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Pulmonary function tests in male patients with type II diabetes mellitus

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Abstract

Diabetes mellitus is a condition in which a person has a high blood glucose level. It is associated with different complications and impairment in the function of many organic systems. This study was to investigate the pulmonary function in males' patient with type 2 diabetes mellitus, which is more common than type 1. Lung function was evaluated by measuring lung function tests FEV1, FVC and FEV1% of two male groups: diabetic and healthy subjects. The measurement was done by using micro medical spirometer. The results showed that there were no significant differences in FEV1 and FVC. The only significant reduction was in the FEV1%. In conclusion: Lung function may be affected by Diabetes mellitus type II as reflected by FEV1%, but not FEV1 and FVC. There are many possible reasons for these variable changes. The most possible explanation may be due to the effect of disease duration and treatment.

Key words: Lung volumes, Diabetes mellitus

1. Introduction

Diabetes mellitus is a condition in which a person has a high blood glucose level [1] results from the inadequate secretion of insulin or inability of tissues to respond to insulin [2]. Diabetes mellitus is associated with the development of microvascular complications as well as with

impairment in the function of many organic system [3]. Consequently, the kidney, eyes, cardiovascular system and respiratory system can be damaged [4].

Type II diabetes mellitus is more common than type I, about 80% of people who have diabetes, have type II [1]. That is

why this study was applied on patient with type II diabetes mellitus ,which develops in people older than 40 years old .^[5]

Pathoanatomical studies in diabetic patients have represented changes in basal lamina of alveolar epithelium and capillaries [6] .The consequence is development of obstructive or restrictive disorders [7].Some histopathological evidences of involvement of lungs in patients with diabetic mellitus showed thickened alveolar walls, alveolar capillaries walls and pulmonary alveolar walls due to collagen an elastin alterations and microangiopathy .These changes become the cause of pulmonary dysfunctions [8,9]. A great attention was centered for the complications of diabetes ,as a wide distributed disease ,over the last

20 years ,these complications include: cardiovascular diseases ,nephropathic ,retinopathy ,neuropathy but pulmonary complications have been poorly characterized [10,11] .Although some authors have reported normal pulmonary functions [12] .Others found abnormalities in the lung volumes, pulmonary mechanisms and diffusing capacity and pulmonary functions were not included within [13, 14] .That was the aim of this study : to find the possible effect of diabetes on lung functions as evaluated by measuring pulmonary function tests FEV1,FVC and FEV11% and the possibility to insert the diabetes within the factors which greatly influence the lung functions such as :age, height, weight, smoking and socioeconomic status.

2. Materials and methods

The study was carried out on two male groups of population: A-60 type II diabetic patients are within the range 40-60years of age .The source of this group was the diabetic patients attending the out patients department of one major hospital in Basra City. B-57 control healthy group is from Pharmacy College staff. They are apparently healthy, within the range 43-60years of age .This group was from the staff of Pharmacy College. Both groups studied are matched by age, body mass index (BMI), history of non smoking and without prior cardiovascular or respiratory diseases.

Forced Vital Capacity (FVC) and volume of air expired forcefully in the first second of expiration (FEV1) and the ratio of FEV1/FVC are used to evaluate the lung function and to determine if the person has an obstructive lung diseases such as asthma, or restrictive lung disease such as pneumonia [15].These three parameters are

the most common parameters in spirometry used to estimate lung function [16].The measurement of lung functions tests was estimated for all patients at the same time. Because the maneuver is highly dependent on patient's cooperation and the effort, its normally repeated at least three times to ensure reproducibility. This measurement was done by using a spirometer (Micro Medical Ltd.England) spirometer. The micro medical spirometer is compact, battery operated ,hand held spirometer ,and it's a precision instrument designed to measure FEV1,and FVC.Its easy to use and the results are displayed on a clearly legible custom liquid crystal display.

Statistical analysis of the data was done using t-test, statistical package SPSS(Statistical Packages for Social Science).Data expressed by mean \pm SD .The comparison between the studied groups was tested at the level of 0.05 of significance[17].

3. Results

Data analysis of FEV1 shows that despite the fact there is a difference the two groups studied ;diabetic patients($2.7 L \pm 0.59$) and healthy subjects($2.86 L \pm 0.64$) ,this difference is not significant ($P > 0.05$) as in the table below .

Same result has been reported for FVC. The table also shows a non

significant difference in FVC between diabetic patients ($3.40 L \pm 0.58$) and healthy subjects ($3.29 L \pm 0.69$) ($P > 0.05$). On the other hand the only significant difference has shown between the two studied groups in the ratio of FEV1/FVC ($80.47 L \pm 9.97$ VS $86.86 L \pm 6.87$), ($P < 0.05$).

