Original Article

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Assessment of Pulmonary Function Test in Patients with Diabetes Mellitus

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Abstract

Background: The aim is to assess pulmonary function test in patients with diabetes mellitus. **Subjects and Methods:** One hundred fifteen type II diabetes mellitus of both genders were classified into group I. Equal number of healthy controls were put in group II. We recorded forced vital capacity (FVC) (litres), forced expiratory volume in 1 second (FEV_1), FEV1/FVC (%), forced expiratory flow during 25% of FVC (FEF_{25}), forced expiratory flow during 50% of FVC (FEF_{50}), forced expiratory flow during 75% of FVC (FEF_{75}), forced expiratory flow during 25–75% of FVC ($FEF_{25–75}$), forced expiratory flow during 0.2–1.2 litres of FVC ($FEF_{0.2–1.2}$), and peak expiratory flow rate (PEFR). **Results:** Group I were type II diabetes and group II were control. Each group had 75 males and 40 females. The mean age of patients in group I was 57.2 years and in group II was 56.2 years. The mean weight was 62.4 kgs in group I and 60.2 kgs in group II. The mean height was 156.7 cm in group I and 153.7 cm in group II. There was non- significant difference in age, weight and height distribution between both group with p value >0.05. The mean FVC in group I was 76.4 litres and in group II was 92.1 litres, FEV1 was 77.3 in group I and 86.5 in group II, FEV1/ FVC was 1102.4 in group I and 108.8 in group II, PEFR was 56.2 and 75.4, FEF_{25} was 60.8 and 81.9, FEF_{50} was 61.2, FEF_{75} was 73.4 in group I and 84.7, FEF_{25-75} was 64.7 in group I and 73.2 in group II, $FEF_{0.2-1.2}$ was 70.1 in group I and 91.4 in group II. The difference between parameters in both groups was significant (P< 0.05). **Conclusion:** Pulmonary function tests were greatly reduced in type II diabetics as compared to healthy subjects.

Keywords: Diabetics, Pulmonary function tests, forced expiratory flow, forced vital capacity

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Introduction

According to World health organization estimate, there are more than 180 million individuals who are diabetics and this number is going to be doubled till year 2030.[1] India contributes to huge amounts of diabetics worldwide and stands among top Asian countries with higher prevalence of both type I and type II diabetics.[2]

Diabetes is a micro-macrovascular multi- organ metabolic disorder. It affects pancreas first.[3] This gland is responsible for production of insulin from beta cells of islets of Langerhans which control blood glucose level.[4] Any abnormality to pancreas function may hampers its ability to produce insulin which in turns fails to reduce blood glucose level. There are many complications of diabetes. Pulmonary complications of DM are commonest of all.[5] There are reduction in lung volume (LV), respiratory muscle performance, elastic recoil, inflammation of low grade, etc. Apart from this, there is considerable autonomic neuropathy of respiratory muscles and decrease in pulmonary diffusion capacity.[6]

Ljubic et al,[7] in their study revealed that diabetes may result in development of pulmonary complications due to collagen and elastin changes. Few researchers emphasized that increased non-enzymatic glycation of proteins and peptides of the extracellular matrix at chronic high circulating glucose levels may also have an important role in the pathological changes of the lungs in DM patients. Autonomic neuropathy involving respiratory muscles may occur in these patients.[8,9] Considering this, we selected present study with the aim to assess pulmonary function test in patients with diabetes mellitus.

Subjects and Methods

A sum total of one hundred fifteen type II diabetes mellitus of both genders were enrolled in this prospective, observational study. This study commenced for 1 month and it was approved from higher authorities which on scrutinizing found this study beneficial for society and gave their approval. All those were enrolled in this study were convinced for their participation. Once they were fully agreed with their written consent, they were selected.

