ORIGINAL ARTICLE

Patterns of Pulmonary Dysfunction in Diabetes Mellitus and their Effects on Patient Life

ZAHID HUSSAIN SHAH, FARRUKH GHIAS, AYESHA IRSHAD, *IMRAN MEHFUZ KHAN, MUHAMMAD IMRAN, IRSHAD HUSSAIN QURESHI,SAJID ABAIDULAH, ALI SHOAIB*

ABSTRACT

Aim: To determine the patterns of pulmonary dysfunction in diabetic patients and thus to educate the patients that good glycemic control can prevent or minimize this damage and delay the complications.
Methodology: 200 diabetic patients were included in this study. Standard spirometry was used to measure Forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1)
Study design**:** It was cross-sectional study
Results: The mean age in our study was 45.23±17.056 years. 160(80%) were male patients and 60 (30%) were females. 70(35%) patients were of type 1 diabetes Mellitus and 120(60%) were of type 2 diabetes. 50(25%) were diagnosed with restrictive lung pathology, 10(5%) were found to have obstructive lung disease and 120(60%) were observed with normal lung function tests. Mild restrictive pulmonary dysfunction was detected in 36(18%) and 4(2%) were found with moderate restrictive pulmonary dysfunction.
Conclusions: Lung is usually affected in diabetic patients and is one of the important organ of damage.
Keywords: Diabetes metllitus, pulmonary function test, complication

INTRODUCTION

The prevalence of Diabetes Mellitus patients has raised for the last two to three decades[1]. DM leads to decrease in alveolar gas exchange and also reduction in lung volume. The decline in lung function is closely related to poor glycemic control[2] in diabetics. Diabetes Mellitus leads to reduced lung function in patients with type 2 diabetes[3]. FEV1 and FVC are consistently low in diabetics as compared to healthy individuals with an average reduction of 8% of predicted value[4,5]. Reduction in lung function is typically seen also in type 1 diabetes mellitus patients.Type-1 diabetic patients also showed reduced TLC and DLCO which is a feature of pulmonary restrictive dysfunction[7].

Study was performed to determine the effects of diabetes mellitus on pulmonary functions. Diabetes mellitus is much common in Pakistan.

The objective of the study was to determine the patterns of pulmonary dysfunction in diabetic patients.

OPERATIONAL DEFINITIONS:

Forced vital capacity (FVC): It is defined as maximum volume of air expired with maximum forced effort from a maximum inspiration expressed in units per liter.

Department of Medicine, King Edward Medical University/Mayo Hospital, Lahore
Correspondence to Dr. Zahid Hussain Shah, Assistant Professor Medicine, Email: zahidhamdani65@gmail.com Cell: 03009466289

Forced expiratory volume in one second (FEV1): It is defined as maximum volume of air exhaled in the first second of a forced expiration after full inspiration expressed as liters.

FEV1/FVC Ratio (FEV1%): The normal ratio is 75-85%.

Restrictive & Obstructive Pathology: Restrictive lung dysfunction is defined as increased FEV1/FVC ratio from normal predictive value.

A patient with an FEV1/FVC ratio less than the lower limit of normal was declared to have obstructive pulmonary dysfunction.

Restrictive Lung Dysfunction Classification of Severity:

Normal: FVC ≥ 80% of predicted.

Mildly Impaired: FVC 60% to 79% of predicted value.

Moderately Impaired: FVC 51% to 59% of predicted value.

Severely Impaired: FVC 50% or less of the predicted.

Diabetes mellitus: Defined as fasting blood glucose level <7.0mmol/l (126mg/dl) and random blood glucose level of < 11.1 mmol/l (200mg/dl)

MATERIALS & METHODS

It was a cross sectional & an observational study. This study was conducted at outpatient department of Pulmonology and General Medicine Department Mayo Hospital Lahore. Sample size was 200 patients with 5% margin of error and 95% confidence interval

Inclusion criteria
Diagnosed cases of diabetes mellitus.
Diabetes >10 years.
Non smokers
Patients of either sex
Exclusion criteria:
Patients already having any other underlying lung disease e.g. Occupational lung disease etc.
Patients of MI attack in the last one month or patients of cardiac failure.
Data collection procedure: Patients with diabetes mellitus, visiting medical and chest outdoor departments of Mayo Hospital Lahore were entered in to study in the light of inclusion criteria. Consent was taken. The information like name, age, sex, height and weight were recorded. Pulmonary functions tests were performed by spirometery on *Spirolab 11*. All collected information was entered in specified Proforma.
Data analysis procedure: Data was analysed by SPSS 17.0. The quantitative variables e.g., age, height, weight and pulmonary function tests were expressed in the form of mean±Standard deviation and range. The qualitative variables e.g., sex, occupation and spirometery interpretation were expressed as frequency and percentage.

RESULTS

Study was conducted on 200 diabetic patients. The mean age was 45.23±17.056 years. The mean FVC was found to be 2.99±0.49 L while mean predicted FVC was 3.101±0.399. The mean percent predicted FVC was observed as 86.1±14.24 and LLN was 2.12±0.40 L. The mean FEV1 was calculated as 2.11±0.49 L while the mean Predicted FEV1 was calculated as 3.11 ±0.39. Mean Percent predicted FEV1 was calculated as 122.2±20.44 and the LLN was observed 1.788±0.50 L.

The Mean FEV1/FVC% ratio was 80.99±10.57 L while the Mean Predicted FEV1/FVC% ratio was observed 111.02±27.4. There were statistically significantly differences between spirometry results between males and females. (p value= 0.004 for FVC, 0.001for FEV1 and 0.005 for FEV1/FVC).50 patients (25%) were diagnosed as having restrictive pathology, 10 patients (5%) had obstructive pathology and 120 patients (60%)were found to have normal lung function tests.

