Original Article

Prevalence of Lung Dysfunction in Chronic Type 2 Diabetic Mellitus

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Abstract

Background and objectives: Lung dysfunction is seen as a microvascular complication of diabetes which can be prevented if proper attention is paid during the course of clinical examination. Our effort in the present study was to evaluate the prevalence of pulmonary dysfunction among asymptomatic type 2 diabetic patients. We studied the association of lung dysfunction with age, gender, duration of diabetes and body mass index (BMI).

Methods: Subjects with established diabetes for over three years and did not have prior history of lung dysfunction were considered for this study. After screening, pulmonary function test was conducted in subjects fitting the inclusion criteria. Finally, 100 patients (41 men and 59 women) between 23 to 75 years of age were enrolled for the study.

Results: The prevalence of lung dysfunction was higher among those over 50 years of age compared to those less than 50 years (P=0.03). The prevalence of lung dysfunction was higher among women compared to men (50.5% vs. 38.1%), but not statistically significant. Duration of diabetes was significantly associated with the prevalence of lung dysfunction (P=0.05), but BMI was not to affect the prevalence of lung dysfunction (P=0.5). FEV1/FVC ratio was significantly different among those with lung dysfunction (P=0.0001).

Conclusions: This study shows a clear correlation between occurrence of increased lung dysfunction and diabetes. Further, the results suggest that abnormal pulmonary function test value is a good indicator for referring a patient for radiography and diffusion-perfusion tests to assess pulmonary function.

Keywords: Pulmonary dysfunction; type 2 diabetes; BMI; FEV1/FCV ratio; age

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Introduction

The World Health Organization has estimated that the number of diabetics in the year 2000 was 171 million, and the prevalence is projected to be 366 million in 2030[1]. But it was observed that 346 million people were affected with diabetes in 2012. Microvascular and macrovascular complications of diabetes are well known, impaired lung function has attracted growing interest as a potential complication of diabetes[2]. Lung dysfunction is seen as a microvascular complication of diabetes which can be prevented if proper attention is paid during the course of clinical examination. Cross sectional studies have shown that adults with diabetes have lower lung vital capacity than their non-diabetic counterparts[3]. The changes associated with lung dysfunction 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. The pathophysiology includes microangiopathy due to non-enzymatic glycosylation of proteins induced by chronic hyperglycemia[4].

In an era where sophisticated equipments are getting popular and the cost of medical expenditure getting higher, pulmonary function test provides great value in diagnosing lung dysfunction and prevents its potential complications. Pulmonary function test is available in tertiary care centres and is a simple cost effective test. There is limited data on the risk of pulmonary disease in patients with diabetes. Individuals with diabetes are at increased risk of several pulmonary conditions such as asthma, COPD etc. due to declining lung function. Our effort in the present study was to evaluate the prevalence of pulmonary dysfunction among asymptomatic type 2 diabetic patients. We studied the association of lung dysfunction with age, gender, duration of diabetes and body mass index (BMI). We also analyzed the type of ventricular patterns associated with lung dysfunction in type 2 diabetes patients.

Materials and Methods

This cross sectional study was conducted in the Departments of Medicine and Diabetology at a tertiary care hospital. Institutional Ethics Committee approved the study and informed consent was obtained from all participants. Subjects with established diabetes for over three years and did not have prior history of lung dysfunction were considered for this study. Subjects with history of smoking, alcohol consumption, recent cardiac events, uncontrolled hypertension, skeletal abnormalities and had significant abnormal laboratory findings were also excluded. The subjects were invited to the study centre from a local population and were subjected to screening procedure. Screening procedure included obtaining patient's demographic data and medical history, physical examination, baseline symptomatology, lab investigations such as fasting blood glucose, HbA1c, lipid profile, urea, creatinine, liver function test, chest X-ray and ECG. Subjects fitting the inclusion criteria were asked to come back next day for pulmonary function test. Finally, 100 patients (41 men and 59 women) between 23 to 75 years of age were enrolled for the study.

Baseline spirometry was performed using a vital graph model S bellows spirometer (Vital graph, Buckingham, U.K.). Each subject provided at least three acceptable tracings, from forced vital capacity (FVC %), forced expiratory volume in one second (FEV1%) and forced vital capacity ratio (FEV1/FVC). All values were corrected for body temperature, air pressure and water saturation. Before analysis, spirometric data was normalized by both dividing by the square of the patient's height and expressing them as a percentage of those predicted for age, sex and height based on data from healthy non-smoking Indian subjects aged 23-75 years.