A case history sheet was formed. Demographic data of each patient was entered in it. We classified all patients into group I. Equal number of healthy controls were put in group II. A

thorough examination was carried in all. 5 ml of venous blood was collected in a sterile vial and the level of glycated haemoglobin was estimated. Based on American Thoracic Society/European Respiratory Society (ATS/ERS guidelines), pulmonary function test (PFT) was performed. We recorded forced vital capacity (FVC) (litres), forced expiratory volume in 1 second (FEV_1), FEV_1/FVC (%), forced expiratory flow during 25% of FVC (FEF_{25}), forced expiratory flow during 50% of FVC (FEF_{50}), forced expiratory flow during 75% of FVC (FEF_{75}), forced expiratory flow during 25–75% of FVC ($FEF_{25–75}$), forced expiratory flow during 0.2–1.2 litres of FVC ($FEF_{0.2–1.2}$), and peak expiratory flow rate (PEFR). All findings obtained were clubbed together and entered in MS excel sheet. All results were studied using SPSS version 21.0. Results were statistically analysed using Mann Whitney U test. P value less than 0.05 was considered significant.

Results

Table 1: Subjects distribution

Groups	Group I	Group II
Status	Type II diabetes	Healthy
M:F	75:40	75:40

Group I were type II diabetes and group II were control. Each group had 75 males and 40 females [Table 1].

Table 2: Comparison of parameters

Parameters	Group I	Group II	P value
Age (years)	57.2	56.2	>0.05
Weight (Kgs)	62.4	60.2	>0.05
Height (cm)	156.7	153.7	>0.05

The mean age of patients in group I was 57.2 years and in group II was 56.2 years. The mean weight was 62.4 kgs in group I and 60.2 kgs in group II. The mean height was 156.7 cm in group I and 153.7 cm in group II. There was non-significant difference in age, weight and height distribution between both group with p value >0.05 [Table 2, Figure 1].

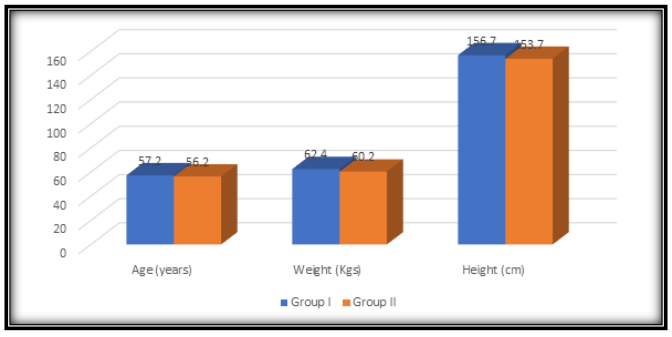

Figure 1: Comparison of parameters

The mean FVC in group I was 76.4 litres and in group II was 92.1 litres, FEV1 was 77.3 in group I and 86.5 in group II, FEV1/ FVC was 1102.4 in group I and 108.8 in group II, PEFR was 56.2 and 75.4, FEF_{25} was 60.8 and 81.9, FEF_{50} was 61.2, FEF_{75} was 73.4 in group I and 84.7, FEF_{25-75} was 64.7 in group I and 73.2 in group II, $FEF_{0.2-1.2}$ was 70.1 in group I and 91.4 in group II. The difference between parameters in both groups was significant (P< 0.05) [Table 3, Figure 2].

Table 2: Pulmonary function test in both groups

Parameters	Group I	Group II	P value
forced vital capacity (FVC) (litres)	76.4	92.1	<0.05
forced expiratory volume (FEV1)	77.3	86.5	<0.05
FEV1/ FVC	110.4	108.8	>0.05
peak expiratory flow rate (PEFR)	56.2	75.4	<0.05
forced expiratory flow (FEF_{25})	60.8	81.9	<0.05
forced expiratory flow (FEF_{50})	61.2	0	<0.05
forced expiratory flow (FEF_{75})	73.4	84.7	<0.05
forced expiratory flow (FEF_{25-75})	64.7	73.2	<0.05
forced expiratory flow ($FEF_{0.2-1.2}$)	70.1	91.4	<0.05