Table: FEV1, FVC and FEV1% comparison between the diabetic patients and healthy subjects

Group Parameter Means \pm SD	Diabetic patients	Healthy patients	P value
FEV1	2.7 ± 0.59	2.86 ± 0.64	0.29
FVC	3.40 ± 0.58	3.29 ± 0.69	0.36
FEV1%	80.47 ± 9.97	86.86 ± 6.87	0.0011*

*A significant difference

4. Discussion

The most common parameters measured in spirometry are FEV1, FVC and FEV1% .These expiratory volumes are used to determine if a person has an obstructive lung diseases such as emphysema and asthma ,or restrictive lung disease such as pneumonia or lung cancer [16] .Therefore using these three lung volumes in the recent work is enough to reflect the pulmonary dysfunction in the two studied groups, and determine the pattern of pulmonary abnormalities and pulmonary complications caused by collagen and elastin changes as part of pathogenesis of diabetes mellitus, as pointed by some researches [3] .This work has shown that FEV1 is less in diabetic patients than in healthy subjects ,but the difference is not a significant one. The significant reduction in FEV1 of diabetic patients has been reported by many other studies [18, 19,20] suggesting that the lung may be involved in the pathogenesis of diabetes and histopathological alterations developed into functional abnormalities: lung volumes, reduced pulmonary diffusion

capacity and elastic recoil ,getting the lung finding of the average rate of decline of lung volume as measured by FEV1 which was 71 ml/year compared with an expected decline in healthy non smokers of 25-30ml/year. This change in lung function was similar whether or not smokers were included in the analysis indicating its independence from smoking state [21]. On the other hand these results are inconsistent with the results reported by other studies (Sandler M et al.) [12], which concluded there was no association between abnormal pulmonary function and the presence of diabetic complications . Some authors have reported normal pulmonary function and no correlation between the results of the pulmonary function tests and even the duration of disease or glycemic control. There is no need for routine screening of pulmonary function tests among diabetic patients [22], and that pulmonary impairment in diabetes mellitus is under recognized [23]. On the other hand this may give a clear explanation about why we have

got no significant difference in forced vital capacity (FVC) between the two studied groups.

The most possible explanation for those conflicting results is the effect of duration of disease and glycemic control. It is found that there is a significant association between the duration of disease and lung volume [24]. This finding is in agreement with other results observed by Law Love et al [25]. Lung function tests are reduced in men with type II Diabetes Mellitus of 10 years or more duration, due to reduced lung volumes and air flow limitation and likely to be chronic complication of type II Diabetes Mellitus. As a result of the reduction in the FEV₁, regardless to the significance, unchangeable FVC, the FEV₁% is reduced. This work has shown that FEV₁% is significantly different between the two studied groups ($p=0.0001$). Even though FEV₁% is significantly different between the two groups, these changed values of FEV₁% are still within the normal range (75%-85%). That is the ratio of FEV₁ to FVC in healthy adults should be approximately 75%-80%.^[16] Two probable explanations for this result: The lung volumes are normal within diabetic patients and the lungs are not involved in the pathogenesis of diabetes mellitus which is in agreement with Benbassate et al, [22] or the lung may be considered as a target organ in the diabetes mellitus and the pattern of the pulmonary

abnormalities is a restrictive pulmonary disease, in which FEV₁ is normal. This is in agreement with Boulbou et al [7] and Sultan et al [11]. There are many pathological mechanisms have been proposed as underlying impaired pulmonary function in diabetes first: Because of the thorax and lungs are rich in collagen and elastin, non enzymatic glycation of these structural compounds could cause stiffening of the thorax and lung parenchyma [26]. This may lead to a restrictive pattern [11]. Second: Diabetes related to microvascular damage may reside in the lungs in parallel to complications in the kidneys, retina and the nerves. Structural changes of the lung parenchyma in diabetics may be: Narrowing of the alveolar space, flattening of the alveolar epithelium, expansion of the interstitium, involvement of pulmonary vessels [9].

In conclusion, diabetic patients show changes, but not significant, in pulmonary function tests FEV₁, FVC. There was a significant difference between the diabetic patients and healthy group in FEV₁%. In spite of the significant difference in FEV₁%, the changed values were still within the normal range 75-80%. The probable explanation for the conflicting results related to these three volumes studied is that the groups were studied regardless to the period of exposure to disease and treatment.

References:

[1] Rosen Bloom AL, Silverstein JH, Amemiya S, Zeitler P and Klingsmith GJ. Type 2 diabetes in children and adolescents. *Pediat Diabetes*. Sep 2009; 10 suppl 12: 17-32.
[2] Seety R.R, Stephens T.D and Tate P. *Anatomy and physiology*. McCraw Hill companies. New York. 2008, 8th. ed.
[3] Ljubic S, Roglic G, Mesie R, Renar IP and Mettelko Z. Trends in pulmonary functions in type 1 diabetic patients with

nephropathy. *Diabetologia Croatic* Feb. 2005; 17: 137-140.
[4] Strojck K, Ziora D, Sroczyński JW et al. Pulmonary complications of type I diabetic patients. *Diabetologia* 1992; 35: 1173-1176.
[5] Brown TA. *Rapid Review Physiology*. Mosby, Inc., an affiliate of Elsevier Inc. 2012. 2nd. ed.
[6] Innocenti F, Fabbri A, Anichi R et al. Indications of reduced pulmonary function

