormalities of the vertebral column or thoracic cage.
- Known history of neuromuscular disease, malignancy and those who had undergone major abdominal or chest surgery.
- Smokers with regular smoking of 1 year or more and obese subjects.
- Who do not give written informed consent.

Method

50 type 2 diabetic patients suffering since 10-20 years and 50 normal subjects from general population confirming the inclusion criteria was included in the study. The patients were randomly selected for the sole purpose of studying, lung function by using computerized “MIR Spirolab III”. Age, height (m), weight (kg), body mass index (BMI) (Quetlet’s index – weight (kg) / Height² (m)) of both patients and controls were measured.

- Age and height matched 50-subjects without any health ailments were selected as normal controls for the present study.
- A pretested structured Performa (Annexure 1) were used to collect the relevant information regarding clinical findings and investigation test results of patients. These patients and normal control group was subjected to pulmonary function test (PFT) by using computerized “MIR Spirolab III”.
- “MIR Spirolab III” is a computerized spirometer self calibrating, which fulfils the criteria for

standardized lung function tests. Detailed Pulmonary functions tests (PFTs) including forced vital capacity (FVC), forced expiratory volume in first second (FEV1), peak-expiratory flow rate (PEFR), forced expiratory flow (FEF25-75%) & FEV1/FVC were measured by MIR Spirolab III, for 3 times at every 15 minutes interval and best of 3 readings was taken in a quiet room in sitting position, according to American Thoracic Society/European Respiratory Society ATS/ERS guidelines [8,9].

Contraindications of Spirometry in diabetic patients-

- Nausea, vomiting, headache, dizziness (these disorders affect the test performance)
- Hemoptysis of unknown origin
- Current history of any abdominal or thoracic surgery
- Current history of any limb amputation
- Current history of glaucoma or any eye surgery
- Recent history of severe chest pain, unstable angina or myocardial infarction
- Thoracic aneurysms/pneumothorax
- Diabetic patients with a history of HIV/hepatitis B/hepatitis C (because of high risk of transmission of infection. However, spirometry can be performed after taking high standard sterilizing measures)

STATISTICAL ANALYSIS:

Statistical analysis of data is done by help of SPSS 20.0 Software (trial Version). And Significance of difference of pulmonary parameters in both the groups was inferred with Unpaired ‘T’ Test and Chi square test is use in data analysis.

RESULT

In the present study difference in means of age, sex, BMI between cases and controls were not significant (P>0.05) (Table 1, 2), whereas mean Serum glucose levels was found significantly more in cases group (P<0.0001) (Table3). In this study, among 50 patients 29 had restrictive, 5 had obstructive, 8 mixed blockage and 8 normal spirometric pattern (Table 4). Even though Type2 diabetic patients did not have any respiratory symptoms they did have underlying sub clinical restrictive patterns of lung functions. Regarding pulmonary function defects in the present study, it was observed that normal functioning of lung was found significantly (P<0.05) more in control group whereas restriction was found significantly (P<0.0001) more in cases group.

Table 1: Distribution of Age according to Groups

	Group	N	Mean AGE	Std. Deviation	T value	P value
AGE(YEARS)	Case	50	53.1800	12.14150		
	Control	50	54.7000	11.20723	0.650	0.517

Table2 : Distribution of Gender according to Groups

GENDER	Group	Group		Total	Chi sq	P value
		Case	Control			
FEMALE		27	22	49		0.317
		54.0%	44.0%	49.0%		
MALE		23	28	51	1.000	
		46.0%	56.0%	51.0%		
Total		50	50	100		
		100.0%	100.0%	100.0%		

Table 3: Distribution of SERUM GLUCOSE LEVEL(mg/dl) according to Groups

SERUM GLUCOSE LEVEL(mg/dl)	Group	N	Mean	Std. Deviation	T value	P value
	Case	50	177.2600	40.07229		
Control	50	91.1000	13.28226	14.432	<0.0001*	

Table4 : Pulmonary Function Defects Comparison of Cases with Controls

SPIROMETRIC INTERPRETATION	Group	Group		Total	P value
		Case	Control		
MIXED		8	7	15	>0.05
		16.0%	14.0%	15.0%	
NORMAL		8	24	32	<0.0001*
		16.0%	48.0%	32.0%	
OBSTRUCTION		5	13	18	>0.05
		10.0%	26.0%	18.0%	
RESTRICTION		29	6	35	<0.0001*
		58.0%	12.0%	35.0%	
Total		50	50	100	
		100.0%	100.0%	100.0%	

Table 5: Pulmonary Function Tests Comparison of Cases with Controls

FVC(L)	Group	N	Mean	Std. Deviation	T value	P value
	Case	50	2.0904	.78914		
Control	50	2.5862	.91776	2.896	0.005*	