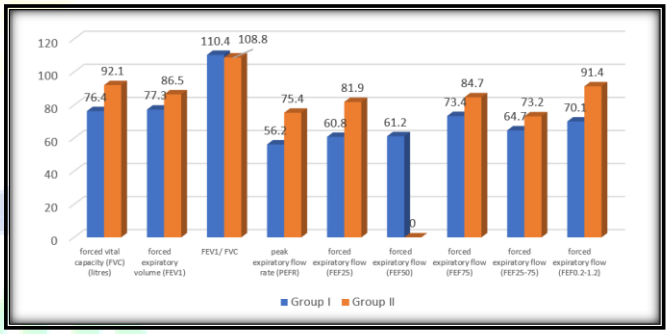

Figure 2: Pulmonary function test in both groups

Discussion

Diabetes mellitus (DM) is a systemic metabolic disorder characterized by the presence of chronic hyperglycemia accompanied by changes in the metabolism of lipids, carbohydrates, and proteins.[10] Diabetes is a global health problem which causes multiorgan damage.[11] The presence of widespread lung microvascular circulation and abundant connective tissue with a large reserve raises the possibility that the lung may be a target organ of the pathologic processes induced by type 2 diabetes.[12] This means that a extensive huge loss in the microvascular bed can be tolerated without developing any significant pulmonary symptoms in type 2 diabetics.[13] This leads to disturbed pulmonary function continuing for a long time and being discovered only at a late stage in the diabetics.[14] The present study assessed pulmonary function test in patients with diabetes mellitus.

Our study comprised of 115 diabetics and equal number of healthy control. Tesema et al,[15] in their study found that in type 2 diabetics PFTs among were significantly reduced when compared to their matched non-diabetics (FVC (%)

(m=73.7± 13.8 vs m=93.8± 12.3), FEV_1 (%) (m=76.4± 13.4 vs m=93.3± 12.4), FEV_1/FVC (%) (m=78.99± 11.4 vs m=96.6± 9.33), PEF (L/s) (m=3.91± 0.28 vs m=5.03± 0.35), and FEF_{25-75} (L/s) (m=2.89± 0.75 vs m=3.39± 0.82)). This study also indicated that body mass index (BMI) and fasting blood sugar (FBS) were negative predictors of FVC%. BMI and FBS were negative predictors of FEV1%. BMI was a negative predictor of mean FEV_1/FVC. BMI and FBS were negative predictors of mean PEF (L/s). BMI and FBS were negative predictors of FEF_{25-75} (L/s).

We observed that the mean age of patients in group I was 57.2 years and in group II was 56.2 years. The mean weight was 62.4 kgs in group I and 60.2 kgs in group II. The mean height was 156.7 cm in group I and 153.7 cm in group II. Kaur et al,[16] assessed pulmonary function tests in 50 type 2 diabetes mellitus (T2DM) and 50 healthy controls. It was found that there was significant reduction in all the PFT parameters in diabetics as compared to controls. Thus, mixed obstructive-restrictive pattern of pulmonary dysfunction is seen in diabetics. A strong positive correlation was seen between fasting blood sugar and FEV1/FVC in diabetics.

We observed that the mean FVC in group I was 76.4 litres and in group II was 92.1 litres, FEV1 was 77.3 in group I and 86.5 in group II, FEV1/ FVC was 1102.4 in group I and 108.8 in group II, PEFR was 56.2 and 75.4, FEF_{25} was 60.8 and 81.9, FEF_{50} was 61.2, FEF_{75} was 73.4 in group I and 84.7, FEF_{25-75} was 64.7 in group I and 73.2 in group II, $FEF_{0.2-1.2}$ was 70.1 in group I and 91.4 in group II. Shah et al[17] correlated forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV_1) in 60 diabetic patients with duration of the disease and glycosylated hemoglobin (HbA1c). 60 normal healthy male controls were also enrolled. The PFTs recorded were - FVC, FEV_1, FEV_1/FVC, FEF_{25}, FEF_{50}, FEF_{75}, FEF_{25-75}, $FEF_{0.2-1.2}$, and peak expiratory flow rate (PEFR). 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.

