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A Study on Spirometric Evaluation in Patients with Diabetes Mellitus

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Abstract
The prevalence of diabetes mellitus is on a rising trend. Though great attention has been centered on the chronic complications like retinopathy, nephropathy, neuropathy and the macrovascular complications, the pulmonary complications have been poorly characterised. The aim of the present study was to assess the effects of chronic hyperglycemia on lung function, focusing on mechanical aspects of lung dysfunction with the help of spirometry. These complications might have a significant impact on the quality of life of the patients. This study showed reduced lung function in patients with diabetes, showing a restrictive pattern of lung involvement. Diabetes duration seems a more important influence than the glycaemic control.
Keywords: *Diabetes Mellitus, Spirometry.*

Introduction

Diabetes mellitus is a growing epidemic in the world. Nearly 70% of the people with diabetes live in developing countries; the largest numbers are in the Indian subcontinent (65.1 million) and China. The largest numbers with diabetes are in the 40 to 59 age groups (132 million, in 2010) which is expected to rise further. The prevalence of diabetes has risen from 30 million in 1985 to 382 million in 2013. It is estimated that the prevalence may rise to 592 million by the year 2035 according to current trends.[1]

Diabetes mellitus affects many organ systems and are the cause for the majority of the mortality and morbidity associated with the disease. Chronic complications are divided as vascular and non vascular complications. The vascular complications are divided as micro and macrovascular complications. The risk of chronic complications increases with the duration of the disease and the glycemic control. Since type 2 DM has a long asymptomatic period many patients present with complications at the time of diagnosis. Airflow limitation and reduction in lung volumes are likely to be chronic complications of diabetes mellitus. This study hypothesises that the lung is also a target organ in diabetes.[2] The pulmonary function is assessed using spirometry.

Materials and Methods

Diabetic patients, who are on treatment for more than 3 months were randomly selected from the outpatient department. Their consent was taken. Screening of the patients was done for exclusion criteria and 100 patients were included in the study. A detailed history including the duration and treatment along with examination of the respiratory system was carried out. Age, height (in cms), weight (in kg), body mass index (wt in kg/ht in m^2) was recorded. All the findings were recorded in the proforma. Fasting blood sugar[3], Post prandial blood sugar[3], HbA1c[4] levels were measured for all the study subjects.

Smokers, those with previous history of lung disease, those with signs and symptoms of respiratory infections at the time of test, Obese person (BMI > 30 kg/m^2), those with neurom-uscular disease or thoracic cage abnormalities were all excluded from the study.

Spirometry was performed in all the study subjects and the variables recorded were forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), peak expiratory flow(PEF) and the ratio of FEV1/FVC.

Results

Among the 100 diabetic subjects, most of them belonged to the age group of 41-50 years. Our study showed that all the spirometric variables, that is, FVC and FEV1 were reduced to less than 80% of the predicted values. PEFR was also reduced. The ratio of FEV1/FVC was within normal limits suggestive of a restrictive pattern. [Table -2,3]

Table 1: Age distribution

Age group	No	%
Upto 40 years	12	12.0
41-50 years	56	56.0
51-60 years	32	32.0
Total	100	100.0
Range	20-60 yrs	
Mean	46.53 yrs	
SD	8.58 yrs	

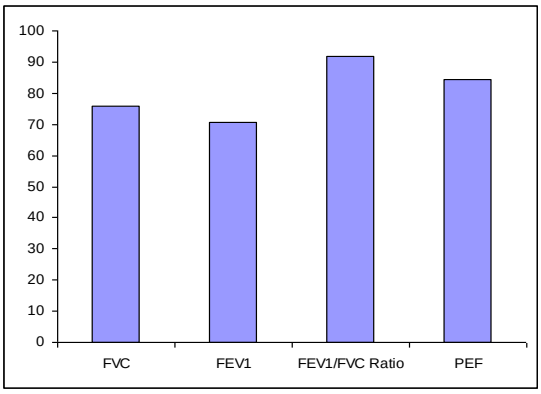
Table 2: Observed spirometric results

Variable	Mean	SD
FVC	2.31	0.60
FEV1	1.78	0.59
FEV1/FVC Ratio	76.17	9.15
PEF	399.51	77.71

Table 3: % predicted PFT in diabetic subjects

Variable	Mean	SD
FVC	75.82	14.96
FEV1	70.45	19.20
FEV1/FVC Ratio	91.82	10.97
PEF	84.31	11.53

Graph -1: % predicted PFT in diabetic subjects



Discussion

The results of the present study indicate that diabetes is associated with reduced lung function. This study is in accordance with many previous studies which showed reduced pulmonary function in diabetic patients.[5-9]

Timothy Davis et at conducted a study on pulmonary function test in 421 European subjects with type 2 diabetes. The pulmonary function parameters were reduced by an average of approximately 10%. The lowest values were observed in smokers, both current and ex-smokers.[10]

Uchida et al found that the pulmonary diffusion capacity was decreased in patients with diabetes. A perfusion defect in ventilation perfusion scintigrams was observed.[11]

Ehrlich et al showed that patients with diabetes were at increased risk of pulmonary conditions like Asthma, COPD, fibrosis and pneumonia.[12]

The mechanism by which impaired glycemic control may lead to a reduction in lung function is

uncertain, though it has been suggested that the increased systemic inflammation associated with diabetes [13] may result in pulmonary inflammation [14] as well, and hence, it can cause air way damage[15]. Moreover, secondary reduction in the antioxidant defence of lung and increased susceptibility to environmental oxidative insults results in the subsequent loss of lung function[16] and ultimately, lung damage. The thorax and lungs are rich in collagen and elastin. Stiffening of lung parenchyma can occur because of nonenzymatic glycosylation of these structural compounds. This may lead to restrictive pattern.[2] In our study, more than 50% of the diabetic patients had a restrictive pattern of lung involvement with <80% predicted values of FVC and FEV1, and the ratio of FEV1/FVC was >70% of predicted values.

Conclusion

Diabetes Mellitus being a systemic disease, also affects lungs causing restrictive type of pulmonary function tests probably because of glycosylation of connective tissues, reduced pulmonary elastic recoil and inflammatory changes in lungs. It is advisable therefore, that diabetic patients must undergo periodic spirometry tests to assess the severity of lung function impairment. Additional research is required to identify pathophysiologic mechanisms and to determine clinical significance of this association.

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