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Full Length Research Article

A study of pulmonary function test in type 2 diabetics

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ABSTRACT

Diabetes mellitus is a public health problem in developing and developed world. Diabetes is a complex medical syndrome in which microangiopathy is brought in by the non-enzymatic glycosylation of various scleroproteins in lungs and elsewhere. Type 2 diabetes mellitus is characterized by persistent hyperglycaemia and abnormal metabolisms of carbohydrates, proteins and lipids.Out of its various complications like cardiovascular , nephropathy, retinopathy, and neuropathy, the pulmonary complications are poorly characterized. So we conducted this study to assess the effect of hyperglycemia on lung functions. We found that spirometric values were lower in subjects with type 2 diabetes mellitus than in non-diabetic.

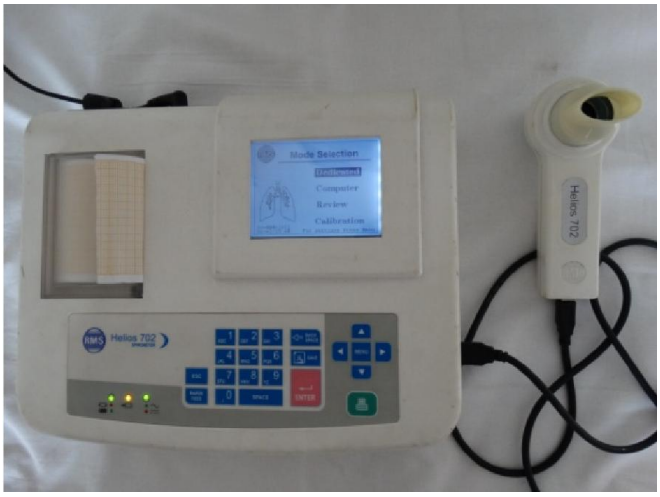
Key words: Diabetes mellitus, Microvascular Angiopathy, Pu Lmonary function test.

INTRODUCTION

Diabetes mellitus is a public health problem in developing and developed world, according to WHO, India will be world diabetic capital in 2025 (King *et al.,* 1998). 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 systems in the body producing biochemical, morphological and functional obnormalities mainly of collagen and elastine. The alterations in these scleroproteins in turn affect the mechanical behaviour of the lungs manifesting in altered lung volumes measured by pulmonary function tests (Benbassat *et al.,* 2001). Type 2 diabetes mellitus is characterized by persistent hyperglycaemia and abnormal metabolisms of carbohydrates, proteins and lipids. These metabolic disorders result from impaired insulin secretion, altered tissue sensitivity to insulin or coexistence of both.. Though great attention was centered on the diabetic complications like cardiovascular, nephropathy, diabetic retinopathy, and neuropathy, pulmonary complications are poorly characterized. Of late, the concept of the lung as a target organ for diabetic microangiopathy is receiving continuing attention. The aim of the present study was to assess the effects of chronic hyperglycaemia on lung functions.

MATERIAL AND METHODS

A cross-sectional study, descriptive, prospective study of the lung function of diabetics compared with age and sex-matched non-diabetic controls was carried out over a period of 2 years in D.Y Patil medical college hospital, Kolhapur using RMS Helios 702 spirometer, Microsoft Excel and SPSS Version 10 software. Patient were requested to attend a medical interview, and underwent physical examination including fundoscopy. Non-smoking diabetic patients who had no history of respiratory disease, and who gave informed consent were selected for this study, and underwent pulmonary function testing. Healthy, non-smoking, non-diabetics who were matched for age and sex were chosen as controls, and also underwent pulmonary function testing. The results were entered on a Microsoft Excel spreadsheet and were analyzed using SPSS version 10.0 software.



RESULTS

A total number of 130 cases were suitable for analysis. There were 74 diabetics (STUDY GROUP) and 56 non-diabetics

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(CONTROL GROUP). Spirometric values were consistently lower in diabetic than non-diabetic

Table 1. Comparison of PFT parameters among Male and Female

	Male DM	Female DM	
FVC	3.23 ± 0.80	2.65 ± 0.44	P=0.0021**
FVC Observed	7.18 ± 3.83	7.96 ± 9.19	P=0.78
FVC Pred %	269.44 ± 183.76	258.06 ± 128.45	P=0.78
FEV 1 Observed	41.59 ± 2.23	3.51 ± 1.70	P=0.78
FEV 1 Pred %	193.24 ± 83.55	154.76 ± 64.75	0.0619
FEV 1/FVC Pred	76.77 ± 13.69	64.33 ± 14.89	0.0619
FEV1/FVC Observed	60.20 ± 12.65	51.29 ± 11.87	0.0054**
FEV 1/FVC Pred %	79.13 ± 10.92	82.75 ± 12.04	0.0054**
PEFR Pred	6.83 ± 0.60	5.47 ± 1.09	P<0.0001
PEFR Observed	6.69 ± 2.36	5.69 ± 2.064	P=0.080
PEFR Pred %	55.08 ± 50.36	120.38 ± 122.78	P=0.08
	55.06 ± 45.18	81.31 ± 15.86	P=0.080