Conclusion

Pulmonary function tests were greatly reduced in type II diabetics as compared to healthy subjects.

References

1. Hamlin CR, Kohn RR, Luschin JH. Apparent accelerated aging of human collagen in diabetes mellitus. Diabetes 1975;24:902 4.
2. Fogarty AW, Jones S, Britton JR, Lewis SA, McKeever TM. Systemic inflammation and decline in lung function in a general population: A prospective study. Thorax 2007;62:515 20. 7
3. Mori H, Okubo M, Okamura M, Yamane K, Kado S, Egusa G, et al. Abnormalities of pulmonary function in patients with non insulin dependent diabetes mellitus. Intern Med 1992;31:189 93.
4. Williams JG, Morris AI, Hayter RC, Ogilvie CM. Respiratory responses of diabetics to hypoxia, hypercapnia and exercise. Thorax 1984;39:529 34.
5. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, et al. Standardization of spirometry. Eur Respir J 2005;26:319 38.
6. Nathan DM, Singer DE, Hurxthal K, Goodson JD. The clinical information value of the glycosylated haemoglobin assay. N Engl J Med 1984;310:341 6.
7. Davis WA, Knuiman M, Kendall P, Grange V, Davis TM. Glycemic exposure is associated with reduced pulmonary function in type 2 diabetes, the fremantle diabetes study. Diabetes Care 2004;27:752 7.
8. Asanuma Y, Fujiya S, Ide H, Agishi Y. Characteristics of pulmonary function in patients with diabetes mellitus. Diabetes Res Clin Pract 1985;1:95 101.
9. Lange P, Groth S, Kastrup J, Mortensen J, Appleyard M, Nyboe J, et al. Diabetes mellitus, plasma glucose and lung function in a cross sectional population study. Eur Respir J 1989;2:14 9.
10. Barrett Conor E, Frette C. NIDDM, impaired glucose tolerance, and pulmonary function in older adults. Diabetes Care 1996;19:1441 4.
11. Yeh HC, Punjabi NM, Wang NY, Pankow J, Duncan BB, Cox CE, et al. Cross sectional and prospective study of lung function in adults with diabetes mellitus. Diabetes 2002;51:A242 3.
12. Davis TM, Knuiman M, Kendall P, Vu H, Davis WA. Reduced pulmonary function and its association in type 2 diabetes: The fremantle diabetes study. Diabetes Res Clin Pract 2000;50:153 9.
13. Engstrom GJ, Janzon L. Risk of developing diabetes is inversely related to lung function: A population based cohort study. Diabet Med 2002;19:167 70. 17.
14. Kornum JB, Thomsen RW, Riis A, Lervang HH, Schonheyder HC, Sorensen HT. Diabetes, glycemic control, and risk of hospitalization with pneumonia: A population based case control study. Diabetes Care 2008;31:1541-5.
15. Tesema DG, Gobena T, Ayalew A. Pulmonary Function Tests and Their Associated Factors Among Type 2 Diabetic Patients at Jimma Medical Center, in 2019; Comparative Cross-Sectional Study. International Journal of General Medicine. 2020;13:111.
16. Kaur S, Agarwal N. Pulmonary function tests in type 2 diabetes mellitus. Arch Med Health Sci 2016;4:35-9.
17. Shah SH, Sonawane P, Nahar P, Vaidya S, Salvi S. Pulmonary function tests in type 2 diabetes mellitus and their association with glycemic control and duration of the disease. Lung India: Official Organ of Indian Chest Society. 2013 Apr;30(2):108.

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