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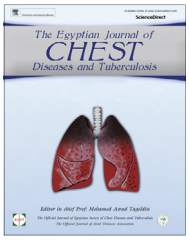

ORIGINAL ARTICLE

Respiratory function in type II diabetes mellitus

Mokhles Abdel Fadil Zineldin [a,*], **Kamel Abdel Ghaffar Hasan** [a], **Ahmed Salama Al-Adl** [b]

[a] *Chest Disease Medicine Department, Al-Azhar University, Egypt*
[b] *Internal Medicine Department, Al-Azhar University, Egypt*

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KEYWORDS

Pulmonary function;
Respiratory muscle;
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Abstract *Background:* Type 2 diabetes mellitus (DM) and metabolic syndrome (MetS) are particularly common medical disorders and are leading causes of morbidity and mortality worldwide. Pulmonary function can be affected by DM.

Aim of the work: The study aimed to evaluate respiratory function tests and respiratory muscle in patients with type 2 diabetes mellitus and correlated it with disease duration and control.

Subjects and methods: 45 male cases with type-2 diabetes were included as a study group; another age-matched 45 cases were included as a control group. Clinical data, respiratory functions were measured and correlated with disease duration and HA1c (diabetes control).

Results: Mean duration of diabetes mellitus was 7.62 ± 2.63 years, while mean HA1c was 7.48 ± 0.32.0. There was a significant decrease of TLC, FVC, FEV1, PEFR, PI_{max} and PE_{max} in the study group, when compared to the control group. On the other hand, no significant difference was found between the two groups as regards FEV1/FVC. On the other hand, there was an inverse, significant correlation between HA1c and DM durations from one side and each of FVC, FEV1 and PI_{max} from the other side.

Conclusion: Patients with type-2 diabetes had a restrictive respiratory defect and glycemic levels and duration of disease are probably major determinants of lung pathology. However, these findings require further validation in subsequent research.

Introduction

Type 2 diabetes mellitus (DM) and metabolic syndrome (MetS) are particularly common medical disorders and are leading causes of morbidity and mortality worldwide [1]. World Health Organization estimated that, more than 180 million people worldwide are affected by the disease and expected that this number will be doubled by the year 2030 [2].

Diabetes causes various microvascular complications (e.g., retinopathy, nephropathy and neuropathy). These complications could be attributed to the biochemical and structural changes in basement membrane proteins in different organ systems. Chronic hyperglycemia leads to glycosylation of proteins such as collagen and elastin with subsequent thickening of

* Corresponding author at: Al-Azhar Faculty of Medicine, Radwan Street, Eti Albaroud, Beheira, Egypt. Mobile: +20 100 6628361.
E-mail address: mokhles.zineldin@yahoo.com (M.A.F. Zineldin).
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basement membrane and microangiopathy. Microangiopathy in alveoli may restrict lung volumes and capacities [3].

In another study, Weynand et al. (1999) found that alveolar epithelial and endothelial capillary basal lamina was significantly thicker in diabetics than in control subjects [4].

Several studies have shown that diabetes mellitus is associated with reduced lung function, as well as respiratory muscle weakness, and this relationship could be interpreted as demonstrating the damaging effects of diabetes on the lung [5–8].

Pulmonary gas exchange occurs through the respiratory membrane that includes the alveolar basement membrane, interstitium and capillary endothelium. Any insult to the integrity of alveolo-capillary membrane of the lung will affect the alveolar gas exchange. Thus it can be hypothesized that alterations in pulmonary function, especially diminished alveolar gas exchange can occur in patients with diabetes mellitus [9].

Aim of the work

The study aimed to evaluate respiratory function tests and respiratory muscle in patients with type 2 diabetes mellitus and correlated it with disease duration and control.

Patients and methods

The present study included 45 diabetic male patients, on oral hypoglycemic drugs. The diagnosis of diabetes was determined according to WHO criteria as follows, fasting blood sugar $\geqslant$126 mg/dl and 2 h post load glucose test $\geqslant$200 mg/dl [10].