- in type I diabetes mellitus .Diabetes Res Clin Pract 1994;25:161-168.
- [7] Boulbou M S,Gourgoulisian KI,Klisiaris V K et al.Diabetes mellitus and lung function Med Princ Pract 2003;12:87-91.
- [8] Sandler M,Bunn AE ,Stewart RI. Pulmonary Function in young insulin – dependent diabetic subjects .Chest 1986;90:670-675.
- [9] Borst B,Gosker H R ,Zeegers MP and Annemie M W J.Pulmonary Function in Diabetes .A metaanalysis .Chest .Aug2010;138:393-406.
- [10] Matsubara T and Hara F .Pulmonary function and histopathological studies of the lung in diabetes mellitus .Nippon Ika Daigaku Zasshi1991;58:528-536.
- [11] Sultan A M ,Al-Drees A M,Arif M and Al-Rubean K. Lung Function in type 2 Saudi diabetic patients.Saudi Med J 2006;27(3):338-343.
- [12] Sandler M ,Bunn A E and Stewart R I.Cross section study of pulmonary function in patients dependent diabetes mellitus .Am Rev Respir Dis 1987;135(5):1223.
- [13] Wanke T,Formanck D,Auinger Met al .Inspiratory muscle and Pulmonary function changes in IDDM.Am Rev Respir Dis 1991;143:97-100.
- [14] Largz P,Groth S ,Kastrup J et al .Diabetes mellitus plasma glucose and Lung function in cross sectional population study .Eur Resp J 1989;2:14-19.
- [15] Allen C and Harper V .Laboratory manual for anatomy and physiology .John Wiley ND Son ,Inc 2009,3th.ed.
- [16] Levitzky M G .Pulmonary physiology.McGraw.Hill Inc.Singapore.1995,4th.ed.
- [17] SPSS Statistical Packages of Social Science. Version 15.USA.2006.
- [18] Hamdy A B.The lung function and diabetes mellitus. Diabetes Care 2003; 26(6):1915.
- [19] Goldman M D.Lung dysfunction in Diabetes.Diabetes Care 2003;26:1915-1918.
- [20] Davis W A,Knuiman M,Kerdall Pet al.Glycemic exposure is associated with Reduced pulmonary function in type 2 diabetes:The fremental diabetes study.Diabetes care 2004;27:752-757.
- [21] Kaminsty D A.Spirometry and Diabetes. Implications of reduced lung function. Diabetes Care 2004;27(3):837-838.
- [22] Benbassat C,Stern E,Kramer M,Lebzelter J,Blum I,Fink G.Pulmonary function in patients with diabetes mellitus.Am J Med Sci 2001;322:127-132.
- [23] Hsia C Cand Raskin P.The diabetic lung :relevance of alveolar microangiopathy for the use of inhaled insulin.Am J Med.2006;119(2):184-185.
- [24] Davis T,Knuiman M,Kendall P,Vu H,Davis W A.Reduced pulmonary functionand its association in type 2 diabetes :The Fremantle diabetes study .Diabetes Res Clin Prac 2000;50:153-159.
- [25] Lawlore D A,Ebrahim S,Smith G D.Association of measure of lung function with insulin resistance and type 2 diabetes: :Findings from the British women. Heart and Health Study.Diabetologia 2004;47:195-203.
- [26] Litonjua AA ,Lazarus R,Sparrow D,Demolles D,Weiss ST.Lung function in type 2diabetes:the normative aging study .Respir Med.2005;99(12):1583-1590.

اختبارات وظائف الرئة لدى الذكور المرضى المصابين بالسكر نوع 2

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الخلاصة:

مرض السكري من الأمراض المرتبطة بمختلف المضاعفات والوظائف التالفة لكثير من أعضاء الاجهزه كالكليتين والعين والجهاز الوعائي والجهاز التنفسي .اجريت هذه الدراسه لغرض التحري عن وظيفة الرئه في مرضى السكري نوع 2 ومقارنتها بمجموعه الأصحاء .قيمت وظيفه الرئه عن طريق قياس اختبارات الوظائف الرئوية %FEV1,FVC,FEV1 لمجموعتين من الاشخاص الذكور: المصابين بالسكري نوع 2 ضمن المدى العمري (40-60)سنة والأصحاء ضمن المدى العمري (43-60)سنة .تم القياس عن طريق استخدام جهاز Micromedical spirometer .لم تظهر فروقات معنوية بين المجموعتين المدروستين في FEV1,FCV .الفرق المعنوي الوحيد كان في %FEV1. هناك عدة أسباب يمكن إن تفسر هذه التغيرات ,والتي كان أهمها يعود إلى تأثير مده التعرض للمرض والعلاج .