ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by JK Welfare & Pharmascope Foundation Journal Home Page: https://ijrps.com

The relationship between the level of albuminuria and severity of impairment in pulmonary function in type II diabetic patients

Zahraa A. Al-Mudhafer[1], Nibras H. Abdulsada Al-Ghuraibawi*[2], Salam J. Mohammed[3]

[1]Department of Physiology, College of Medicine, University of Kufa, Iraq
[2]Department of Pharmacology, College of pharmacy, University of Kufa, Iraq
[3]Department head of Community Medicine, College of Medicine, University of Kufa, Iraq

Article History:

Received on: 07.11.2018
Revised on: 27.12.2018
Accepted on: 29.12.2018

Keywords:

Diabetes mellitus type ii, diabetic nephropathy, Albuminuria, Spirometry, Pulmonary function

ABSTRACT

Diabetes mellitus type II can lead to acute and chronic complications. The progression of many complications might be explained via modification of connective tissue and microangiopathy. The major microvascular structure in the body is the pulmonary alveolar- capillary network, which might be influenced by diabetic microangiopathy. Diabetic nephropathy (DN) remains a major end-organ complication in diabetes. Complications of diabetes including pulmonary dysfunction and diabetic nephropathy have an analogous microangiopathic origin. There are numerous studies cover the relationship between albuminuria and lung impairment in type I diabetic patients, but few studies about this relationship in type II diabetic patients, so current study aimed To assess the relationship between the levels of albuminuria and pulmonary function in diabetic patients type II. The design of the study is a cross-sectional study included 245 types II diabetic patients (119 male and 126 female), aged 41-80 years with mean ± SEM (57.43±0.54 years). Spirometry was done for all patients. Albumin/creatinine ratio and HbA1c were measured. There was a significant statistical negative relationship between ACR with FEV1 (% predicted) and FVC (% predicted). The progression of diabetic nephropathy to further advanced stages is associated with further changes in pulmonary function.

* Corresponding Author

Name: Nibras H. AL-Ghuraibawi
Phone: +9647805057667
Email: nibrash.abdalsada@uokufa.edu.iq

ISSN: 0975-7538

DOI: https://doi.org/10.26452/ijrps.v10i1.1797

Production and Hosted by
IJRPS | https://ijrps.com

INTRODUCTION

Diabetes mellitus is a condition in which the human body becomes unable to use the absorbed glucose appropriately. That may be because of the lack of insulin hormone or due to that the hormone is not functioning successfully. Diabetes can be classified into two categories– Type I and type II (American diabetes association 2017). The major microvascular structure in the body is the pulmonary alveolar- capillary network, which might be possibly influenced by diabetic microangiopathy. Numerous research papers revealed that in DM patients, collagen and elastin changes are the reason for the loss of elastic recoil. Pulmonary dysfunction might be caused by chronic inflammation and microangiopathy of the alveolar capillaries (Kalappan *et al.,* 2016). Diabetic nephropathy (DN), which remains a major end-organ complication in diabetes, persists to be the major cause of renal disease. Nephropathy is defined as being there is more than or equal to 30 mg albumin in a urine sample collected per day (Beckman and Creager 2016). So, these complications might not be diagnosed clinically. It has been proved that all complications of DM have an analogous microangiopathic origin (Shafiee *et al.,* 2013).

In type I diabetes, a relationship connecting diabetic nephropathy and the change of lung function have been illustrated, but in type II, few kinds of

research were performed in order to study the change of pulmonary function in relation to diabetic nephropathy, so, it is reasonable to study lung function parameters in type II diabetic patients and its association with albuminuria. Therefore, this study aims to evaluate the relationship between the level of albuminuria and severity of impairment in pulmonary function in type II diabetic patients.

