ISSN: 2279 - 0594

Available Online at www.jbpr.in

Journal of Biomedical and Pharmaceutical Research 3 (1) 2014, 58-60

RESEARCH ARTICLE

A STUDY OF FORCED VITAL CAPACITY IN TYPE 2 DIABETES MELLITUS PATIENTS IN CHITRADURGA CITY, KARNATAKA

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Received 02 February 2014; Accepted 15 February 2014

ABSTRACT

Diabetes Mellitus (DM) is a metabolic disorder precipitating micro vascular, macro vascular complications and peripheral vascular diseases. Less has been known about the after effects of diabetes on lungs. So this work was carried out to know the relation between diabetes and pulmonary function tests. The study group consists of 100 patients with diabetes. Vital capacity was measured by Medspiror. The data was statistically analyzed by using cross tabs procedure (contingency coefficient test), descriptive statistics. **Results and conclusion:** Among 100 patients 78 had decreased vital capacity and remaining 22 had normal spirometric pattern. Even though Type2 diabetic patients did not have any respiratory symptoms they did have underlying sub clinical restrictive patterns of lung functions. Type 2 Diabetes mellitus is associated with restrictive pattern of respiratory abnormality. Spirometry remains a cost effective, a simple non-invasive early diagnostic tool and its judicious use can give warning signal for patients to take early preventive measures.

Key words: Type 2 Diabetes Mellitus, Micro Vascular, Macro Vascular, vital capacity

INTRODUCTION:

Diabetes mellitus represents a spectrum of metabolic disorders, which has become a major health challenge worldwide. The unprecedented economic development and rapid urbanization in Asian countries, particularly in India has led to a shift in health problems from communicable to non communicable diseases. Diabetes and cardiovascular diseases lead this list. It is predicted by the World Health Organization that India would contribute nearly 57 million people to the global burden of diabetes by the year 2025 (1) and it would become the "Diabetic capital" of the world (2). Recent reports suggest that these figures are based on conservative estimates and do not include rise in diabetes related risk factors like obesity and aging of the population. Hence, the original numbers projected may be too low and the actual figures may be around 80million by the year 2030 (1).

Hutchinson, a London surgeon, in 1846 in his classic treatise "On the capacity of lungs and respiratory function" introduced the concept of spirometry. He suggested that vital capacity might be good indicator of functional status of the lungs. However, Hutchinson, credited a physiologist of earlier years, Borelli (1679) for being the first person to attempt measurement of "quantity of air received by a single inspiration". Measurement of vital capacity was used during the First World War for assessing fitness of military personnel, particularly aircrew for the Royal Air Force. The Indian perspective was first presented to the Indian Science Congress in 1929 by Major General S.L. Bhatia of the IMS, the then Professor of Physiology and Medicine, and the Dean, Grant medical college Bombay. Elanor Mason from Madras first reported in the Indian Science Congress of 1932 the data of lung functions for Indian women.

From 1950's onwards, rapid development of sophisticated measuring devices have refined the measurement methods.(3)

Forced Vital Capacity: (FVC) is defined as the maximum volume of air expired forcefully and rapidly after a maximal inspiration to the level of total lung capacity. FVC is recorded in liters.

Significance: The FVC is normally equal to the slow vital capacity in subjects without airway obstruction. The FVC and VC should be within 5% of each other. The FVC and VC differ substantially if the subject's effort is variable or in the presence of severe airway obstruction. Decreased FVC is also a common feature of restrictive lung disease.

Materials and methodology:

Hundred diabetic patients previously diagnosed, belonging to either sex attending / admitting to OPD / ward at

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Basaveshwara medical college Hospital,Chitrdurga, were studied.

Inclusion criteria:

Previously diagnosed diabetic patients, non- smokers, with no previous H/o any respiratory diseases and clinically ruled out cardiovascular diseases.

Exclusion criteria:

Smokers, non-diabetics, patients with previous/present cardiorespiratory diseases.

Pulmonary functions were carried out using the instrument medspiror (a computerized spirometer self-calibrating, which fulfill the criteria for standardized lung function tests) available. Medspiror is a type of flow sensing spirometer. It is designed to be used with an electro mechanical pneumotachometer which is attached to mouth piece to detect air flow through it. The electronic circuit converts the raw signals to actual volume and flow rates.

METHODOLOGY:

Diabetic patients were, selected carefully using criteria laid down. Their written consent was taken. The history was elicited. Age, height, weight were recorded.

Thorough clinical examination was carried out. The performance of the pulmonary function tests was demonstrated. Patients were made to undergo pulmonary function tests using medspiror, for 3 times at every 15 minutes interval and best of 3 was taken into account.

The FVC was recorded.

OBSERVATIONS AND RESULTS:

In the present study following observations were made.Out of 100 patients 64 were male and 36 were female. Out of 100, 78patients showed decreased FVC and 22 showed normal spirometric patterns.

Table 1: Sex distribution

Sex	Total
Male	64
Female	36

Table 2: Comparison between actual value and predicted values of Pulmonary Function Tests

Parameter	FVC (ltr)
Actual	2.30±0.50
Predicted	2.49±0.45
p value	0.01
Significance	S

Table 3: Spirometric pattern in diabetic patients.

	Normal	Restrictive	total
Number of patients	22	78	100

DISCUSSION:

In a study by Davis A. Wendy et.al., there was a decrease in mean FVC values as the duration of DM increased. In their study the annual rate of fall in FVC was 68 ml.(9)

In a study by Robert E. Walter et.al., there was a progressive decrease in mean FVC values by 109 ml/year(8)

A study by Timothy M.E Davis, showed there was an average decrease of 9.5% in mean FVC values in diabetics(7)

In our study also there was a progressive decrease in mean FVC values of diabetic patients.

The pathophysiologies of many lung abnormalities are believed in part to result from the microangiopathic changes in the basement membrane of pulmonary vessels and respiratory epithelium as well as from non enzymatic glycation of proteins. Collagen is the major connective tissue of lung parenchyma. Both quantitative and qualitative abnormalities in collagen can cause restrictive pattern of pulmonary disease.

Non enzymatically glycosylated collagen seen in diabetic is considerably more resistant to digestion by pepsin & collagenase than non- diabetics. 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.(4)

Decreased elasticity of collagen especially in Type2 pneumatocyte cause decreased permeability of capillary basement membrane. Since normal lung mechanism and gas exchanges are influenced by the integrity of pulmonary connective tissues and microvasculature, abnormalities in either of these two structural components of the lung may lead to development of measurable abnormalities of pulmonary functions. (5)

In the Fremantle Diabetes Study by Wendy A. Davis, 495 patients with Type2 DM who had no history of pulmonary disease underwent spirometry. Seven years later 125 patients were restudied for FVC, FEV_1, VC & PEF corrected for body, temperature and pressure (btps) expressed either in absolute terms or as percentage predicted value for age, sex and height.

According to Malcom Sandler study there is a histopathological evidence of lung involvement in subjects with diabetes by thickened alveolar epithelial and pulmonary capillary basal lamina suggestive of pulmonary micro angiopathy. Abnormal pulmonary function has been detected in diabetic patients such as reduced lung volumes, reduced pulmonary elastic recoil, impaired

diffusion due to reduced pulmonary capillary blood volume. And non – enzymatic glycosylation induced alteration in the lung connective tissue is the most likely pathogenic mechanism underlying the mechanical pulmonary dysfunction in diabetic subjects(6)

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