COMPARISON OF FEV1/FVC IN TYPE-2 DIABETES MELLITUS PATIENTS AND HEALTHY INDIVIDUALS

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Abstract

Background

Diabetes mellitus is a disease which is affecting 5.9% of the world's adult .The most common (90%) form of diabetes mellitus is type-2 diabetes mellitus and almost 80% of the total cases are found to be in the developing countries.

According to International Diabetes Federation (IDF) 366 million people had diabetes in 2011 and by 2030 this will rise to 552 million. Due to large population, diabetes epidemic is much more pronounced in India where over 61 million diabetics reside and in 2030 it cross the100 million mark[1]

spirometric lung function parameters (FEV1and FVC), were decreased in type-2 diabetics[13] and the calculation of FEV1/FVC allow the identification of obstructive or restrictive ventilatory defects.[27]

This investigation's primary goal was to assess how people with diabetes mellitus's lungs performed during spirometer.

Aim

Our aim was investigating the comparison of FEV1/FVC in type-2 diabetes mellitus patients and healthy individuals.

Material and methods

A Total of 432 subjects who were no acute or chronic pulmonary disease were recruited. A total of 432 age matched subjects 216 of these subjects had type-2 diabetes mellitus patients and 216 were healthy individuals controls. All underwent screening with detailed spirometric measurements at the Department of Physiology, Maharaja Suheldev Autonomous State Medical College & Maharshi Balark Hospitals, Bahraich, Uttar Pradesh.

Results

Pulmonary function test results between case and control groups were significantly different ($p<0.005$). According to the findings, a diabetic's FEV1 was marginally lower than that of a control subject. Forced vital capacity (FVC) and FEV1% PRED (percentage of projected forced expiratory volume at 1st second and FVC) values were lower in the cases group, moreover FEV1/FVC and FEV1/FVC% Predicted were significantly lower in the cases group compared to the control group.

Conclusion

Lung function was diminished in diabetic patients while Lung function was normal in healthy individuals.

Keywords-- diabetes mellitus (DM), spirometer, Forced vital capacity (FVC), forced expiratory volume at 1st second (FEV1).

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Introduction

Diabetes mellitus (DM) is a metabolic condition characterized by hyperglycemia mainly due to insulin resistance ultimately leading to long-term organ dysfunction . Recent research [2-4] has shown a positive relationship between poor glucose control and impaired lung function in DM patients' In comparison to a healthy control group.the patients with diabetes exhibited lower forced expiratory volume in 1st second (FEV1) and forced vital capacity (FVC), according to a meta-analysis involving 3,182 patients with type- 2 diabetes and 27,080 control participants [2].

In one extensive 5-year prospective research found that people with hyperglycemia had a 1.6-fold higher incidence of restricting pulmonary function impairment than people without diabetes [4].

The glycemic control and changes in lung function relate to individuals with DM. Higher Glycated Haemoglobin (HbA1C) levels on follow-up in the Fremantile Diabetes study were consistently associated with deteriorating lung function measurements (FEV1, FVC), according to Davis et al's [5] research.

A logistic regression multivariable model revealed a favourable connection between restrictive patterns and a FEV1 of 80% and HbA1C levels [6]. Furthermore, epidemiological studies indicate that diabetes and hyperglycemia are linked to the emergence of a number of pulmonary disorders, such as interstitial lung disease and airway diseases [7,8].

These investigations support the pathologic autopsy observations that diabetes microangiopathy involves the alveolar capillaries and arterioles, with hyalinosis, plasmorrhagia, and insudation, and that these alterations in metabolism have an impact on the lung [9]. Systemic inflammatory pathways, particularly those involving proinflammatory cytokines like tumour necrosis factor- and interleukin-6, which cause insulin resistance are the common linkages between diabetes and pulmonary illnesses [10,11]. Additionally obesity, a significant risk factor for DM, is thought to trigger an inflammatory cascade that may have an impact on pulmonary function [7, 12].

As a result, this study was created to examine the relationship between changes in lung function and glycemic control by comparing FEV1/FVC in type-2 diabetes mellitus patients and healthy individuals.

Methodology

This comparative cross-sectional study was conducted in the Department of Physiology at Maharaja Suheldev Autonomous State Medical College & Maharshi Balark Hospitals, Bahraich, Uttar Pradesh.

The Study was conducted after taking ethical clearance from the institutional ethical committee. After receiving written informed consent, A total of 432 respondents were ultimately chosen based on inclusion criteria (age group 19-60 years, healthy and diabetic individuals as per American diabetes association) and exclusion criteria (Pregnant and lactating women, History of Person with any chronic cardiac disease, History of renal disease, History of hepatic disease, History of lung disease, History of endocrinal disease, History of psychiatric disorder and Subjects not willing to give written consent).

All subjects with type-2 diabetes were placed in the case group (no =216), whereas all adults in healthy individuals were kept in the control group (no =216).

The spirometry procedure was conducted with Easy on PC NDD Medizintechnik AG CH-8005 Zurich.

Only after resting in that position for at least five minutes was spirometry carried out while seated on a stool facing the spirometer. The spirometer also had a brand-new, disposable mouthpiece that was fresh and clean. To take a deep breath, the patient was told (full inspiration). The subjects was ordered to clip both of his nostrils shut with a nasal clip. The subjects was told to forcibly exhale as hard and swiftly as they could, until there was no more air in their lungs to expel. Throughout the procedure, each spirometric index was measured three times.

