

Assessment of Pulmonary Function Tests in Type 2 Dm (Spirometry Based)

Dr. A. Thangadhurai. M. D. (General medicine)

(Senior assistant professor/Government sivagangai medical college/India)

Corresponding author: Dr. A. Thangadhurai. M. D

Background: Diabetes mellitus imparts its effect on all organs of body. There was insufficient documentation of its effect on respiratory system. Hence an attempt is made to document the effect of Type-2 DM on respiratory system by studying the ventilatory function based on spirometry.

Method: 50 Type-2 diabetics of 35-60 yrs age group, Government Rajaji Hospital, Madurai were selected and compared with 50 Healthy Non-Diabetic individuals. The basic parameters of wt in kg, ht in cm, BMI were recorded. The FBS, PPBS and HbA1c were estimated. The pulmonary function tests were recorded by using Micro Medical computerized spirometer, three times for each subject and the best of the three was considered.

Results and conclusion: The pulmonary functions FVC, FEV1, PEF and FEF25%-75% are decreased in Type-2 diabetes mellitus compared to controls. FEV1/FVC% increased in Type-2 diabetes mellitus, which is indicative of restrictive disorder of the lung. There were negative correlation between duration of diabetes mellitus and pulmonary functions FVC, FEV1, PEF and FEF25%-75%. Linear relationship exists between increasing duration and FEV1/FVC%, which is indicative of restrictive disorder of the lung. Poor glycemic control were reflected in pulmonary functions with the decline of spirometric parameters associated with high FBS, PPBS and HbA1c levels. Linear relationship exists between increasing PPBS and FEV1/FVC%, which is indicative of restrictive disorder of the lung. The above mentioned effects of Type-2 diabetes mellitus on pulmonary functions are all due to the alterations in pulmonary connective tissue, thickening of basement membrane of capillary

and alveolus, modification of surfactant, decreased recoiling tendency of lung and decreased muscle endurance (diabetic pulmonopathy).

Keywords: Diabetes mellitus, pulmonary function test, spirometry, pulmonopathy

Date of Submission: 15-08-2018

Date Of Acceptance: 03-09-2018

I. Introduction

Diabetes mellitus is a heterogeneous group of metabolic disorders characterized by chronic hyperglycemia resulting from defects in insulin secretion, action or both. Based on etiopathogenic categories, it is classified as Type-1 and Type-2 diabetes mellitus. In Type-1 there is absolute deficiency of insulin secretion. In Type-2 there is a combination of resistance to insulin action and inadequate compensatory insulin secretory response. Diabetes mellitus is accompanied by wide spread biochemical, morphological and functional abnormalities which may precipitate certain complications that affect the renal, cardio-vascular, neural systems and also skin, liver, collagen and elastic fibres. Thus diabetes is a multisystem disorder that affect many organs of the body.

II. Aim Of The Study

- ✓ To study the ventilatory function of individuals with type 2 diabetes mellitus by performing spirometry.
- ✓ To record the pulmonary function test in Type-2 diabetes mellitus and control group.
- ✓ To evaluate the impact of Type-2 DM on pulmonary functions by comparing with control groups.
- ✓ To correlate the spirometric values and HbA1c of diabetes.

III. Materials And Methods

A case-control study, descriptive, prospective study of the lung function of diabetics compared with age and sex-matched non-diabetic controls.

Sample size:

The sample used in this study consisted of 100 subjects – 50 Diabetics, 50 Healthy Non-Diabetics.

Sampling procedure:

50 Diabetic individuals were recruited from those attending outpatient departments of Government Rajaji Hospital, Madurai. 50 Healthy Non-Diabetic individuals from the general population were taken as controls.

Inclusion criteria:

- ✓ Type 2 diabetes mellitus of more than 5 years duration
- ✓ able to give informed consent.

Exclusion criteria:

- ✗ Smokers
- ✗ Present or past history of respiratory illness that might affect lung function such as asthms, COPD, tuberculosis, bronchiectasis, interstitial lung disease.
- ✗ History of occupational exposure to any substance that could affect lung function.
- ✗ Individuals with current or recent upper respiratory or lower respiratory infection, that could predispose to heightened airway reactivity.
- ✗ Individuals with unacceptable spirometric technique. An unacceptable spirometry was that in which FEV1 or FVC could not be correctly measured due to
 - ☒ Cough
 - ☒ Lack of understanding of the procedure
 - ☒ Recent thoracic and abdominal surgery

Materials

Micro medical spirometer, weighing scale, stadiometer, Microsoft excel.