They were recruited from the internal medicine department, Al-Azhar Faculty of Medicine; new Damietta; during the period from January 2014 through May 2014. Another 45 healthy male subjects, matched for age were included in the study as a control group.

Exclusion criteria

- Patients diagnosed with cardiopulmonary diseases.
- Patients with any endocrinological disease other than diabetes mellitus.
- Smokers.

Pulmonary function tests, including forced expiratory maneuver parameters [forced vital capacity (FVC), force expiratory volume in 1 s (FEV1), and peak expiratory flow (PEF)], gas dilution lung volumes (total lung capacity, functional residual capacity, and residual volume), inspiratory muscle strength (PI_{max}), and expiratory muscle strength (PE_{max}) measurements, were performed by a spirometer (Messgeraete GhbH Germany). All these pulmonary function tests met the American Thoracic Society criteria [11], and predicted values used are those of the European Coal and Steel Community [12].

For laboratory investigations, 2 ml of venous blood was drawn in EDTA-pretreated tubes under complete aseptic precautions. Blood glucose levels were estimated by the glucose oxidase–peroxidase GOD/POD method and the glycated hemoglobin (HbA1C) was determined by the immuno-inhibition method, both using Beckman Coulter auto-analyzer.

The study protocol was approved by the hospital's ethics committee for human studies, and written informed consent was obtained from all subjects.

Statistical analysis of data

Data were collected, organized, tabulated and statistically analyzed by statistical analysis with SPSS 16.0 version (SPSS Inc, Chicago, USA). Quantitative data were expressed as mean ± SD, while qualitative data were expressed as relative frequency and percent distribution. Independent samples *t*-test was used for quantitative normally distributed variables, while Chi square was used for qualitative data. A *P*-value of <0.05 was regarded as statistically significant.

Results

Results of the present study are depicted in Tables 1–3 and Figs. 1 and 2. Table 1 reveals that, there was no significant difference between cases and controls as regards age, weight, height or BMI; mean duration of diabetes mellitus in the study group was 7.62 ± 2.63 years, while mean HA1c was 7.48 ± 0.32 (poor control). Table 2 shows that, there was a significant decrease of TLC, FVC, FEV1, PEFR, PI_{max} and PE_{max} in the study group, when compared to the control group. On the other hand, no significant difference was found between

Table 2 Respiratory function tests in studied subjects.

Variables	Patients	Controls	*t*	*P* value
TLC	3.56 ± 0.13	4.24 ± 0.14	*23.14*	*<0.001**
FVC	75.04 ± 3.81	88.82 ± 4.95	*14.78*	*<0.001**
FEV1	73.42 ± 3.77	87.02 ± 5.59	*13.51*	*<0.001**
FEV1/FVC	97.84 ± 1.74	97.99 ± 3.57	0.23	0.81
PEFR	59.91 ± 8.32	78.35 ± 4.44	*15.24*	*<0.001**
PI_{max}	59.57 ± 3.41	66.86 ± 2.82	*11.03*	*<0.001**
PE_{max}	36.28 ± 1.96	73.80 ± 3.97	*11.36*	*<0.001**

* Statistically significant.

Table 1 Clinical characteristics of studied subjects.

Variables	Patients	Controls	*t*	*P* value
Age (years)	51.11 ± 6.16	52.44 ± 4.69	1.15	0.25
Weight (kg)	70.11 ± 2.97	69.40 ± 2.94	1.14	0.25
Height (m)	1.69 ± 0.013	1.69 ± 0.018	0.39	0.69
BMI (kg/m^2)	24.49 ± 0.81	24.20 ± 0.72	1.77	0.08
Duration of DM (years)	7.62 ± 2.63	–	–	–
HA1c%	7.48 ± 0.32	–	–	–