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STUDY ON COMPARISON OF PULMONARY FUNCTION TESTS AMONG DIABETIC AND NON-DIABETIC PATIENTS UNDERGOING MAJOR ABDOMINAL SURGERIES UNDER GENERAL ANAESTHESIA

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ABSTRACT

Background: Diabetes mellitus is a chronic disease with microvascular and macrovascular complications. The pulmonary complications of diabetes mellitus have been poorly characterized. Pulmonary function tests (PFTs) are noninvasive tests that show how well the lungs are working.

Objectives: The aim of this study is to compare pulmonary PFTs in type 2 diabetic and non diabetic patients undergoing elective major abdominal surgeries under general anesthesia.

Materials & Methods: A total of 100 patients (50 diabetic & 50 non diabetic), undergoing elective major abdominal surgeries under general anesthesia were enrolled for the study. Pulmonary function tests were performed 60 minutes before and after the end of surgery. The PFTs recorded were FEV1, FVC, FEV1/FVC, FEF 25%, and Peak expiratory flow rate (PEFR).

Results: Majority of the subjects (34% diabetic and 42% non diabetic) was 51-55 years age group, the mean age among diabetics was 52.9 ± 4.8 and non diabetic group were 51.3 ± 4.8 years. The male were slightly higher than female in both the groups. The mean age, gender and BMI of both the groups was not statistically different and both the groups were comparable at baseline**.** The pulmonary function test (FEV1, FVC, FEF 25%, and PEFR) were significantly reduced in diabetic subjects compared with non diabetic subject, except FEV1/FVC.

Conclusion: The mean scores of FVC, FEV1, PEFR, and FEF 25% were significantly reduced among type 2 diabetic patients as compared to non-diabetic subjects, except FEV1/FVC ratio

Keywords: Diabetes mellitus, pulmonary function tests, FVC, FEV1, FEV1/FVC, PEFR

INTRODUCTION

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, result from impaired insulin secretion, altered tissue sensitivity to insulin or coexistence of both these mechanisms [1]. Diabetes mellitus is a major global health problem associated with long term damage, dysfunction and failure of various organs and its complications are mostly caused

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by macro vascular and micro vascular damages [2-3]. There is extensive micro vascular circulation and abundant connective tissue in the lungs which raises the possibility that lung tissue may be affected by microangiopathy process and non-enzymatic glycosylation of tissue proteins, induced by chronic hyperglycemia, thereby rendering the lung a "target organ" in diabetic patients and observed to contribute to the pulmonary function abnormalities [4-5]. Spirometry is the most common method of the pulmonary function tests (PFTs) which measures mechanical lung function, specifically the amount (volume) and/or speed (flow) of air that can be inhaled and exhaled [6]. Some study observed that increase HbA1c is associated with decrease in lung function parameters FVC & FEV1. They hypothesized that impaired glucose auto-regulation is associated with impaired lung function [7-8]. Clear relationship was found between spirometric pulmonary function test and metabolic control in type 2 diabetes mellitus [9].

Although a lot of research work is being carried out on the effects of diabetes mellitus on pulmonary parameters worldwide, the literature pertaining to this feature is not in abundance from India.

Aims & objectives: In this study, we evaluate and compare the pulmonary function tests among diabetic and non diabetic patients who undergoing major abdominal surgeries under general anesthesia.

MATERIALS AND METHODS

This was a Prospective case control study conducted in the department of anesthesiology in Madurai Medical College and associated Rajaji hospital, Madurai.

Study group (diabetic group) - Diabetic patients with duration of diabetes of 5-15 undergoing elective major abdominal surgeries

Control group (non-diabetic group) – Non diabetic patients undergoing elective major abdominal surgeries.

Inclusion criteria

- Patients of 40-60 years age group with both sexes
- ASA grade I & II
- Elective major abdominal surgeries (duration not more than 04 hours)
- Patients who provide consent for the study

Exclusion criteria

- Duration of surgery > 4 hrs
- Patient requiring mechanical ventilation after surgery
- Patients with cardio-respiratory diseases or any major illness
- Patients who not willing for the study

Pulmonary function tests were performed 60 minutes before and 60 minutes after the end of surgery. All participants of the study underwent assessment of the pulmonary function tests using a spirometer and findings were recorded and compared in both the groups.

The pulmonary function tests performed were; Forced expiratory volume in 1 second (FEV1), Forced Vital Capacity (FVC), FEV1/FVC ratio, FEF 25% and Peak Expiratory Flow Rate (PEFR).

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Statistical analysis: Statistical analysis was carried out by statistical package of social sciences (SPSS) version 22.0. Mean and standard deviation were computed for all continuous variables and comparison was done using Student's t-test. Frequencies were generated for categorical variables and compared with chi-square test. P<0.05 considered statistically significant

RESULTS

Fifty diabetic cases and fifty non diabetic controls who undergoing major abdominal surgery under general anesthesia were selected. The male were slightly higher in number than female in both the groups. Majority of the patients (34% cases and 42% control) were 51-55 years age group, the mean age among diabetics were 52.9 ± 4.8 and non diabetic group were 51.3 ± 4.8 years. The mean duration of surgery in diabetic group was 129.0 ± 24.2 and non diabetic group was 132.6 ± 20.9 minute. The mean age, gender, BMI and duration of surgery of both the groups was not statistically different and both the groups were comparable at baseline

