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Relation of FEV1/FVC in Type 2 Diabetes Mellitus Patients

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Abstract: ***Aim and Objectives: To study the relationship of FEV1/FVC in type 2 diabetes mellitus patients by performing spirometry. Methods: Study included non - smoker, diabetic patients, who had no previous history of respiratory disease and undergone pulmonary function test by spirometry. This study included 100 such patients (50 male and 50 female). Spirovit schiller SP - 1 pneumotech flowsensor spirometer was used. FEV1/FVC was measured and analysed. It was an observational study. The study was conducted at Department of General Medicine, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh, India. Results: There was no significant derangement in the spirometric readings of FEV1/FVC of the diabetic patients. Only significant result was that as the duration of Diabetes mellitus increases the ratio decreases. The mean FEV1/FVC value was 73.28 % in male patients and while it was 79.46 % in female diabetic patients. In male diabetics with diabetes duration >5 years the mean FEV1/FVC value was 72.15 and in male diabetics with diabetes duration =/<5 years the value was 75.27. In female diabetics with diabetes duration >5years the mean FEV1/FVC value was 77.98 and in female diabetics with diabetes duration =/<5 years, the value was 81.30. p value was observed to be 0.240. In diabetics patients with diabetes duration > 5years, the mean FEV1/FVC value was 80.31 and in diabetics with diabetes duration=/<5 years the value was 90.92. Conclusions: This study reveals non significant relation of FEV1/FVC with diabetic patients. There was no significant derangement in the spirometric readings of FEV1/FVC of the diabetic patients in this study in contrast to what was seen in other studies. There is a need for further study in this area, extending the study to a larger group.***

Keywords: Diabetes, t2dm, spirometry

1. Introduction

Global burden of diabetes mellitus is increasing day by day. India is becoming the diabetes capital of world. It leads to serious morbidity and mortality among patients. Diabetes mellitus and its complications has become a challenge for health care industry. There are 347millions diabetics world wide.1More than 67 million people have been affected in India. It has become the diabetic capital of world. WHO projects that diabetes will be the 7th leading cause of death in 2030.[1] It is increasing in incidence, and along comes the long term complications. [2]Diabetes mellitus is an incurable life – long disease, involving multiple systems, and with devastating complications which end up in severe disability and death.3 Diabetes mellitus complications include mainly the consequences of macro and micro – vascular damage.[4]

Diabetes per se is not associated with any specific pulmonary symptom and hence periodic screening for lung disease is not done. However, an extensive micro vascular circulation and an abundant connective tissue in the lung raise the possibility that the lung may also be a target organ in diabetic patients.[5, 6] However, because of its large reserve, substantial loss of the microvascular bed can be tolerated without developing dyspnea. As a result, pulmonary diabetic micro – angiopathy may be under - recognized clinically.[5, 7]

Theoretically, several pathological changes may affect the lungs in patient with DM. The pathophysiology for reduced lung functions in diabetics is still not very clear but there have been some reports of fibrosis in the lungs of diabetic patients.8 Impairment in lung function of patients with diabetes are believed to be the consequence of biochemical alterations in the connective tissue constituents of the lung, particularly collagen and elastin.[9- 12]This may result in reduction in elastic recoil of the lung, lung volumes, and pulmonary capacity for the diffusion of carbonmonoxide.[12] The concomitant pulmonary structural impact of these biochemical alterations, consist of a thickening of the alveolar epithelial basal lamina and a specific type of nodular fibrosis of the lung.[13] Autonomic and phrenic neuropathy causing alterations in bronchial reactivity and respiratory muscle function was also suggested in one study.[14]

Ventilation of lungs may be affected by my opathy and altered elastic recoil of lung tissue. Perfusion may be affected by changes in basement membrane and micro – vascular angiopathy.

Normal lung function has three components, which contribute to gas exchange.

- Ventilation
- Perfusion
- Diffusion

Spirometry is a basic, widely used pulmonary function test (PFT). It typically assess the lung volumes and flow, and is ideally suited to describing the effects of obstruction or restriction on lung function.[15]

PFT has assumed a key role in epidemiological studies investigating the incidence, natural history and causality of lung disease.[16] Spirometry is essential for diagnosing respiratory illnesses, assessing their severity, determining response to treatment and tracking patients progress over

time.[17]

Pulmonary damage at an early stage in most patients with diabetes mellitus is subclinical, and rarely present with complaints.[18]Spirometry non – invasively quantifies the physiological reserves in a large micro - vascular bed that is not clinically affected by diabetes. Lung functions may provide useful measures of the progression of systemic microangiopathy in diabetic patients.[18]

Pulmonary dysfunction may be one of the earliest measurable non – metabolic alteration in diabetes.[19, 20] Despite the unclear nature, the relationship between DM and pulmonary function tests (PFTs) remains important because of potential epidemiological and clinical implications. The loss of pulmonary reserve may become clinically important. The aim and objective of this study is to study the relationship of FEV1/FVC in type 2 diabetes mellitus patients by performing spirometry.

