ejpmr, 2018,5(11), 648-650

SJIF Impact Factor 4.897

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

CHANGES IN LUNG FUNCTION TESTS IN TYPE -2 DIABETES MELLITUS

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Article Received on 20/09/2018 **Article Revised on 10/10/2018** **Article Accepted on 31/10/2018**

ABSTRACT

Background: Type-2 Diabetes mellitus complications are mostly caused by macro vascular and micro vascular damages. Diabetes is a complex medical syndrome comprising of heterogeneous group of disease resulting from diverse aetiologies predominantly of genetic and environmental origin. In type -2 diabeties there is persistent hyperglycemia and abnormal metabolisms of carbohydrate, proteins and lipids. These metabolic disorders result from impaired insulin secretion, altered tissue sensitivity to insulin or coexistence of both. The pulmonary complications of diabetes mellitus have been poorly characterized. The present study has focused on the mechanical aspects of lung dysfunction which are attributable to type 2 Diabetes Mellitus :maximal forced spirometric pulmonary function tests (PFTs) like Forced vital capacity (FVC), Forced Expiratory volume in 1^{ST} sec(FEV1), FEV1/FVC% and peak expiratory flow rate (PEFR), to be specific.

KEYWORDS: Diabetes mellitus, spirometry, FVC, FEV1, FEV1/FVC%, PEFR.

INTRODUCTION

Type-2 Diabetes mellitus complications are mostly caused by macro vascular and micro vascular damages. Diabetes is a complex medical syndrome comprising of heterogeneous group of disease resulting from diverse aetiologies predominantly of genetic and environmental origin. DM affects almost all the organ system in the body producing biochemical, morphological and functional abnormalities mainly of collagen and elastine. The alteration in these scleroprotein in turn affect the mechanical behaviour of the lungs manifesting in altered lung volumes measured by pulmonary function tests (Benbassat et al., 2001).[1] In type -2 diabeties there is persistent hyperglycemia and abnormal metabolisms of carbohydrate, proteins and lipids. These metabolic disorders result from impaired insulin secretion, altered tissue sensitivity to insulin or coexistence of both. The pulmonary complications of diabetes mellitus have been poorly characterized. The present study has focused on the mechanical aspects of lung dysfunction which are attributable to type 2 Diabetes Mellitus. The aim of present study to do a comparative analysis of the PFTs in type-2 diabetes and non-diabetes by using computerised spirometry and to assess the effects of chronic hyperglycaemia on lung functions.

MARTERIAL AND METHODS

A cross-sectional and retrospective study was conducted in Department of physiology, D.Y Patil medical college & hospital, Kolhapur India using RMS Helios 702 Spirometer. The subjects of the study included forty type-2 diabetics who were between 40-65 years of age and a similar number of age, sex and BMI matched controls. Both were selected on the basis of exclusion criteria.

Persons with any conditions that effect lung functions were excluded from the study: the subject with abnormality of vertebral column, those having history of acute and chronic infection, their detailed histories were taken to determine whether they could be included in the study or not. About 22 apparently healthy male type 2 Diabetic patients who were within the age range of 40-65 and 18 apparently healthy female type 2 Diabetic patients who were in the age range of 40-65 years were selected and the others were excluded. In controls among 56 subjects who were interviewed, 40 age, sex and BMI matched controls were selected. The type 2 diabetics were individually matched for gender, age and BMI with controls. 22 male pairs and 18 female pairs were formed. Controls and type 2 diabetics both were assessed by using a proforma and written informed consents were taken from them. The study was approved by the institutional ethical committee. After taking the anthropometric data, the subject were informed about the whole maneouver. The subjects were encouraged to practise this maneouver before doing PFT. The test was performed with the subject in the sitting position and by using soft nose clip. The values of parameters (FVC, FEV1, FEV1/FVC% and PEFR) of these the best maneouver were taken and were analyzed with a software EPI INFO statistical software by using unpaired students t-test (two-tailed).

OBSERVATION AND RESULTS

In the female group, the age and BMI were matched for type 2 diabetics and control (p=NS*). The following parameters FVC, FEV1 and PEFR were significantly reduced in type 2 diabetics as compared to those in controls & FEV1/FVC% was significantly increased in type 2 diabetics as compared to controls. Similar results found in male groups.

[Table/Fig-1]: Anthropometric and spirometric lung function test data for female type 2 Diabetics compared with their matched controls.