Table 1: Baseline characteristics of the diabetic and non diabetic group

Baseline characteristics		**Diabetic group**	**Non diabetic group**	**P value**
Age Group	41 - 45 yrs	6 (12%)	7 (14%)	0.103
	46 – 50 yrs	9 (18%)	14 (28%)	
	51 – 55 yrs	17 (34%)	16 (32%)	
	56 – 60 yrs	18 (36%)	13 (26%)	
Mean±SD		52.9 ± 4.8 yrs	51.3 ± 4.8 yrs	
Gender	Male	26 (52%)	28 (58%)	0.420
	Female	24 (48%)	22 (44%)	
BMI (Mean±SD)		22.7 ± 1.7	23.2 ± 3.0	0.310
Duration of Surgery in min. (Mean±SD)		129.0 ± 24.2	132.6 ± 20.9	0.428

On preoperative comparison the differences in mean FEV1, mean FVC, mean FEF25% and the mean PEFR (L/min) were statistically significant between the diabetics and non-diabetics group, however the difference in the mean FEV1/FVC was not statistically significant.

Table 2: Preoperative comparison of PFTs in diabetic and non diabetic patients

PFTs	**Diabetic Group (Mean±SD)**	**Non diabetic group (Mean±SD)**	**P value**
FEV 1	84.5 ± 3.5	88.3 ± 3.7	**<0.001**
FVC	80.6 ± 3.0	82.4 ± 2.6	**0.001**
FEV1/FVC	105.8 ± 7.0	107.2 ± 4.4	0.051
FEF 25%	80.9 ± 4.6	83.4 ± 4.1	**0.005**
PEFR	74.4 ± 4.4	77.1 ± 6.8	**0.019**

On post-operative comparison the differences in mean FEV1, mean FVC, mean FEF25% and the mean PEFR (L/min) were statistically significant between the diabetics and non-diabetics group, however the difference in the mean FEV1/FVC was not statistically significant.

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Table 3: Post-operative comparison of PFTs in diabetic and non diabetic patients

PFTs	Diabetic Group (Mean±SD)	Non diabetic group (Mean±SD)	P value
FEV 1	69.1 ± 4.1	86.6 ± 3.6	**<0.001**
FVC	63.1 ± 4.6	80.4 ± 3.5	**<0.001**
FEV1/FVC	108.8 ± 6.3	107.8 ± 4.9	0.269
FEF 25%	62.6 ± 4.3	81.9 ± 3.4	**<0.001**
PEFR	59.1 ± 3.4	76.3 ± 5.6	**<0.001**

DISCUSSION

The link between diabetes mellitus and pulmonary function is not fully understood
Defective pulmonary function seen in diabetes can be due to diabetic microangiopathy in lungs. The potential mechanism of decreased lung function can also be non-enzymatic glycosylation of proteins, such as collagen in the lungs and chest wall [10].

The mean age of our study group among diabetics were 52.9 ± 4.8 and non diabetic group was 51.3 ± 4.8 yrs, not significant (P>0.05). This is similar to the study published by Tesema et al [11] and Irfan M et al [12].

In this study male was predominant in both the group as compared to female, but statistically not significant (p>0.05), our finding constant with the study done by Kumari R, et al [13] and Mahendra kumar K, et al [14].

The mean Body Mass Index of the study group was 22.7 ± 1.7 kg/m2 and the control group was 23.2 ± 3.0 kg/m2, (P>0.05). In this study BMI was within the normal range, concordance results reported by Borst, et al [15] and Klein O, et al [16]. This probably only reflects the need for varied BMI standards based on ethnic background.

A study done by Li AM, et al [17], documented that the BMI significantly reducing the lung function, but current study revealed that BMI not significantly affect the lung function. The effect of BMI in reducing lung function may be due to reduced chest wall compliance and increased airway resistance.

In our study on pre and post operative measurement the mean value of FVC, FEV1, FEF 25% and PEFR in diabetic group were found to be less than the non diabetic group and the difference was statistically significant. Similar observation was detected by many other researchers: Shravya Keerthi G, et al [18], Aparna A. et al [19] and Kaur S, et al [20], reported that pulmonary function tests were reduced in diabetic patients as compared to non diabetic individuals. This is the likely explanation for chronic hyperglycemia causing glycosylation of lung collagen and hence less compliant lung parenchyma leading to restrictive changes in lungs.

In the present study, the FEV1/FVC ratio was slightly increased in type 2 diabetics as compared to that in the non diabetic group and the increase was not significant statistically (p>0.05), in agreement with the Taha EH, et al [21] and Walter R, et al [22]. The increased FEV1/FVC % suggested that the impairment of pulmonary functions in type 2 diabetics was primarily restrictive in nature.

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The pathophysiology behind this is that reduced lung function in diabetic patients is the alteration in the alveolar-capillary network in the lungs producing micro angiopathic changes.

CONCLUSION

We have concluded that the age of the patients, gender distribution, BMI and duration of surgery were not significant statistically between the diabetic and non diabetic group. **P**ulmonary function tests (FEV1, FVC, FEF 25% and PEFR) were significantly reduces in diabetic patients as compared to non diabetic patients, except FEV1/FVC ratio were not differing statistically significant. Early detection of functional impairment and its appropriate treatment will probably help to reduce morbidity.

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Conflicts of interest: None

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