Methodology

Diabetics and controls were selected as per the criteria laid down. Their written consent was taken. The screening of diabetic subjects and control group was done for exclusion criteria. The history was elicited. Age, height, weight, BMI were recorded. Each subject was instructed to visit cardio respiratory laboratory with 6 hrs of fasting on a specific date, the blood samples [3ml volume] was drawn for estimation of FBS and glycated hemoglobin.

IV. Observation And Results

A total number of 100 subjects were suitable for analysis. There were 50 diabetics (CASES) and 50 non-diabetic group (CONTROL)

The pulmonary function test was conducted on 50 Type-2 diabetics with a history of diabetes for more than 5 yrs duration and 50 healthy individuals. An attempt was made to evaluate the effect of Type-2 DM on pulmonary functions. The effect of extent of diabetes status as reflected by FBS, PPBS, HB1Ac and duration on pulmonary function was also evaluated. The pulmonary function tests recorded were FVC, FEV1, FEV1/FVC%, PEF and FEF25%-75%.

The basic character's Age, sex, height, weight, BMI, FBS and PPBS of cases and controls, are shown in the table 3&4. The P value for the basic characters FBS and PPBS is <0.05 which is significant, however the basic character's age, sex, ht, wt, BMI and P value is >0.05 which is not significant.

B : Effect of Type-2 diabetes mellitus on pulmonary function test

Table 1: Observed Spirometric results

Pulmonary function test	DM Cases group (n=50)		Control group (n=50)		P Value	Significance
	Mean	SD	Mean	SD		
FVC	2.67	0.48	3.25	0.24	0.0001	Significant
FEV1	1.68	0.37	2.32	0.38	0.0001	Significant
FEV1/FVC Ratio	62.75	6.9	72.02	11.01	0.0001	Significant
PEF	400.52	118.92	448.94	105.40	0.0336	Significant
FEF 25-75	2.34	0.55	2.69	0.53	0.0022	Significant

Table 2 : % Predicted values of PFT

Pulmonary function test	DM Cases group (n=50)		Control group (n=50)		P Value	Significance
	Mean	SD	Mean	SD		
FVC	68.26	16.7	84.72	13.4	0.0001	Significant
FEV1	53.88	15.03	76.46	13.84	0.0001	Significant
FEV1/FVC Ratio	78.95	8.2	90.7	13.21	0.0001	Significant
PEF	79.23	17.69	86.46	10.78	0.0155	Significant
FEF 25-75	77.23	19.73	91.62	20.13	0.005	Significant

Spirometric values were consistently lower in Diabetic case groups than control groups. However, the differences were statistically highly significant for FVC, FEV1 & FEV1/FVC ratio (p=0.0001) and moderately significant for PEF & FEF 25-75%. (p=0.0155, p=0.005)

PFT AND HbA1c LEVEL

Table 3 : HbA1c Level and Observed Spirometric results

Pulmonary function test	HbA1c (mg/dl) in DM group (Mean ± SD)			P Value	Significance
	5-7(n=18)	7.1-9(n=24)	>9(n=8)		
FVC	2.75±0.60	2.49±0.48	1.81±0.66	0.001	Significant
FEV1	1.98±0.47	1.76±0.33	1.53±0.20	0.019	Significant
FEV1/FVC	64.35±5.28	61.08±5.54	58.67±3.4	0.028	Significant
PEF	458.83±140.81	371.54±92.43	356.25±94.28	0.029	Significant
FEF25-75	2.57±0.54	2.37±0.53	2.14±0.59	0.59	Not Significant

Observed spirometric results were negatively correlated with HbA1c levels with significant p (<0.05) value for FVC, FEV1, FEV1/FVC,PEF. Which indicates poor glyceemic control was associated with pulmonary functions.

Table 4 : HbA1c level and% Predicted values of PFT

Pulmonary function test	HbA1c (mg/dl) in DM group (Mean ± SD)			P Value	Significance
	5-7(n=18)	7.1-9(n=24)	>9(n=8)		
FVC	66.16±16.85	59±16.21	59.81±13.9	0.034	Significant
FEV1	58.67±15.15	53.29±15.07	51.06±10.49	0.039	Significant
FEV1/FVC	76.86±5.76	75.08±5.96	73.9±3.85	0.040	Significant
PEF	84.83±19.32	74.21±14.23	68.91±17.15	0.046	Significant
FEF25-75	75.93±20.98	79.92±19.68	75.45±19.84	0.78	Not Significant

Poor glyceemic control were also reflected in Pulmonary function test as HbA1c level increases the spirometric values were decreased with significant p value for FVC,FEV1 and FEV1/FVC ratio.