2. Methods

This was a cross-sectional prospective study. Cases included non - smoker diabetic patients, who had nohistory of respiratory disease and undergone spirometry.

The present study was conducted at department of General Medicine, Shri Ram Murti Smarak Institute of Medical Sciences Bareilly, Uttar Pradesh, India. Patients who attend medical OPD and IPD were included in the study.

Inclusion Criteria

a) Patients with type 2 Diabetes mellitus of at least 6monthsduration, and who were able to give informed consent.
b) No history of smoking, with no recent history of respiratory illness,
c) No respiratory symptoms such as running nose, sore throat, pain suggestive of sinusitis, epist axis, dry throat, hoarseness of voice, cough and dyspnoea.

Exclusion Criteria

a) Present or past history of smoking,
b) Present or past history of respiratory illness that might affect lung function such as bronchiectasis, tuberculosis, asthma, interstitial lung diseases, COPD,
c) History of occupational exposure to any substance that could affect lung function. Individuals with current or recent respiratory tract infection that predisposes to heightened air way reactivity,
d) Individuals with unacceptable spirometry techniques. Unacceptable spirometry means any effort in which FEV1 or FVC could not be measured due to:
   - Cough
   - Submaximal effort
   - Obstructed teeth
   - Air escape
   - Effort sustained for less than 6 seconds duration
   - Failure to attain a volume time curve
   - Lack of understanding the procedure
   - Recent surgery
e) Patients who have cardiac and liver disease on history (history of jaundice) and clinical examination (icterus, ascites, hepatomegaly, splenomegaly) basis.

The study protocol has been evaluated and approved by the department and institutional review committee. Informed consent was taken from all the patients.

3. Methodology

For spirometry spirovit schiller SP - 1 pneumotech flow - sensor with SEMA PC software was used. Chest X – ray was done to exclude the presence of pre – existing pulmonary disease.

Data Collection

Data was obtained by taking a detailed history of patients. Information on major co - morbidities, significant past history, and occupational history was taken. Patients were thoroughly examined including general and systemic examination. The following parameter was measured FEV1/FVC by using spirometer.

Statistical Analysis

The results were analyzed using SPSS software. Values were expressed as a percentage of each group or as mean+/ - SD unless otherwise stated. t Test was used to test the difference between two means. On the basis of p value, we defined the significance of above mentioned statistical variables. P value <0.05 was taken to be significant.

Table 1: Characteristic of Patients

Characteristics	Diabetic (n=100)			
	Male (n=50)		Female (n=50)	
	Mean+/ - S. D.	Range	Mean+/ - S. D.	Range
Age (years)	55.28+/ - 9.89	42 - 74	54.4+/ - 10.98	34 - 73
Weight (kg)	65.4+/ - 11.47	42 - 82	59.88+/ - 8.58	44 - 77
Height (cm)	165.28+/ - 7.85	142 - 176	154.12+/ - 7.68	144 - 168

4. Results

A total number of 100 cases were taken for analysis. There were 100diabetic patients. The mean age of male subjects was 55.28 years (range 42 – 74 years) and the mean age of female subjects was 54.4 years (range 34 – 74 years) (Table1). The mean weight of males was 65.4 kg (SD 11.47, range 42 - 82 kg), and the mean weight of females was 59.88 kg (SD 8.58, range 44 – 78 kg) (Table1). The mean height of males was 165.28 cm (SD 7.85, range 142 - 176 cm), and the mean height of females was 154.12 cm (SD 7.68, range 144 - 168 cm (Table 1). The number of patients with diabetes duration more than 5 years were 66 and number of patients with diabetes duration less than or equal to 5 years were 34 (Table 2).

The number of patients with diabetes duration more than 5 years among males were 36 and number of patients with diabetes duration more than 5 years among females were 30, while number of patients with diabetes duration less than or equal to 5 years among males were 14 and number of patients with diabetes duration less than or equal to 5 years among females were 20 (Table 2). The spirometric values were found to be lower in diabetic individuals (Table3).