MATERIAL AND METHODS

The current study is a cross-sectional study involved 245 types II diabetic patients (119 males and 126 female), aged 41-80 years with mean ± SEM (57.43±0.54 years). All patients were collected from Al-Sadder Teaching Hospital / Annajaf Center for diabetic and endocrine during the time between September 2017 to September 2018. All participants are type II diabetic patients and visit the centre for routine follow-up; they are treated by oral hypoglycemic agents and insulin. Permission for carrying out the study was obtained from the Ethical Committee of Medical Faculty /Kufa University. The patients that enrolled in this study signed an informed consent form before the screening tests were performed. All patients underwent a complete assessment includes full history, chest radiography, physical examination and finally biochemical analysis. Respiratory disease patients, current or X- smokers, Patients with renal disease other than diabetic nephropathy, Patient with chronic liver disease, Patients with hypertension (an independent risk factor for nephropathy) and patients with heart failure were excluded from the study. All patients had undergone a comprehensive assessment including full history according to a well-prepared questionnaire, including name, age, sex, duration of DM, mode of treatment, history of smoking, history of hypertension and drug history as shown in (Table 1). The specialist physician does complete chest examination for each member. Those with abnormal physical findings were excluded from the study. All patients were sent for Chest X-Ray to exclude chest problem.

To calculate the Body Mass Index (BMI) (an index of obesity) the participants, weight and height were measured by using weight and height scale. Spirometric parameters were measured by Spiro lab III (new 3rd generation), (del Maggiolono, Italy) a computerised diagnostic spirometer. The patient should be restful in a sitting position. Spirometry was performed by trained and certified pulmonary technicians according to American Thoracic Society Guidelines (Hankinson & Bang 1991) procedure should be repeated three times and choose the best one (highest one). The parameters to be measured and recorded are forced vital capacity (FVC), forced expiratory volume in the first second (FEV1). The percentage of the predicted FEV1 and predicted FVC are also recorded for all patients. A urine sample was collected to test Albumin/Creatinine Ratio (ACR) which was measured by auto-analyser (BS-120 Chemistry Analyzer), (Mindray Biomedical Electronics Co., Ltd. China). ACR of ≤30 mg/g (≤ 3 mg/mmol), considered normal, (ACR) between (30-300 mg/g) or (3-30 mg/mmol), labeled as microalbuminuria, and (ACR) of ≥300 mg/g (≥30 mg/mmol) is defined as macroalbuminuria (Gnudi *et al.,* 2016). Two millilitres (ml) of blood were collected from every patient for measurement of Glycosylated haemoglobin (HbA1c) by using the D-10 Hemoglobin A1C Testing System (Bio-Rad, USA) which utilises principles of ion exchange high-performance liquid chromatography (HPLC).

Statistical analysis

Statistical analysis was done by using SPSS (statistical package for social sciences) version 20. Using frequencies, percentages and mean with +

RESULTS

The results indicate that there was a significant statistical negative relationship between ACR with FEV1 (% predicted) and FVC (% predicted) ($p<0.05$) table (2).

There was no significant statistical relationship between age and ACR ($p>0.05$), but there was a significant statistical negative relationship between age and FEV1 (% predicted) also between age and FVC (% predicted) ($p<0.05$) table (3).

There was no significant effect of gender, BMI and HbA1c on ACR, FEV1 (% predicted), and FVC (% predicted) ($p>0.05$) table (4), (5) and (6) respectively.

There was a significant statistical positive relationship between duration of DM and ACR, and a significant statistical negative relationship between duration of DM and FEV1 (% predicted) and duration of DM and FVC (% predicted) ($p<0.05$) table (7).

Binary logistic regression for many risk factors affecting FEV1 % Predicted show that the only significant risk factor for impaired FEV1% predicted is ACR**.**

Binary logistic regression for many risk factors affecting FVC % predicted the only significant risk factor for impaired FVC% predicted is ACR.

DISCUSSION

Current study revealed that there was a positive association between impairment of lung function and diabetic nephropathy and the degree of lung

Table 1: Demographic characteristics of the studied patients (n=245)

Gender	Mean	SEM
Age/years	57.43	0.54
BMI Kg/m^2	30.02	0.35
Duration of DM/years	8.74	0.34
HbA1c	8.28	0.10
ACR (mg/mmol)	9.19	0.80
FEV1 (%predicted)	67.38	1.48
FVC (%predicted)	66.38	1.43

Male - 119(48.6%); Female - 126(51.4%)

Table 2: The relationship between albuminuria (ACR) and FEV1 and FVC in type II diabetic patients