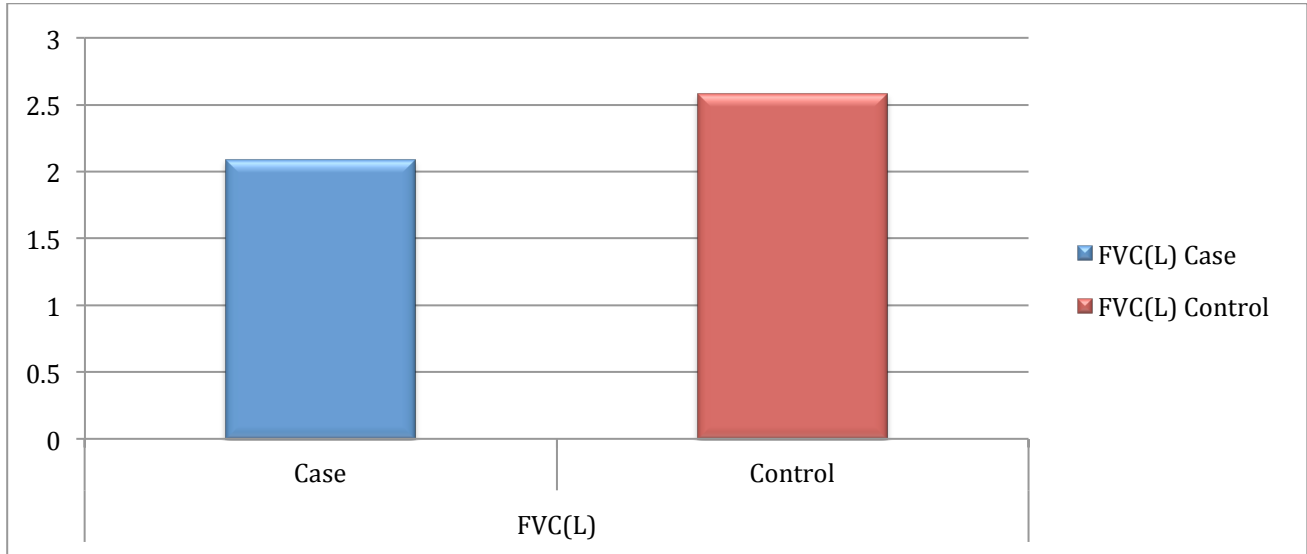


Figure No 11 Depicting comparison of FVC (L) in case & control

DISCUSSION

The present study was conducted in the Department of physiology, Jhalawar medical college & hospital, Jhalawar (Rajasthan) in collaboration with Department of Medicine to observe the alterations in lung functions in patients with Diabetes Mellitus. Various observations depending on duration of disease and pulmonary function impairment were analysed.

The aim of present study was

- To study the pulmonary function of individuals with type 2 Diabetes Mellitus.
- To compare the pulmonary function tests of Type 2 Diabetes mellitus with that of healthy non- diabetic subjects

Physical Parameters:-

- The mean age is comparable in case & control. There is no significant difference between the mean age of case and control ($p = 0.517$).
- B.M.I is compared in case, control. There is no significant difference between the B.M.I of case when compared with control ($p = 0.167$)
- Meo S A et al reported that there was no statistically significant difference in the anthropometric profiles (age, weight, height) between diabetic and control.^[10]
- Asauma et al also observed that there was no significant difference in the anthropometric Profiles (age, height, weight) between diabetics and control^[11].
- **Blood Glucose Fasting:-** In the present study, the mean value of BGF were 177.26 mg%, 91.10 mg% in case & control group respectively (table 3) .
- Type 2 diabetic patients had statistically significant increase in BGF ($P = 0.0001$).
- **Forced Vital Capacity (FVC):-** The forced vital capacity represents the largest amount of air that can be expired after a maximal inspiratory effort, is frequently measured as an index of pulmonary function. It gives useful information about the strength of the respiratory muscles and other aspects of pulmonary function^[12].

- In the present study, the mean value of FVC were 2.09 litres, 2.58 litres in case, control group respectively (table 5). Type 2 diabetic patients had statistically significant reduction in FVC ($P = 0.005$).
- Similar observations were reported by Davis W.A et al who conducted a large Community based study in western Australia in type 2 diabetic patients and demonstrated that FVC were decreased in type 2 diabetic patients^[12].
- DM being a systemic disease, which also affects lungs causing restrictive type of ventilatory changes, because of glycosylation of connective tissues, reduced pulmonary elastic recoil and inflammatory changes in lungs. The histopathological changes in the lungs of diabetics are associated with the thickening of the alveolar epithelium and the pulmonary capillary basal lamina and also due to the reduced recoiling of the lung.¹³ This is caused by biochemical alteration of connective tissue constituents, particularly collagen and elastin. There is increased cross-linkage formation between polypeptides of collagen which leads to thickening, leading to restriction of lung volume and alveolar gas transport, reduced membrane diffusion capacity and pulmonary capillary blood volume.^{14,15}

CONCLUSION

This study was conducted to measure pulmonary function test (PFT) in type 2 diabetes mellitus subjects and to determine the influence of duration and severity of type 2 diabetes mellitus on pulmonary function test. Pulmonary function tests were measured by MIR Spirolab III spirometer. Statistical analysis of data was done by help of SPSS 20.0 Software (trial Version) And Unpaired -t test and Chi square test is use in data analysis.

According to our study, there was a predominant restrictive pattern of the disease in type 2 diabetes mellitus, with a significant reduction of FVC. From the results of this study following conclusions were drawn:-

This study demonstrated that pulmonary function is significantly decreased in type 2 diabetes mellitus, independent of smoking. Reduced lung functions were of particularly restrictive pattern and more in long durational diabetes mellitus.

There is a need for periodically assessing the pulmonary function in type 2 diabetes mellitus and spirometry remains a cost effective, a simple non-invasive diagnostic tool and its judicious use can give warning signal for patients to take early preventive measures.

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