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Effects of diabetes mellitus on pulmonary function tests

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Abstract
Diabetes mellitus on pulmonary symptoms are poorly described. Some authors report normal pulmonary functions and have conducted that spirometer is not at all important in patients with diabetes. The problems which are connected with Diabetes mellitus are often induced by macro vascular and micro vascular damages. This case control study performed with 50 type 2 diabetes patients and 50 non-diabetic patients. Cases and controls were chosen by implementing inclusion & exclusion criteria using random sampling process. The study was undertaken to evaluate whether the duration of diabetes has any association with severity of pulmonary functions. Mean of the anthropometric parameters and age in diabetic and control group were compared with no significant difference (p value>0.05) between the two groups. In our study we conclude that with increase in duration there was reduction in pulmonary parameters.

Keywords: pulmonary function, diabetes mellitus, glycemic, hemoglobin, peak expiratory, PEFR

Introduction
Diabetes mellitus is a metabolic condition that induces secondary pathophysiological alterations in various organ systems, and the disorders involving these processes are responsible for the majority of diabetes-related morbidity and mortality [1, 2]. There have been several studies which have studied pulmonary function abnormalities in Type1 DM [3, 4]. which evidenced reduced elastic recoil [5, 6] reduced lung volumes [7, 8], diminished respiratory muscle performance [9], decreased in pulmonary diffusion capacity for carbon monoxide[9] but there are only a few studies which have measured lung function in Type 2 DM [10]. While much work is being conducted on the impact of diabetes mellitus on pulmonary parameters worldwide, there is not much literature on this in India. This research was therefore conducted to establish the impact of diabetes mellitus on pulmonary function measures in patients with type 2 DM who are attending or admitted to the medical OPD or KIMS institute.

AIM
To study the effects of diabetes mellitus on pulmonary function tests

Objectives
To compare the pulmonary function tests in type 2 Diabetics and Non-diabetics. To evaluate whether the duration of diabetes has any association with severity of pulmonary functions. To evaluate whether the glycemic status in diabetes have an association with severity of pulmonary functions.

Review of Literature
Maintenance of blood glucose homeostasis is of paramount importance to the survival of human organism. Glucose level is finely and effectively regulated because it is essential to have continuous supply of glucose to the brain as it does not store glucose and RBC, renal medulla are also dependent on glucose. Complications of DM are related to quality of glycemic control, hence normoglycemia or near glycemia is the goal for treatment of diabetic patient. Self-monitoring of blood glucose (SMBG) allows the patient to monitor his or her blood glucose at any time by using glucometer. Long term glycemic control is assessed by measuring glycated hemoglobin (HbA1c). Adult human hemoglobin is heterogenous. In 1958, three minor components which are more negatively charged were separated by ion exchange chromatography and were called as HbA1a, HbA1b and HbA1c. Of these the largest component is HbA1c constituting 60-80% and is frequently measured in clinical practice. DCCT (Diabetes Control and Complications Trial) clearly suggests that normoglycemia is beneficial to delay the pulmonary function derangement [11]. The study of pulmonary function tests in type 2 diabetes mellitus by Makkar, Meenu et.al, clearly states that patients with longer duration of diabetes had significantly low values of FVC, FEV1, PEFR and FEF 75% and FEF 50%[11]. Peak Expiratory Flow Rate (PEFR) is the maximum flow rate attained during FVC maneuver measured as liters per second. PEFR measurement helps to assess the degree of large airway function. This is highly effort dependent and hence many clinicians now use PEFR in addition to FVC and FEV1.

Shaikh GP n *et al* in 2000 published a study in Indian practioner showed that with increase in glycemic status there is derangement in pulmonary function test. That is if glycemic parameters increases there is reduction pulmonary function tests. High FBS levels (>160mg%) were associated with significant reductions in FEV1, FVC, FEV1/FVC, FEF25-75%, PEFR (p value <0.005). These study also showed that PPBS levels as high (>210mg%) the PFT abnormalities were

present across all the parameters (p value< 0.05) [12].

Materials and Methodology

This was a case control study which was conducted in diabetic clinic of Krishna institute of Medical science & Research Centre, Karad from October 2011 to May 2013. 50 type 2 Diabetes Mellitus patients taken from the diabetic clinic of Krishna institute of Medical science & Research Centre, Karad. 50 Non diabetic age, Height, Weight & sex matched subjects were taken. 100 subjects were selected using simple random sampling after taking consent for the same. Established cases of type 2 DM receiving treatment in diabetic clinic from October 2011 to May 2013 in Krishna institute. The PFT was compared with duration of diabetes by ANOVA test (One way ANOVA) and variation among mean duration of diabetes was tested by Tukey-Kramer multiple comparison test.