Parameter	Albuminuria ACR (mg/mmol)			P value
	1-3 (N=118)	>3-30 (N=93)	>30 (N=34)	
FEV1 (%Predicted)	84.29±0.82	59.76±1.96	29.54±1.12	<0.001
FVC (%Predicted)	83.26±0.79	59.37±1.63	26.96±0.86	<0.001

Table 3: The effect of age on ACR, FEV1 and FVC in type II diabetic patients

Parameter	Age/years	
	41-60 (N=157)	61-80 (N=88)
	Mean±SEM	Mean±SEM
ACR (mg/mmol)	8.61±0.92	11.02±1.49
FEV1 (%Predicted)	70.60±1.79	61.64±2.52
FVC (%Predicted)	70.02±1.75	59.88±2.35

Table 4: The effect of gender on ACR, FEV1 and FVC in type II diabetic patients

Parameter	Gender	
	Male (N=119)	Females (N=126)
	Mean±SEM	Mean±SEM
ACR (mg/mmol)	7.93±1.05	10.37±1.19
FEV1 (%Predicted)	68.63±2.07	66.21±2.11
FVC (%Predicted)	67.17±1.79	65.63±2.22

Table 5: The effect of HbA1c on ACR, FEV1 and FVC in type II diabetic patients

Parameter	HbA1c %		P value
	<7 (N=63)	≥7 (N=182)	
	Mean±SEM	Mean±SEM	
ACR (mg/mmol)	6.72±1.20	10.04±0.99	0.071
FEV1 (%Predicted)	71.10±2.44	64.74±1.72	0.053
FVC (%Predicted)	71.98±2.53	65.79±1.78	0.068

Table 6: The effect of BMI on ACR, FEV1 and FVC in type II diabetic patients

Parameter	BMI Kg/m^2		P value
	<25 (N=37)	≥25 (N=208)	
	Mean±SEM	Mean±SEM	
ACR (mg/mmol)	7.64±2.04	9.46±0.87	0.418
FEV1 (%Predicted)	67.41±4.11	67.38±1.59	0.994
FVC (%Predicted)	68.20±3.08	66.05±1.60	0.594

impairment was associated with the degree of diabetic nephropathy, so, the decline in the parameters of lung function was higher in the cases with albuminuria in relation to cases without albuminuria and for patients with macroalbuminuria comparing to those with microalbuminuria independent of other risk factors including age, gender, BMI, HbA1C and duration of DM (regression analysis for confounders show no significant relationship between these risk factors with lung function parameters). The progression of many complications might be explained via modification of connective tissue and microangiopathy, which result from hyperglycemia (Chawla *et al.,* 2016).

The findings of the current study are agreed with (Shafiee *et al.,* 2013) and (Jitendra *et al.,* 2014) they demonstrate that in patients with albuminuria,

Table 7: The effect of duration of DM on ACR, FEV1 and FVC in type II diabetic patients

Parameter	Duration of DM (years)		P value
	<10 (N=147)	≥10 (N=98)	
	Mean±SEM	Mean±SEM	
ACR (mg/mmol)	7.04±0.82	12.41±1.52	0.001
FEV1 (%Predicted)	70.46±1.75	60.26±2.31	<0.001
FVC (%Predicted)	72.20±1.76	60.16±2.43	<0.001

Table 8: Binary logistic regression for many risk factors affecting FEV1 % Predicted

Parameter	B	S.E.	P value	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Gender	-0.566	0.446	0.204	0.568	0.237	1.360
Duration	-0.013	0.032	0.682	0.987	0.926	1.052
ACR	0.904	0.190	0.000	0.405	1.279	1.587
HbA1c	0.068	0.102	0.502	1.071	0.877	1.308
BMI	0.023	0.038	0.542	1.024	0.950	1.103
Age	-0.024	0.024	0.314	0.976	0.931	1.023

Table 9: Binary logistic regression for many risk factors affecting FVC % Predicted