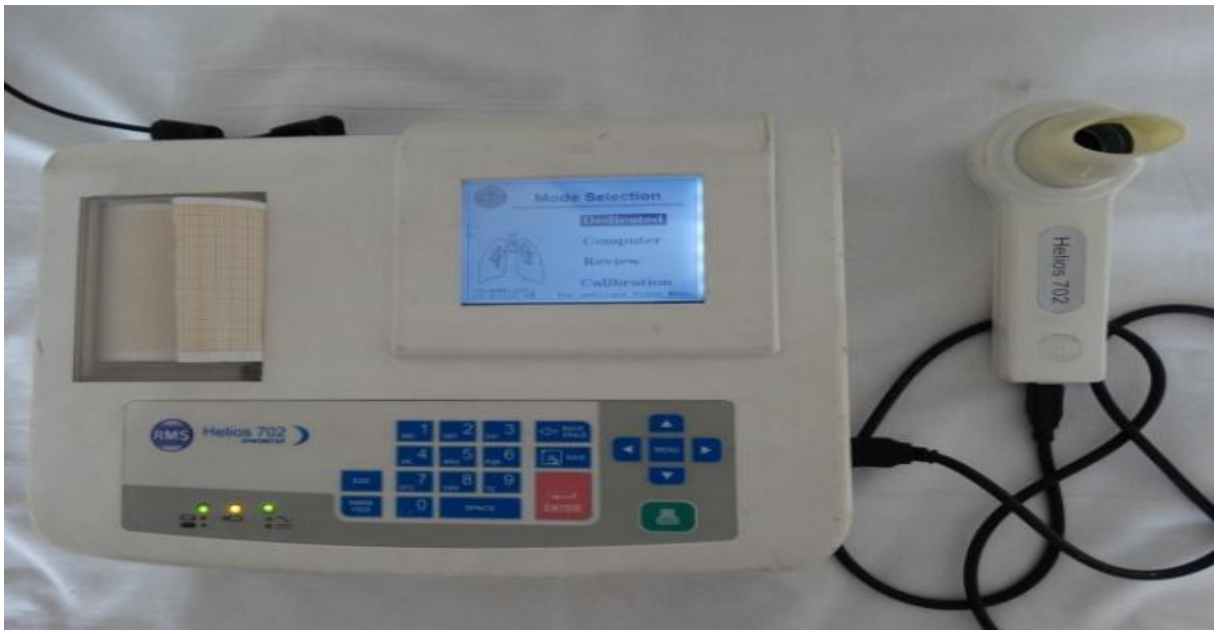
Parameters	Type-2 diabetics (Mean ±SD)	Controls (Mean ±SD)	P value
Age (years)	96.78± 3.12	95.66± 3.18	1.6092 NS*
BMI	0.005362± 0.0003134	0.005232± 0.002998	1.537 NS*
FVC(liters)	3.764± 0.1978	5.6188± 0.3288	0.0002
FEV1(liters)	3.0466± 0.1528	3.9778± 0.1882	0.001
FEV1/FVC %	168.2312± 3.7562	144.5322± 4.9412	0.001
PEFR (liters/sec)	7.1188± 0.4766	9.04± 0.5684	0.0484

[Table/Fig-2]: Anthropometric and spirometric lung function test data for male type 2 Diabetics compared with their matched controls.

Parameters	Type-2 diabetics (Mean± SD)	Controls (Mean± SD)	P value
Age (years)	99.46± 4.12	97.72± 3.8	1.52 NS*
BMI	0.004764±0.00015	0.004836±0.00014	1.4498 NS*
FVC (liters)	4.77±0.3718	6.7382± 0.2252	0.0002
FEV1 (liters)	3.991± 0.3248	5.2172± 0.1496	0.0028
FEV1/FVC %	165.0936±7.826	144.6418±2.5146	0.0008
PEFR (liters/sec)	10.0146± 0.7266	14.2464±0.6216	0.0002

DISCUSSION

In our study diabetes showed reduced lung function. Mean values in diabetics were less when compared with non-diabetics for FVC, FEV1 and PEFR. Both in the Copenhagen city heart study (Lange et al., 1989)[2] and in the Fremantle diabetes study, lung function among diabetic subjects were diminished when compared among controls.



FEV1/FVC% is the volume of air expired in the first second, expressed as percentage of FVC. It is a more sensitive indicator of airway obstruction than FVC or FEV1 alone. Our study showed statistically significant increase FEV1/FVC%. The FEV1/FVC% was increased suggested that the impairment of pulmonary functions in type 2 diabetics was primarily restrictive. Meo et al in their studies on diabetic patient showed a significant reduction in FEV1, FVC and PEFR as compared to their matched control. The association between PFT and diabetes is also affected by age, sex and BMI. In this study also it is seen. Diabetics showed reduction in PFT

when compared with matched control. We observed significant reduction in mean FVC in all diabetic patients and the reduction was more pronounced in female diabetics than male diabetics. Age was a significant determinant of PEFR in the FDS. The age of the diabetics subject with ventilatory defects was also significantly higher than the age of diabetic subjects with normal ventilatory function, its all reflecting the age – related decline in the lung function. In our study the effect of BMI in reducing lung function has been well documented. Another more important effect of BMI on lung function is related to the metabolic syndrome in which low grade inflammation plays a central role in the development of diabetes as well as reduced lung function. In our study level of glucose & HBA1c correlation with decline in PFT values is kept out of the study. some studies Mckeever and colleagues (McKeever et al., 2005)[3] have shown that the decline in PFT was negatively correlated with HBA1c, while others showed no correlation between HBA1c and PFT. The association between type 2 diabetes mellitus and reduced lung functions is determined by Davis et al.[4] and reported that FVC, FEV1 and PEFR, when expressed as percentages of those which were predicted for age, sex and height, the means of all spirometric measures were reduced. Although the underlying mechanism which relate type 2 diabetes to reduced lung functions remains unclear, previous studies suggested several explanation that is glycosylation of chest wall and bronchial tree proteins and increased cross-linkage formation between polypeptide of collagen in pulmonary connective tissue that decreases forced vital capacity so responsible for restrictive respiratory defects[5], thickening of basal lamina[6], and increased susceptibility to respiratory infections.[7]

CONCLUSIONS

This study concluded that mechanical function of the lung are adversely affected by type 2 diabetes, the pattern of disease being primarily restrictive in nature. In past relatively few studies have been done on pulmonary mechanical function. The present study focused on the mechanical aspects of lung dysfunction, here FVC is specific. so diabetic patients should must undergo regular lung function test to assess the severity of lung function impairment, in the initial stage lung damage can be prevented. There is scope for further intensive work and additional research to identify pathophysiologic mechanisms.

ACKNOWLEDGEMENT

I am thankful to our laboratory staff and colleagues in the department of physiology for helping us in conducting this study.

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