Table 2: Total Number of Patients according to Duration of Diabetes

Gender	Total no. of diabetic patients	No. of patients (Diabetes duration>5 years)	No. of patients (Diabetes duration</=5 years)
Males	50	36	14
Females	50	30	20

Table 3: Analysis of Spirometric Findings

Gender	Parameters	Diabetic
		Mean (SD)
Males	FEV_1/FVC (%)	73.28 (8.41)
Female	FEV1/FVC (%)	79.46 (13.87)

The mean FEV1/FVC value was 73.28 % in male patients and while it was 79.46 % in female diabetic patients.

Table 4: Spirometric Findings in Male Diabetics Subjects

Males	Diabetes duration >5 year (n=36)	Diabetes duration </=5 years (n=14)	P value
Mean FEV_1/FVC (%)	72.15	75.17	0.290

The spirometric values were consistently lower in male diabetics with diabetes duration > 5years than in male diabetics with diabetes duration=/<5years (Table4).

In male diabetics with diabetes duration >5 years mean FEV1/FVC values was 72.15and in male diabetics with diabetes duration =/<5 years it was75.17. (Table4). The spirometric values were consistently lower in female diabetics with diabetes duration > 5years than in female diabetics with diabetes duration=/< 5years (Table5).

In female diabetics with diabetes duration >5years the mean FEV1/FVC value was 77.98 and in female diabetics with diabetes duration =/<5years, it was 81.30 (Table 5).

Table 5: Spirometric Findings in Female Diabetics Subjects

Females	Diabetes duration >5 yrs (n=30)	Diabetes duration </=5 years (n=20)	P value
Mean FEV_1/FVC (%)	77.98	81.30	0.346

The spirometric values in predicted % were consistently lower in diabetics with diabetes duration >5 years than in diabetics with diabetes duration=/<5years (Table6).

Table 6: Spirometric values in predicted % of diabetes according to duration

Parameters in Predicted %	Diabetics >5 years (n=66)	Diabetics </= 5 years (n=34)	P-value
FEV1/FVC%	80.31	90.92	0.241

In diabetics patients with diabetes duration > 5years, mean FEV1/ FVC predicted % value was 80.31 and in diabetics with diabetes duration=/<5years it was 90.92.

5. Discussion

This study was undertaken to assess the ventilatory functions of type 2 diabetes mellitus patients.

In the present study, 100 diabetics were taken. The parameters (age, height and weight) being the major determinant of the spirometric values, were comparable in this study.

Spirometric values were found to be consistently lower in diabetics our results confirm the results observed in other studies that showed decreased pulmonary functions in diabetics.

Davis WA et al, conducted a large community based study in Western Australia in type 2 diabetic patients and demonstrated that FVC, FEV1, and PEF were decreased in type 2 diabetic patients.[22] They also suggested that the reduced lung volumes and airflow limitation are likely to be chronic complications of type 2diabetes.

Meo SA et al, in their study on Saudi diabetic patients showed significant reduction in FVC, FEV1 and PEF, as compared to their matched controls.[23]They also showed a strong association with a dose - effect response of duration of disease and decreased pulmonary functions impairment in their diabetic patients.

Similarly, Cazzato S et al, conducted a cross sectional study to assess pulmonary functions in children with insulin dependent diabetes mellitus (IDDM), and reported that FVC and FEV1 were significantly lower in diabetics than in controls.2[4]

Similarly, Makkar P et al, performed spirometry on patients with IDDM, and reported that the IDDM patients had reduced FVC, FEV1 as compared totheirmatchedcontrol.2[5]

In present study, there was a tendency for all parameters to fall with longer duration of diabetes. However, statistical analysis showed that this was not significant. Diabetics with more than 5years duration, showed a more pronounced fall in FVC. This revealed that longer duration of diabetes was associated with more significant spirometry abnormalities. This was supported by many other studies.

Rosenecker J et al, demonstrated that in patients with diabetes, FVC and FEV1 declined significantly over the five year study period, whereas patients without diabetes did not show a significant decline duringthisperiod.2[5]

6. Conclusion

This study reveals non significant relation of FEV1/FVC with diabetic patients. There was no significant derangement in the spirometric readings of FEV1/FVC of the diabetic patients in this study in contrast to what was seen in other studies. There is a need for further study in this area, extending the study to a larger group, with inclusion of diffusion studies in the protocol.

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