Prevalence of Lung Dysfunction in Type II Diabetes Mellitus

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Original Research Article

ABSTRACT

The pulmonary function test was also used in this study as a screening tool to detect Lung Dysfunction in asymptomatic Type 2 diabetic patients. This is a cross-sectional study conducted in a hospital. This study involved 100 patients, including 41 males and 59 females ranging in age from 23 to 75 years old, who underwent spirometry after providing their consent for the study. FEV1 and FVC absolute values were compared to predicted values and represented as a percentage of predicted values. The current study's data were analysed with SPSS 15.0, and the results are reported in Descriptive Statistics such as Frequency, Percentage, Range, Mean, Standard Error (Mean), and 95 percent Confidence Interval. The current findings demonstrated that the prevalence of Lung Dysfunction was 63 (64.9%) when the duration of diabetes was less than 5 years, compared to 23 (23.7%) when the length was more than 5 years. With a Chi Square value of 3.85 (P=0.05), this revealed a statistically significant difference.

1. INTRODUCTION

The World Health Organization has estimated in the year 2000, the number of people affected with Diabetes is 171 million and the prevalence to be 366 million by 2030. According to 2012 estimates 346 million people suffer from Type 2 Diabetes Mellitus. The ill effects of

hyperglycemia have been well known and established in various organs and tissues of the body [1]. Risk of cardiovascular diseases and neurological complication associated with Diabetes are well known and vigorous studies have brought down such complication and treatment has been well advocated [2-7]. It must also be emphasized that microvascular complication of the lung are of great importance and often goes unnoticed in common clinical setup [2,3]. Our hypothesis is based on three main observations. Firstly, recent studies have also suggested that the incidence of asthma, COPD, pulmonary fibrosis and pneumonia, but not of lung cancer, was greater in those with a diagnosis of diabetes than in those without diabetes. Secondly, studies have shown that restrictive pattern but not obstructive pattern is associated with insulin resistant Type 2 Diabetes Mellitus and Type 1 Diabetes mellitus. Thirdly, Cross sectional studies have shown that adults with diabetes have lower lung vital capacity than their non-diabetic counter parts.

2. MATERIALS AND METHODS

2.1 Study Design

The Design of the present study is institution based longitude Cross Sectional. This study is aimed to assess Lung Dysfunction in asymptomatic type 2 diabetic patients for microvascular lung injury as a potential complication at one point of time.

2.2 Study Area

Diabetic Out - patients attending Department of General Medicine, Sree Balaji Medical College & Hospital (Tertiary Care) , Chromepet, Chennai , India.

2.3 Study Period

July 2010 to August 2011

2.4 Study Population

This study was conducted in the Department of Medicine and Department of Diabetology, Sree Balaji Medical College, Chennai, Tamil Nadu. The Type 2 Diabetes patients were included based on the selection criteria. Out of 100 patients selected, there were 41 males and 59 females whose age was ranging from 23 years to 75 years.

2.5 Inclusion Criteria

Male and female patients of > 20 age of years were selected.Subjects who are defined as Type 2 Diabetes by Physician Diagnosis and regular use of diabetic medications were included.

The duration of Diabetes was ranging from 1 month to 28 years were eligible for inclusion in the analysis.Individuals were classified as having diabetes if any of the following criteria, adapted from 1997 American Diabetes Association criteria, and were met: fasting glucose level of at least 7.0 mmol/1 (126 mg/dl); non fasting glucose level of at least 11.1 mmol/1 (200 mg/dl); current use of anti-diabetes medication.Subjects with no history of lung disease or complaints related to lung disease. But complications due to Diabetes other than lung disease were included in the study.

2.6 Exclusion Criteria

Subjects with History of Lung diseases and abnormal Chest Radiographs and ECG finding related to lung disorder were excluded.

- History of Congestive Heart Failure.
- History of End Stage Renal Failure.
- History of Smoking and Alcohol
- Subject with uncontrolled hypertension
- History of COPD, Interstitial Lung Disease
- History of Cystic Fibrosis , Pneumonia
- History of Pulmonary Tuberculosis
- Any other health or mental condition that in the Investigator's opinion may adversely affect the subject's ability to complete the study.

