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A PROSPECTIVE STUDY OF EFFECT OF GLYCAEMIC STATUS ON PULMONARY FUNCTION TEST IN TYPE 2 DIABETES MELLITUS

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Abstract

Introduction: Diabetes mellitus as we all know is a systemic disorder which affects many organs by causing pathological changes in them. It is considered as a leading cause of increasing morbidity and deaths in today's world. The main objective of the study is to study the effect of glycaemic status on pulmonary function test in type 2 diabetes mellitus.

Materials and Methods: 100 type-2 diabetes mellitus patients who were not on insulin visiting Department of General Medicine, Mallareddy Medical College for Women, Hyderabad, Telangana as in-patients & out-patients were included. The sample size was taken based on the convenience of the study. 100 healthy controls who's fasting blood glucose (FBG) and postprandial blood glucose (PPBG) were in normal limits from administrative office of Department of General Medicine, Mallareddy Medical College for Women, Hyderabad, Telangana and other volunteers constituted the control group. The informed consent of the patient / guardian was obtained.

Results: FBG among cases and controls were compared which shows a mean FBG value of 207.8 mg / dl in diabetes mellitus group as compared to a mean value of 97.42 mg / di in controls with P value of 0.000 which is highly significant. The mean % of predicted FVC among the cases was 68.37 and 92.74 among the control group with P-value of 0.001, which is statically significant. And % predicted FEV1 among the cases was 81.39 and 85.08 among the control group with significant P-value of 0.008.

Conclusion: Despite the fact that type 2 diabetes mellitus patients did not exhibit any respiratory symptoms, their lung function did exhibit a subclinical restrictive pattern. Respiratory abnormalities with a restrictive pattern are linked to type 2 diabetes mellitus. The restricted profile became more noticeable as diabetes mellitus duration grew. The glycemic status and the FEV1 and FVC spirometric indices had an antagonistic relationship. Hence, regardless of the

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other positive outcomes, aggressive glycemic management may lower the risk of death through enhanced ventilator function. The spirometer is still a low-cost, straightforward, noninvasive diagnostic tool that, when used properly, can alert patients to take quick preventive action.
Key Words: Diabetes mellitus, fasting blood glucose, postprandial blood glucose, spirometer.

INTRODUCTION

Diabetes mellitus as we all know is a systemic disorder which affects many organs by causing pathological changes in them. It is considered as a leading cause of increasing morbidity and deaths in today's world.[1]

The vascular complications of Diabetes mellitus remains the main cause of mortality & morbidity. It includes macrovascular i.e.., coronary artery disease, cerebrovascular disease, peripheral artery disease and Microvascular ie.., retinopathy, neuropathy and nephropathy. Generally the microvascular complications occur early in the course of diabetes ie.., 5 to 10 years and it takes 10 to 15 years for macrovascular complications to develop.[2] Even though respiratory tract infections like tuberculosis is increased in incidence in patients with diabetes mellitus, attention is only minimally given to respiratory system.[3]

Many studies suggested that lung is a target organ in DM and that glycaemic exposure is a strong determinant of reduced pulmonary function in DM patients theoretically, several pathological changes may affect the lungs in patients with DM. Many studies show that diabetes could lead to the development of pulmonary complications due to the collagen & elastin changes.[4] Another theory suggested that micro angiopathy due to increase in enzymatic glycation of proteins and peptides of the extracellular matrix at chronic high circulating glucose levels may also have important role in the pathological changes of lungs in DM patients.[5] The above pathophysiological mechanisms suggest that lung is also involved in diabetes subjects as target organ.

MATERIALS AND METHODS

This cross-sectional study was conducted over a period of 8 months from November 2021 to June 2022.

Study Population

100 type-2 diabetes mellitus patients who were not on insulin visiting Department of General Medicine, Mallareddy Medical College for Women, Hyderabad, Telangana as in-patients & out-patients were included. The sample size was taken based on the convenience of the study. 100 healthy controls who's fasting blood glucose (FBG) and postprandial blood glucose (PPBG) were in normal limits from administrative office of Department of General Medicine, Mallareddy Medical College for Women, Hyderabad, Telangana and other volunteers constituted the control group. The informed consent of the patient / guardian was obtained.

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Inclusion Criteria

All patients presenting to medical outpatient department (OPD) and patients from inpatient department (IPD) at Department of General Medicine, Mallareddy Medical College for Women, Hyderabad, Telangana who were proved cases of type 2 diabetes mellitus and not on insulin.

Exclusion Criteria

1. Smokers.
2. Previous history of lung disease.
3. Signs and symptoms of respiratory infections at the time of test.
4. History of being admitted in hospital during past six months with respiratory symptoms.
5. History of significant cardiovascular illness.
6. History of occupational exposure to any substances that could affect lung function.

Subjects were selected as per the inclusion and exclusion criteria. Their written consent was recorded. Their detailed history was taken. Age, height, weight, and BMI were recorded, and detailed general physical examination was done. Each patient was instructed to visit hospital with 8 hrs of fasting, and the blood samples were drawn for estimation of FBS and glycated haemoglobin.