DISCUSSION

Studies have shown that adult diabetics have decreased vital capacity as compared to non-diabetic patients[10,11]. This study was conducted on 200 diabetic patients. 50 patients (25%) were diagnosed with restrictive lung pathology, 10 patients (5%) were found to have obstructive lung disease and 10 patients (60%) were observed with normal lung function tests. Mild restrictive pulmonary dysfunction was detected in 36 patients (18%) and 4 patients (2%) were found with moderate restrictive pulmonary dysfunction.

These results were in accordance with previously published studies. Our study results are in accordance with the prior studies which also showed decreased FVC and FEV1 in adult diabetics as compared with their non-diabetic patients.[12,13,14] Lange et al studied 17,506 adult patients in the Copenhagen for nearly 15 years. They concluded that FVC and FEV1 were found low in diabetic patients, with an greater than 8% difference in FVC between diabetic and nondiabetic patients. Davis et al conducted a study on 125 Australian patients with type 2 diabetics for a period of approxmately8 years. They concluded that FVC and FEV1 declined at annual rate of 68 and 71 ml / year, respectively. Litonjua et al[15].performed a study of 352 men with diabetes mellitus and 352 non-diabetic men in the Normative Aging Study. They concluded that patients with diabetes mellitus had low FEV1 and FVC.

Underlying pathophysiologic mechanisms of diabetes leading to reduced lung function include, chest wall glycosylation and increased bronchial tree secretions & proteins, also thickening of basal lamina membrane[16] and high susceptibility to respiratory tract infections. Also, hyperglycemia, inflammation, and oxidative stress induce muscle dysfunction[17,18]. ARIC study has showed that type 2 diabetic patients have reduced lung function as an independent predictor. Our study summarizes the fact that lower lung function, particularly decreased vital capacity, is common among diabetics.

Finally, the findings in our study conclude that the lung is a target organ for damage in diabetics.

CONCLUSION

Data from our study suggests that the lung is one of the major target organs for injury in both type1 and type2 diabetic patients. Also good glycemic control can prevent or minimize this damage.

REFERENCES

1. Alvin. C.P. Diabètes Mellites. Harrison's principles of Internal Med.16th.Edition.New York McGraw Hill 2005;2152-79.
2. Davis WA, Kneuman M, Kendall P, Grange V, Davis TM. Glycemic exposure is associated with reduced

pulmonary functions in type 2 diabetes. *J Diabetes care* 2004;12:752-73.
3. Lange P, Parner J., Schnohr P. and Jenson G. Copenhagen City Heart Study: longitudinal analysis of ventilatory capacity in diabetic and non-diabetic adults, *Eur Respir J* 2002; 20: 1406-12.
4. Meo SA, Al-Drees AM, Shah SF, Arif M, Al-Rubean K. Lung function in type 1 Saudi diabetic patients. *Saudi Med J* 2005; 26: 1728-33.
5. Cazzato S, Bernardi F, Salardi S, Tassinari D, Corsini I, Ragni L, Cicognani A, Cacciari E.Lung function in children with diabetes mellitus.Pediatr Pulmonol2004 ;37:17-23.
6. Boulbou MS, Gourgoulianis KI, Klisiaris VK, Tsikrikas TS, Diabetes Mellitus & Lung Function, Med Princ Pract. 2003; 12:87-91.
7. Aggarwal AN, Agarwal R. The new ATS/ERS guidelines for assessing the spirometric severity of restrictive lung disease differ from previous standards. Respirology 2007; 12:759–762
8. Pellegrino R, Viegi G, Brusasco V. Interpretative strategies for lung function tests. Eur Respir J 2005; 26:948–68
9. Lawlor DA, Ebrahim S, Smith GD: Associations of measures of lung function with insulin resistance and type 2 diabetes: findings from the British Women's Heart and Health Study. *Diabetologia2004;* 47:195–203.
10. Lange P, Parner J, Schnohr P, Jensen G: Copenhagen City Heart Study: longitudinal analysis of ventilatory capacity in diabetic and non-diabetic adults. *Eur Respir J 2002;*20:1406–12.
11. Davis WA, Knuiman M, Kendall P, Grange V, Davis TM: Glycemic exposure is associated with reduced pulmonary function in type 2 diabetes: the Fremantle Diabetes Study. *Diabetes Care 2004;*27:752–7.
12. Litonjua AA, Lazarus R, Sparrow D, Demolles D, Weiss ST: Lung function in type 2 diabetes: the Normative Aging Study. *Respir Med 2005;* 99:1583–90.
13. Niedowicz DM, Daleke DL: The role of oxidative stress in diabetic complications. Cell Biochem Biophys 2005;43:289 –330.
14. Patti ME: Gene expression in the pathophysiology of type 2 diabetes mellitus. *Curr Diab Rep 2004;*4:176 –81.
15. Dandona P, Aljada A, Chaudhuri A, Mohanty P, Garg R: Metabolic syndrome: a comprehensive perspective based on interactions between obesity, diabetes, and inflammation. *Circulation 2005;*111:1448– 54.
16. Engstrom G, Janzon L: Risk of developing diabetes is inversely related to lung function: a population-based cohort study. *Diabet Med 2002;*19:167–70.
17. Cefalu WT: Concept, strategies, and feasibility of noninvasive insulin delivery. *Diabetes Care 2004;*27:239 –46.
18. Ceglia L, Lau J, Pittas AG: Meta-analysis: efficacy and safety of inhaled insulin therapy in adults with diabetes mellitus. *Ann Intern Med 2006;*145:665–75.