The ventilator patterns were estimated using the above predicted values and classified as Normal, obstructive and restrictive patterns. These ventilator patterns are further classified as mild restrictive (MR), moderate restrictive (MDR), moderate severe restrictive (MDSR) and severe restrictive (SR) as well as very severe restrictive (VSR) ventilator patterns, obstructive pattern (OP) and moderate obstructive pattern (MDO).

The data was analyzed by SPSS 15.0. The descriptive statistics were represented as frequency, percentage, range, mean and standard error (mean). Inferential statistics was done by chi square test for association at 5% level of significance with 20% type 2 errors.

Results

Of the 100 patients, 33% had age <50 years, and 77% had diabetes for duration of less than 5 years. According to BMI classification by CDC & WHO, 29% of the subjects were malnourished, 41% were normal built, 26% were overweight and 2% were obese/very obese.86% of the subjects were on oral anti-diabetic treatment and the rest were on insulin + oral anti-diabetic agents.

Table 1: Other illnesses of the patients

Illness	Percentage
Anaemia	7.2
Cellulites	3.6
Cellulites L UL	3.6
DCMP	3.6
Diabetic foot	3.6
Hypertension	39.2
Ischemic heart disease	10.6
Monoparesis L UL	3.6
Mucor mycosis + L total ophthalmoplegia	3.6
Nephropathy	3.6
RHD	3.6
RHD+ Diabetic retinopathy	3.6
Ulcer foot	10.6

Table 2: Distribution of type 2 diabetes patients for spirometry

Spirometry findings	Percentage
Normal	14
Abnormal	86
MR	39.5
MDR	26.7
MDSR	15.2
SR	16.3
VSR	2.3
OP	2
MDO	1

The prevalence of lung dysfunction was higher among those over 50 years of age compared to those less than 50 years (P=0.03). The prevalence of lung dysfunction was higher among women compared to men (50.5% vs. 38.1%), but not statistically significant. Duration of diabetes was significantly associated with the prevalence of lung dysfunction (P=0.05), but BMI was not to affect the prevalence of lung dysfunction (P=0.5). FEV1/FVC ratio was significantly different among those with lung dysfunction (P=0.0001).

Discussion

Our study results show that subjects below 50 years of age had lower incidence of abnormal respiratory pattern compared to those above 50 years. This provides valuable information suggestive that lung dysfunction is associated with age and diabetes[5]. Our cross sectional study further suggested that restrictive ventilator patterns were observed in most of the study subjects compared to obstructive ventilator pattern. This study shows the relationship between variables suggestive of prevalence of lung dysfunction among type 2 diabetics. Patients with diabetes have an impaired ventilator response to hypoxia. They have increased perception of dyspnoea when hypoxic and make an increased respiratory effort but changes in tidal volume are decreased. Abnormal peripheral airway function is thought to be responsible for altered response to hypoxia[6].

There are studies that suggested a possible relationship between respiratory dysfunction and BMI[7]. But such a relationship was not observed in the present study. The duration of diabetes was not a significant factor in

restrictive ventilator patterns though studies have supported the notion that lower lung function, particularly decreased vital capacity, not only precedes the onset of the diabetes, but also continues an accelerated phase after the disease has set in [8]. Histopathology evidence of lung involvement in subjects with diabetes mellitus has included thickened alveolar epithelial and pulmonary capillary basal laminate[9,10]. Other possible contributory factors include location of chest wall, bronchial tree proteins, autonomic or phrenic neuropathy causing alteration in bronchial reactivity and respiratory muscle function and an increased propensity to respiratory infection[11-13]. In a study on diabetes-induced hamsters, hyperglycaemia was found to cause lung damage, after 6 weeks of diabetes-induction[14]. Thus our results agree with earlier studies that have shown that diabetes can cause pathologic changes to the lungs and patients should be screened for this condition.

Conclusions

This study shows a clear correlation between occurrence of increased lung dysfunction and diabetes. Further, the results suggest that abnormal pulmonary function test value is a good indicator for referring a patient for radiography and diffusion-perfusion tests to assess pulmonary function. We conclude that a single measurement of pulmonary function at the diabetic OPD can provide important information about the lung status of asymptomatic diabetes patients who might require a pulmonary evaluation. Early diagnosis of lung complications would help preventing and reducing morbidity in diabetic patients.

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