3. METHODOLOGY

The diabetics who were willing to engage in the study were invited to the study centre from the local population. Before being included in the study, each subject was informed about it both orally and in writing, and only those who granted written informed consent were included. The subjects were chosen based on the criteria for inclusion and exclusion. The chosen participants were assigned a screening number and put through a screening process to determine who was qualified for enrolment. The screening technique comprises collecting demographic and

medical information from the subject, physical examination, baseline symptomatology, and laboratory tests such as fasting blood glucose, HbAlC, Lipid profile, urea, creatinine, Liver function test, Chest X-ray, and ECG. After the screening phase, the selected subjects were assigned a Subject Number. They were instructed to return the next day for a Pulmonary Function Test.

4. PULMONARY FUNCTION TEST

Baseline spirometry was performed using a Vitalograph Model S bellows spirometer (Vitalograph, Buckingham, U.K.).Each subject provided at least three acceptable tracings, from which forced vital capacity (FVC %), forced expiratory volume in 1 s (FEVI %) and Forced expiratory.flow in the first second and Forced Vital capacity ratio (FEVI/FVC %) is measured. All values were corrected for body temperature, air pressure, and water saturation. Before analysis, spirometric data were 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 nonsmoking Indians subjects aged 23-75 years.

5. RESULTS

The data of the present study was analyzed using SPSS 15.0 and the results are presented in Descriptive Statistics as Frequency, Percentage, Range, Mean, Standard Error (Mean) & 95% Confidence Interval. Inferential Statistics: Chi-square for association at 5% level of Significance with 20% Type II error was tested. Values within parentheses represent percentage.

Age Distribution of Type Ii Diabetes Patients: In the present study of 100 Type II diabetes patients 33 (33.0) were less than 50 years and 67(67.0) were aged above 50 years (Table 1).

Table 1. Age distribution of type II diabetes patients

Age(Years)	N-	%
< 50	33	33.0
2: 50	67	67.0

Sex distribution of Type II diabetes patients: Fifty Nine (59.0) patients were Females and Forty One (41.0) were Males. Table.2 highlights the Age-Sex distribution of the patients (Table 2).

Table 2. Sex distribution of type II diabetes patients

Sex	N	%
Female	59	59.0
Male	41	41.0

Among 100 patients 77(77.0) had a duration of diabetes less than 5 years and 23(23.0) with a duration of more than 5 years (Table 3).

Table 3. Distribution of type II diabetes patients forduration of diabetes

Duration of diabetes (Years)	N	%
<5	77	77.0
2:: 5	23	23.0

According to BMI classification by CDC & WHO, the QUETELET INDEX, twenty nine (29.0) of the patients were malnourished, forty one (41.0) were normally built, twenty six (26.0) of them were overweight rest two(2.0) in each category of Obese and Very Obese (Table 4).

In this Table 5, three patients have the ratio to be less than 80% where two had OP-Obstructive Pattern and one had MDO - Moderate Obstructive. Therefore the Inferential statistical analysis was done only for 97 Abnormal Lung Dysfunction Cases and tested for its significance at 5% level.

Table 4. Distribution of type II diabetes patients forbody mass index

Body MassIndex	N	%
< 18.5	29	29.0
18.5 -25	41	41.0
25-30	26	26.0
30 - 35	2	2.0
35	2	2.0

Table 5. Distribution of type II diabetes patients for fevl/fvc ratio

FEVl/FVC Ratio (%)	N	%
< 50	1	1.0
50 TO 60	0	0
60TO 70	1	1.0
70 TO 80	1	1.0
>80	97	97.0

Spirometry findings revealed 14 with normal and 86 abnormal Lung function.

The Age of the abnormal lung function ranged from 23 years to 75 years with a Mean ± SE(Mean) 55.8±1.07 and a duration of diabetes ranging from 0.1 to 28 years with an average 4.1±0.42 years and had mean FEVl/FVC Ratio as 111.9±1.9 (%) whose BMI ranged between 14.5 to 32.4 with mean±SE(mean) to be 22.8±0.40.

The Age of the normal lung function ranged from 32 years to 74 years with a Mean± SE(Mean) 56.8 ± 3.1 and a duration of diabetes ranging from 0.4 to 5 years with an average 2.6 ± 0.3 years and had mean FEVl/FVC Ratio as 107.6 ± 3.3 (%) whose BMI ranged between 17.3 to 29.3 with mean± SE(mean) to be 22.0 ± 0.97 (Table 6).