Observations and Results

Table 1: Age and sex wise distribution of the cases in Group I and Group II

Age in years	Group I (Diabetic) (n=50)		Group II (Non-diabetic) (n=50)	
	Male	Female	Male	Female
40-50	2	3	-	-
50-60	15	9	25	8
60-70	9	7	10	5
> 70	3	2	1	1
Total	29 (58%)	21 (42%)	36 (72%)	14 (28%)
Mean ± SD	61.3±9.07		59.66±6.67	

By studying the table no. 1 the mean age in case of diabetics was 61.3±9.07 and mean age of Non-diabetics was 59.66±6.67. Majority of the patients were in the age group of 50-60 yrs. Thus it can be seen that diabetic and control group was age matched.

Table 2: Correlation between HBA1c with Pulmonary Function Parameters in Diabetic subjects

	Karl Pearson's correlation coefficient value (r)				
	FVC	**FEV_1**	**FEV_1/ FVC**	**PEFR**	**FEF 25- 75%**
HBA1C	-0.2255	-0.2845	-0.2138	-0.3309	-0.4149
't' test value and significance	1.61, p<0.05 significant	2.17, p<0.05 significant	1.52, p<0.05 significant	2.43, p<0.05, significant	3.46, p<0.05 significant

And after applying Karl Pearson co-efficient of variation, all the correlations in table 2 are significant (p<0.05) in Diabetic cases. The correlation between HBA1C and all pulmonary function parameters is negative, that is if HBA1C increases (decreases) all pulmonary function parameters are decreases (increases) in Diabetic subjects.

Table 3: Distribution of respiratory pattern of involvement among diabetics

	Normal	Obstructive	Restrictive	Mixed
Diabetics	7(14%)	6(12%)	12(22%)	25(50%)
Non-Diabetics	38(76%)	8(16%)	2(4%)	2(4%)
	45	14	14	27

From table 3, we see that respiratory involvement was more in diabetics with 6 (12%) patients belonging to obstructive pattern, 12 (22%) in restrictive pattern and 25 (50%) in mixed pattern. Thus we conclude that mixed pattern is more in diabetic group.

Discussion

This was a case control study which was conducted in diabetic clinic of Krishna institute of Medical science & Research Centre, Karad from October 2011 to October 2013. In our study it was seen that mean age in case group was 61.3±9.07 and mean age in control group was 59.66±6.67. According to a study done by Muhammad Irfan *et al* [13] the mean age of diabetics and matched control were 54.3±9 and 54.0±8 (P<0.87) years, respectively. Hence our study is in co-relation with the above study. In our study Weight and height was matched in the two study groups. Mean weight in case group was 58.24±12.67 and mean weight in control group was 60.2±9.03 with p value of > 0.05 which was not significant. Similarly mean Ht in case group was 164.56±6.53 and in control group was 164.48±6.29 with p value > 0.05. Hence it is seen that in our study case and control were Height and weight matched. According to a study by Aparna A[14] case and control were Wt and Ht matched. In present study it was observed that mean FBS, PPBS, HbA1c values in case group was 158.14±50.39, 252.18±66.04, 9.14±1.66 and mean values in control group was 84.9±13.72, 109.26±17.71, 5.86±1.03 and p value in each group was < 0.01 which was highly significant. Thus it seen that there is a significant difference in glycemic index of two groups. In a study done by Aparna A[14] mean values of FBS, PPBS and HbA1c values of diabetic and control group showed significant difference with p value of <0.05. Hence our study is in relation with the above study.

Conclusion

Duration of diabetes was compared with pulmonary function parameters in three study groups (1-3 yrs, 3-5 yrs and > 5 yrs). In our study we conclude that with increase in duration there

was reduction in pulmonary parameters. Out of 50 diabetic patients 7 (14%) were normal, 6 (12%) were having an obstructive involvement, 12 (22%) were having restrictive and 25 (50%) were having mixed pattern of involvement. Hence in our study we conclude that mixed (restrictive and obstructive) pattern of involvement is common in diabetic group.

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