V. Conclusion

The present study was undertaken to resolve conflict between two schools of thought, one expounding impact of Type-2 diabetes mellitus on respiratory system and another non-impact. Pulmonary functions in Type-2 diabetes mellitus and controls were statistically compared to resolve this. The intra diabetic subgroups- FBS wise, PPBS wise, duration wise and HbA1c were correlated to pulmonary functions to find out the impact of Type-2 diabetes mellitus on respiratory system. This study confirms the following features.

- 1) The pulmonary functions FVC, FEV1, PEF and FEF25%-75% are decreased in Type-2 diabetes mellitus compared to controls. FEV1/FVC% increased in Type-2 diabetes mellitus, which is indicative of restrictive disorder of the lung.
- 2) Poor glyceemic control were also reflected in Pulmonary function test as HbA1c level increases the spirometric values FVC, FEV1, FEV1/FVC, were consistently decreased.

The above mentioned effects of Type-2 diabetes mellitus on pulmonary functions are all due to the alterations in pulmonary connective tissue, thickening of basement membrane of capillary and alveolus, modification of surfactant, decreased recoiling tendency of lung and decreased muscle endurance.

References

- [1]. Bacha F, Lee S, Gungor N, Arslanian SA. From pre-diabetes to type 2 diabetes in obese youth: pathophysiological characteristics along the spectrum of glucose dysregulation. *Diabetes Care*. Oct 2010;33(10):2225-31.
- [2]. Dr.Mohankumar, Dr.S.Arulmozhi. Diabetes in elderly: Pulmonary complications in elderly diabetics. Micro labs Ltd.Bangalore:2005;
- [3]. Philippe MF, Benabadi S, Barbot-Trystram L, et al. Pancreatic volume and endocrine and exocrine functions in patients with diabetes. *Pancreas*. Apr 2011;40(3):359-63.
- [4]. Walter.E.Robert, Alexa Beiser, Rachel J, Givelber, George T, O'Connor, et al. Association between glyceemic state and lung function. *Am J Respir Crit Care Med* 2003;167:911-916.
- [5]. lange P.Diabetes mellitus, plasma glucose and lung function in a cross sectional population study.*Eur Respir J* 1989;2:14-19
- [6]. Davis A Wendy, Matthew Knuiman, Peter Kendell, Valerie Grange, Timothy M.E.Davis.Glyceemic Exposure is Associated with Reduced Pulmonary Function in Type-2 Diabetes.*Diabetes care* 2004;27:752-757.
- [7]. Davis Timothy M. E, Matthew Knuiman, Peter Kendell, Hien Vu, Wendy A. Davis. "Reduced pulmonary function and its associations in type 2 diabetes: Diabetes research and Clinical practice 2000; 50:152-159.
- [8]. Sreeja C.K, Elizabeth Samuel, C.Kesava chandran, Shankar Shashidaran. Pulmonary function in patients with diabetes mellitus. *IJPP* 2003;
- [9]. Benbassat Carlos A, Ervin Stern, Mordechai Kramer, Joseph Lebzelter, Ilana Blum, Gershon Fink. Pulmonary function in patients with Diabetes Mellitus. *The Am J Med Sci* 2001; 322(3):127-132.
- [10]. Robert B Tattersall. History of diabetes mellitus, Picket and Williams Text book of diabetes mellitus: Blackwell Scientific; 3rd ed (1):1-20;2003.
- [11]. Vasudevan .D.M, Sreekumari.S. Textbook of biochemistry. Jaypee publications 9th ed.INDIA:Jaypee publisher:81-114.
- [12]. Marco Guazzi MD, Gianluco Pantane MD, Pieguseppe Agastani, MD, PhD Effect of NIDDM on pulmonary function and Exercise tolerance in chronic congestive heart failure. *Amer Jour Card Vol*.89.Jan2002
- [13]. Hiroshi Mori, Masamichi Okuba, Midori Qkamura, Kiminori Yamane, Sejiro Kado, Genshi Egusa, Abnormalities of pulmonary function in patients with NIDDM *Internal Medicine* 31,2,189-193.

- [14]. SK Rajan, P Rajesh Prabhu, Madhu Sasidharan, Spirometric evaluation of type1DM Abstract of paper presented at APICON 2003, JAPI-vol-50,1529 Dec,2002.
- [15]. Schnaph BM et al. Pulmonary function in IDDM with limited joint mobility. Chest 90; 670. 1986.

Dr. A. Thangadhurai. M. D." Assessment of Pulmonary Function Tests in Type 2 Dm (Spirometry Based)". "IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 8, 2018, pp 23-26.