6. PREVALENCE OF LUNG DYSFU- NCTION

Age: From the lung function of 97 type 2 diabetes patients we observed a prevalence of 29(29.9%) with age less than 50 years and a prevalence of 57(58.8%) with age above 50 years. The x^2 Value of 0.03 did not show any statistically significant difference but has a Vital role in Clinical Significance (Table 7).

Sex: The Prevalence of Lung Dysfunction was observed to be 49(50.5%) among Females while compared to Prevalence observed in 38(38.1%) Males but was not Statistically Significant at 5% level.

Duration of diabetes: The present finding revealed that when the duration of diabetes is less than 5 years the prevalence of Lung Dysfunction was 63(64.9%) when compared with more than 5 years duration as 23(23.7%) . This showed a Statistically difference with a Chi Square value 3.85 (P=0.05).

Body mass index: The Prevalence of Lung Dysfunction was observed to be high for 34(35.1%) among 'Normal' BMI patients when compared with 25(25.8%) 'Under weight' BMI patients and 23(23.7%) 'Overweight' BMI patients. The ChiSquare value 3.30 (P=0.5) did not show statistical significance at 5% level.

Table 8, highlights the Prevalence of 'Severity of Lung Dysfunction' among the 86 type II diabetic patients for different parameters. 34% had Mild Restrictive pattern, 26.7% with Moderate Restrictive pattern, 13.5% each in Moderately Severe Restrictive and Severe Restrictive pattern. 2.3% of Very Severe Restrictive Pattern.

7. DISCUSSION

The duration of diabetes was not significant in relationship to development of Lung Dysfunction. Though studies have suggested a possible association between these variables needing further evaluation. The Body mass Index (BMI) relationship to Ventilatory patterns was studied and found to be associated with BMI of 23 to 27.5 and complete association with BMI of 40 and above.

The duration of diabetes was not a significant factor in restrictive ventilatory patterns though studies have supported the notion that lower lung function, particularly decreased vital capacity, not only precedes the onset of diabetes but also continues, at an accelerated pace, with the onset of the disease [8,9]. Several studies have found an association between impaired lung function and death. It has been showed that a decrease in FEVl by 10% was associated with 12%increase in all cause of mortality. Though microangiopathy and CHD were main cause of death in diabetes, airflow limitation was the main cause of mortality. Nonenzymatic processes produce glycosylated proteins, and alterations in protein structure can affect cellular functioning. Finally, glucose activates a variety of protein kinase C isomers. This, in turn, has an impact on the expression of nitric oxide, endothelin, nuclear factor kappa B (NF-kB), and plasminogen activator inhibitor,

Table 6. Descriptive statistics for quantitative parameters

Parameter	Spirometry	N	Range	Mean	SE(Mean)	95% ConfidenceInterval
Age (years)	Normal Abnormal	14	32–74	56.8	3.16	50.0 to 63.6
		86	23 - 75	55.8	1.07	53.7 to 57.9
Duration of Diabetes(years)	Normal Abnormal	14	0.4 - 5.0	2.6	0.37	1.8 to 3.4
		86	0.1 - 28	4.1	0.42	3.2 to 4.9
FEVI/FVC Ratio(%)	Normal Abnormal	14	80 - 124	107.6	3.36	100.3 to 114.9
		86	49 - 174	111.9	1.90	108.1 to 115.7
FVC	Normal Abnormal	14	45 - 107	82.0	5.7	69.6 to 94.3
		86	24- 84	59.8	1.5	56.7 to 62.9
FEVI	Normal Abnormal	14	43 -114	85.5	6.1	72.2 to 98.7
		86	32 - 134	89.2	3.3	82.4 to 95.9
			-			
HEIGHT(M)	Normal Abnormal			1.5	0.02	1.5 to 1.62
		14	1.4- 1.7	1.5	0.00	1.5 to 1.6
		86	1.4 - 1.7			
WEIGHT(KG)	Normal Abnormal	14	35–75	54.2	2.72	48.3 to 60.1
		86	38 - 80	56.0	1.05	53.9 to 58.1
BMI	Normal Abnormal	14	17.3 - 29.3	22.0	0.97	19.9 to 24.2
		86	14.5 - 32.4	22.8	0.40	22.0 to 23.6

Table 7. Prevalence of lung dysfunction (97 Cases)