Parameter	B	S.E.	P value	Exp(B)	95% C.I.for EXP(B)	
					Lower	Upper
Gender	-0.017	0.462	0.971	0.984	0.397	2.434
Duration	-0.057	0.036	0.110	0.944	0.880	1.013
ACR	0.874	0.215	0.000	0.417	1.274	1.637
HbA1c	0.027	0.105	0.798	1.027	0.837	1.261
BMI	0.050	0.040	0.214	1.051	0.972	1.138
Age	-0.042	0.026	0.105	0.959	0.912	1.009

a significant decrease of pulmonary function parameters is more noticeable in comparison with patients with normal protein excretion. It is also observed that in patients with macroalbuminuria, there was a significant decrease in FEV1 and FVC values in comparison with those with microalbuminuria. This is because those chronic complications of lung and kidney in diabetes have an identical etiopathogenesis or a similar mechanism (Ljubic *et al.,* 2004). The thickness of small vessels and the alveolar wall has increased, this modification may lead to decrease in compliance of lung and then reduce its ventilatory capacity. In the kidney, the same modification in the thickness of glomerular capillaries occur which lead to impairment of protein selectivity and then albumin excretion rate will be increased (Girach *et al.,* 2006) (Marvisi *et al.,* 2001).

CONCLUSION

There was a significant relationship between the level of albuminuria and degree of impairment of pulmonary function in type II diabetic patients. Age, gender, BMI, control of diabetes and duration of DM have no significant effect on pulmonary function in diabetic patients type II. The first limitation of this study is that being an observational study so cannot recognise a causal association between lung impairment and albuminuria so follow up studies are needed to investigate the association between lung function and renal function in type II diabetic patients. Second, the albumin/creatinine ratio was estimated on the basis of a single random urine collection.

Competing interest

The authors declare that they have no competing interests.

Acknowledgements

The authors would like to thank volunteers and all the participants in this study for their kind permission, unconditioned cooperation, time, understanding and efforts which made this study possible, and also appreciate the staff of the Al-Sadder Teaching Hospital / Annajaf Center for diabetic and endocrine.

REFERENCES

American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care 2017; 40(Suppl. 1): S11–S24 [online].

Beckman, JA, Creager, MA, 2016. Vascular Complications of Diabetes. Circulation Research, 118(11),1771-1785.

Chawla, A, Chawla, R, and Jaggi, S, 2016. Microvasular and macro vascular complications in diabetes mellitus: Distinct or continuum; Indian Journal of Endocrinology & Metabolism, 20(4), 546–551.

Girach, A, Manner, D, Porta, M, 2006. Diabetic microvascular complications: can patients at risk be identified? A review. The International Journal of Clinical Practice, 60(11),1471–1483.

Gnudi, L, Coward, RJ, Long, DA, 2016. Diabetic Nephropathy: Perspective on Novel Molecular Mechanisms. Trends in Endocrinol & Metabolism, 27(11), 820-830.

Hankinson, JL, Bang, KM, 1991. Acceptability and reproducibility criteria of the American Thoracic Society as observed in a sample of the general population. American Review of Respiratory Disease, 143(3),516–521.

Jitendra, S, Kamlesh, KG, Himanshu, D, Anju, D, Virendra, A, 2014. Pulmonary Function Tests and Diffusion Capacity in Type 2 Diabetes and Their Possible Correlation with Proteinuria, Journal of medical science and clinical research, 2(12), 3091-3098.

Kalappan, M, Rajendran, K, Prasanna, KS, Priyanka, T, Gayathri, G, Rajendran K, 2016. Study on a comparison of pulmonary function tests among diabetic and non-diabetic patients in a tertiary care hospital International Journal of Advances in Medicine, 3(4), 938-941.

Ljubic, S, Roglic, G, Mesic, R, Pavlic-Renar, I, Metelko, Z, 2004.Trends in pulmonary functions in type 1 diabetic patients with nephropathy. Diabetologia Croatia,16 (4),33-4.

Marvisi, M, Bartolini, L, del Borrello, P, Brianti, M, Marani, G, Guariglia, A, Cuomo, A, 2001. Pulmonary function in non-insulin-dependent diabetes mellitus. Respiration, 68(3), 268–272.

Shafiee, G, Khamseh, ME, Rezaei, N, Aqili, R, Malek, M, 2013. Alteration of pulmonary function in diabetic nephropathy. Journal of Diabetes & Metabolic Disorders, 12(1), 12-15.