Statistical Analysis

Microsoft Excel and SPSS version 11 and Syst at 8.0 were used for the analysis of the data.

RESULTS

FBG among cases and controls were compared which shows a mean FBG value of 207.8 mg / dl in diabetes mellitus group as compared to a mean value of 97.42 mg / di in controls with P value of 0.000 which is highly significant.

Variables	Groups	N	Mean	SD	P Value
FBG(mg/dl)	**Cases**	100	206.7	49.25	0.001
	Controls	100	97.41	5.13	
PPBG(mg/dl)	**Cases**	100	254.22	48.51	0.001
	Controls	100	126.77	6.15	

Table 1: Comparison of Cases and Controls with FBG and PPBG

Variables	Groups	N	Mean	SD	P Value
FVC (in litres)	Cases	100	2.4712	0.43	0.0001
	Controls	100	2.9810	0.4320	
FEV1 (in litres)	Cases	100	2.0791	0.4079	0.0001
	Controls	100	2.4316	0.3915	
FEV1 / FVC	Cases	100	0.8375	0.1015	0.0001

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	Controls	100	0.8170	0.063	

Table 2: Comparison of Cases and Controls with Regard to FVC, FEV and FEV1 / FVC

Variables	Duration	N	Mean	SD	P-Value
FVC (in litres)	≤ 5 yrs	36	2.7235	0.3532	0.004
	>5 years	64	2.3076	0.415	
FEV1 (in litres)	≤ 5 yrs	36	2.2526	0.39	0.008
	>5 years	64	1.9523	0.374	
FEV1 / FVC	≤ 5 yrs	36	0.8185	0.0884	0.2567
	>5 years	64	0.8516	0.116	

Table 3: Comparison of Duration (5 yrs. and > 5 yrs.) with FVC, FEV1 and FEV1 / FVC

PFT	Summary	90-110	110-200	200-300	P-Value
FVC (in litres)	Mean	2.80	2.50	2.3	0.415
	SD	0.3	0.44	0.41	
FEV1 (in litres)	Mean	2.2	2.08	2.02	0.956
	SD	0.18	0.42	0..42	
FEV1 / FVC	Mean	0.74	0.82	0.87	0.145
	SD	0.01	0.1	0.09	

Table 4: Comparison of FBG Subgroups on Pulmonary Function Test

PFT% Predict	Cases	Control	P Value
FVC	68.35 ± 20.12	92.74 ± 25.37	0.001
FEV1	81.32 ±22.35	85.08 ± 24.10	0.008
FEV1/FVC	79.84 ± 10.67	85.46±10.12	0.429

Table 5: Effects of Diabetes on % Predicted FVC, FEV1, FEV1 FVC

The mean % of predicted FVC among the cases was 68.37 and 92.74 among the control group with P-value of 0.001, which is statically significant. And % predicted FEV1 among the cases was 81.39 and 85.08 among the control group with significant P-value of 0.008.

DISCUSSION

Out of the total 100 cases studied 50 were diabetes mellitus subjects and 50 were non-diabetes. The number of male subjects (30) was same in both diabetes mellitus and non-diabetes groups. The number of females in study was 20, equal in both the groups. Hence, there was no significant difference among diabetes mellitus and controls with reference to the gender of subjects.[6]

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The age wise distribution of subjects was matched in both case and controls. Age group of 50 - 59 years was the largest.[7] Study by Ortiz Aguirre et al. has proved that as age increases the pulmonary function test values decrease. In the present study, age has been ruled out as a confounding factor by considering age matched subjects in both diabetes mellitus and non-diabetes groups.[8]

In the study by Crapo et al. BMI in diabetes patients with target organ damage was high compared to those subjects without target organ damage. These subjects with target organ damage and high BMI had reduced mean pulmonary function parameters. The present study shows no significant difference in BMI values among diabetes and non-diabetes nullifying BMI as one of the confounding factors.[9]

The present study is in agreement with the previous studies in comparing FEV1 among diabetes and non-diabetes. The mean values of FEV1 are low in diabetes group subjects compared to controls. The present study is in agreement with Walter. E. Robert et al. who studied the relationship between diabetes mellitus and pulmonary function and showed a decrease in FEV1 by 27 ml in diabetes subjects.[10]

CONCLUSION

Despite the fact that type 2 diabetes mellitus patients did not exhibit any respiratory symptoms, their lung function did exhibit a subclinical restrictive pattern. Respiratory abnormalities with a restrictive pattern are linked to type 2 diabetes mellitus. The restricted profile became more noticeable as diabetes' duration grew. The glycemic status and the FEV1 and FVC spirometric indices had an antagonistic relationship. Hence, regardless of the other positive outcomes, aggressive glycemic management may lower the risk of death through enhanced ventilator function. The spirometer is still a low-cost, straightforward, noninvasive diagnostic tool that, when used properly, can alert patients to take quick preventive action.

Thus, it is recommended that diabetes patients have regular spirometry testing to determine the degree of lung function impairment. By preventing lung damage in its early stages, these actions will help lower type 2 diabetes mellitus patients' morbidity and mortality rates.

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