Parameter	Abnormal (%)	Normal (%)	Chi-square Value(P- Value)
Age			
<50	29(29.9)	4(4.1)	0.03
2'.:50	57(58.8)	7(7.2)	(0.86)
Sex			
Female	49(50.5)	7(7.2)	0.17
Male	37(38.1)	4(4.1)	(0.67)
Duration of diabetes	**63/A4.9)**	11(11.3)	3.85 (0.05)*
<5 YEARS	23(:.:.J.7)	0(0)	
2'.:5 YEARS			
FEVI/FVC RATIO			
< 50	1(1.0)	0(0)	
50 TO 60	0(0)	0(0)	0.261
60 TO 70	1(1.0)	0(0)	(0.87)
70 TO 80	0(0)	0(0)	
> 80	84(86.6)	11(11.3)	
BMI			
< 18.5	25(25.8)	1(1.0)	
18.5 - 25	34(35.1)	7(7.2)	
25–30	23(23.7)	3(3.1)	3.30
30 - 35	2(2.1)	0(0)	(0.50)
2'.: 35	2(2.1)	0(0)	

*Significantat 5% Level

Table 8. Prevalence of severity of lung dysfunction (86 Cases)

Parameter	MR(%)	MDR(%)	MDSR(%)	SR (%)	VSR(%)	Chi- square Value (P- Value)
Age						
<50years	13(15.1)	11(12.8)	3(3.5)	2(2.3)	0(0)	6.4
50years	21(24.4)	12(14.0)	10(11.6)	12(14.0)	2(2.3)	(0.17)
Sex						
Female	20(23.3)	14(16.3)	6(7.0)	9(10.5)	0(0)	3.76
Male	14(16.3)	9(10.5)	7(8.1)	5(5.8)	2(2.3)	(0.43)
Duration of Diabetes						
<5 Years	25(29.1)	19(22.1)	8(9.3)	9(10.5)	2(2.3)	3.24
5 Years	9(10.5)	4(4.7)	5(5.8)	5(5.8)	0(0)	(0.51)
FEVI/FVC Ratio						
< 50	0(0)	0(0)	0(0)	0(0)	1(1.2)	
50 TO 60	0(0)	0(0)	0(0)	0(0)	0(0)	47.68
60 TO 70	0(0)	O(	0(0)	1(1.2)	0(0)	(0.000)*
70 TO 80	0(0)	0(0)	0(0)	0(0)	0(0)	
> 80	34(39.5)	23(26.7)	13(15.1)	13(15.1)	1(1.2)	
BMI						
<20	8(9.3)	6(7.0)	5(5.8)	5(5.8)	1(1.2)	
20.1-24.9	15(17.4)	8(9.3)	4(4.7)	6(7.0)	1(1.2)	
25-29.9	10(11.6)	9(10.5)	2(2.3)	2(2.3)	0(0)	12.33
30 - 39.9	1(1.2)	0(0)	1(1.2)	0(0)	0(0)	(0.72)
>40	0(0)	0(0)	1(1.2)	1(1.2)	0(0)	

*Significant at 5% Level. MR- Mild Restrictive; MDR- Moderate restrictive
MDSR - Moderate Severe Restrictive; SR- Severe Restrictive;
VSR - Very Severe Restrictive

among other things. Finally, hyperglycemia raises glucose flow through the hexosamine pathway, influencing inflammatory mediators and insulin resistance once again. The four systems work together to produce a huge amount of mitochondrial superoxides, which causes cellular stress and damage [10-12].

8. CONCLUSION

This study is a clear correlation between occurrences of increase in Lung dysfunction as a consequence of microvascular injury due to Diabetes Mellitus. Furthermore, the results suggested that abnormal Pulmonary Function Test value is a good indicator for referring a patient for radiography and diffusion perfusion tests to assess lung dysfunction. We concluded that a single measurement of Pulmonary Function Test at the diabetic OPD can provide important information about the lung status of asymptomatic diabetes patients who might require an evaluation of lung dysfunction. Early diagnosis of Lung dysfunction as complications of Diabetes Mellitus would help preventing and reducing morbidity in diabetic patients.

Also reduces complications like reduced lung volumeand airway limitations,impaired lung function,all causes of mortality,also 86% of restrictive ventilator patterns and early diagnosis of lung function and good control of DM.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline patients consent and ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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