Table 2. PFT parameters according to duration of diabetes

	Less < 5	Greater > 5	
FVC Pred	2.84 ± 0.56	2.86 ± 0.83	P=0.95
FVC Observed	8.57 ± 8.57	5.49 ± 3.03	P=0.95
FVC Pred %	273.33 ± 125.57	225.92 ± 195.42	P=0.9572
FEV 1 Observed	4.14 ± 1.99	3.19 ± 1.70	P=0.95
FEV 1 Pred %	176.63 ± 77.41	148.28 ± 66.09	P=0.0957
FEV 1/FVC Pred	66.30 ± 15.84	74.05 ± 13.65	P=0.0454**
FEV1/FVC Observed	53.77 ± 12.63	55.57 ± 13.35	P=0.59
FEV 1/FVC Pred %	83.80 ± 10.70	75.84 ± 12.45	P=0.015**
PEFR Pred	5.99 ± 1.18	5.38 ± 1.18	P=0.0501
PEFR Observed	7.758 ± 9.69	5.08 ± 2.13	P=0.0614
PEFR Pred %	119.88 ± 118.53	91.13 ± 34.23	P=0.0614
MVV	88.096 ± 15.08	79.019 ± 18.76	P=0.0614

Table 3. PFT parameters between Diabetic and Non diabetic control group

	DM	NDM	P Value
FVC Pred	2.84 ± 0.64	3.11± 0.37	0.005*
FVC Observed	4.73 ± 2.49	6.81 ± 2.97	<0.0001***
FVC Pred %	255.66 ± 154.32	306.87 ± 124.46	0.03*
FEV 1 Observed	3.87 ± 1.95	5.30 ± 1.80	<0.001**
FEV 1 Pred %	167.30 ± 7717	240.00 ± 85.47	<.00001***
FEV 1/FVC Pred %	68.53 ± 15.49	77.59 ± 11.91	0.0002**
FEV1/FVC Observed	54.3067 ± 12.78	68.70 ± 16.73	P<0.0001**
FEV 1/FVC Pred	81.41 ± 11.68	88.098 ± 14.45	P<0.0001**
PEFR Pred.	5.82 ± 1.21	7.01 ± 0.54	P<0.001***
PEFR Observed	5.85 ± 2.21	8.47 ± 2.95	P<0.0001***
PEFR Pred %	99.30 ± 36.6	124.78 ±26.66	P=<.0001***
MVV pred	85.52±16.60	96.28±9.6	P<0.0001

DISCUSSION

In our study diabetics showed reduced lung function .Mean values in diabetics were less when compared with non–diabetics for FVC, FEV1, FEV1/FVC% PEFR and MVV. Both in the Copenhagen city heart study (Lange et al., 1989) and in the Fremantle diabetes study, lung function among diabetic subjects are diminished when compared with the lung function among controls. Walter et al. (2003) found that both the diagnosis of diabetes and an elevated level fasting blood glucose were associated with lower than predicted levels of pulmonary function. Our results are consistent with these previous findings. Our study also showed a strong association with the duration of disease and decreased pulmonary function in diabetic patients .Type 2 diabetics with duration longer than 5 years showed reduction in FVC, FEV1, PEFR and statistically significant reduction in FEV1/FVC. According to a study by (Asanuma et al., 1985) FVC and FEV1 were reduced in diabetic subjects when duration of disease is considered. Our result for FVC and FEV1 confirms the results observed by them. They also found that both IDDM and NIDDM patients are associated with reduction in FVC and it was because of impaired defence against environmental challenges such as smoking and airway infections in diabetes.

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 reduction in FEV1/FVC. The decrease in FEV1/FVC% in diabetic subjects may be related with poor mechanical properties of the lungs, loss of elastic recoil leads to dynamic collapse of small airways during expiration. Reported almost similar type of findings. A study conducted by Ali Mo *et al*. (1985) showed similar findings but was not significant. On the contrary Benbassat *et al.,* 2001 showed that FVC, FEV1, PEF, were within the predicted values. MVV is the maximum breathing capacity which is affected by poor respiratory muscle strength, emphysema etc. There was a statistically significant reduction in MVV values in both male and female diabetics compared to controls in our study. This may be due to poor skeletal muscle strength caused by increased protein catabolism in diabetics. A study conducted by Park SW et al and Meo sa et al showed similar findings. Meo et al in their studies on diabetic patients showed a significant reduction in FEV1, FVC and PEF as compared to their matched control. They also showed a strong dose effect response of duration of disease and decreased pulmonary function in their diabetic patients. The association between PFT and diabetes is also affected by age, sex and BMI. 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 found to be significant determinant of PEFR in the FDS. The age of the diabetic subject with ventilatory defects was also significantly higher than the age of the diabetes subjects with normal ventilatory function, reflecting the expected age-related decline in lung function. 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. Some of the prospective and cross sectional studies have shown low vital capacity or restrictive pattern in type 2 DM. Meta-analysis by Vandenborst et al[7] showed that DM is associated with statistically significant impaired pulmonary function in a restrictive pattern. Moreever these results were irrespective of body mass index (BMI), smoking, diabetes duration and HBA1c levels. On correlating the FVC and FEV1 with duration of disease we found that there is no significant correlation between them. In our study we have not correlated level of glucose & HBA1c with decline in PFT values. Some studies Mckeever and colleagues (McKeever et al., 2005) have shown that the decline in PFT was negatively correlated with HBA1c, while others showed no correlation ship between HBA1c and PFT.

Conclusion

- Spirometric values were consistently lower in subjects with Type 2 diabetes mellitus than in non-diabetics. The differences reached statistical significance only for the forced vital capacity, but the trend was seen across all parameters.
- Males with diabetes were affected more than females, attaining lower levels of their percentage of predicted values.
- The effect on the FVC was even more pronounced in diabetics who had duration of disease longer than 5 years, and the effect was not explained by the difference in age alone.
- Subjects with poorer diabetic control have worse spirometric function.
- Non-enzymatic glycosylation of connective tissue, especially the collagen, may be responsible for reduced lung functions.
- There is scope for further intensive work in the same area, extending the study to a larger group, and including diffusion studies as part of the protocol.

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