Statistical evaluations

In order to express data, continuous variables are given means and standard deviations, and categorical variables are given percentage-based figures. The initial FVC, FEV1, FEV1/FVC ratio, of the patients were categorized. By using logistic regression with confounders, the relationships between initial lung function and diagnostic diabetes were established.

SAS 9.4 (SAS Institute, Cary, NC, US) was used for all statistical analyses, and P values lower than 0.05 were regarded as statistically significant.

Results.

Baseline characteristics

The total of 432 individuals were chosen and split into case groups (no=216) and control groups (no=216). Additionally, of this sample size, 139 (64.4%) males and 77 (35.6%) females were put in the case group, whereas 141 (65.3%) male and 75 (34.7%) female were grouped in the control group as [figure 1].

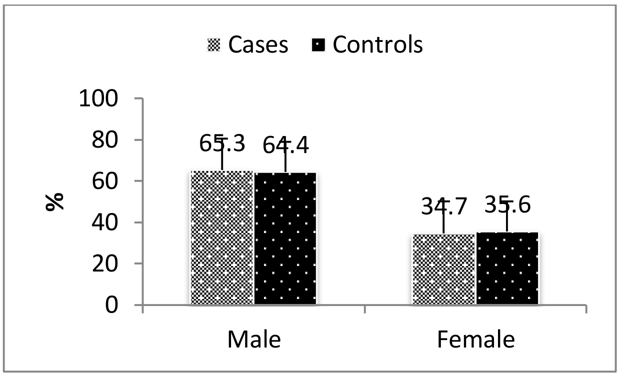

Fig. 1: Distribution of gender between the groups Spirometer parameters

There were significant difference ($p<0.005$) between case and control groups with regards to pulmonary function test. The FEV1 in case sample was 2.27±0.76 while in control it was 2.77±0.73. The results shows that FEV1 In diabetes was slightly decreased in comparison to control individual. The FEV1% PRED (percentage of predicted forced expiratory volume at 1st second and FVC (forced vital capacity) value recorded lower in cases group while, FEV1/FVC (forced expiratory volume at 1st second to forced vital capacity) and FEV1/FVC % Predicted were noticed significantly lower cases group to relative to control group as [figure 2].

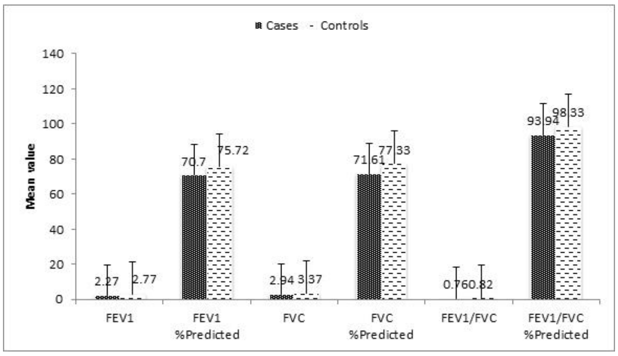

Fig. 2: Comparison of spirometry parameters between the groups

Sensitivity and specificity of FEV1/FVC ratio in predicting diabetes mellitus

The predictive value of FEV1/FVC ratio in predicting diabetes mellitus were displace in form of Receiver operating characteristic (ROC) curve. Overall accuracy is expressed area under the ROC curve (AUC). AUC = 0.74%, p= 0.0001*. The predicting diabetes mellitus had sensitivity of 61.6%, specificity of 76.9%, PPV of 72.7 % and

NPV of 66.7% which determine the occurrence of diabetes mellitus as [figure 3].

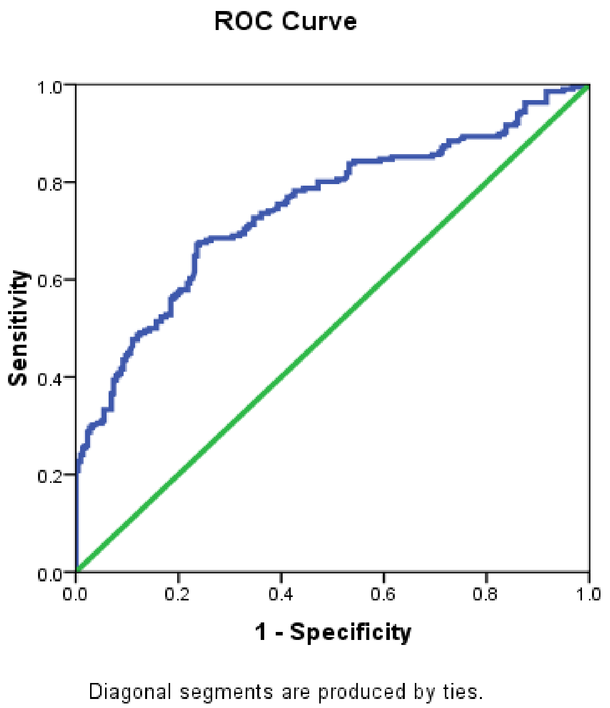

Fig. 3: ROC curve showing sensitivity and specificity of FEV1/FVC ratio in predicting diabetes mellitus

Discussion

This study was conducted to see how diabetes affect pulmonary functioning. When the aforementioned inclusion and exclusion criteria were met, two groups—the case and control groups were chosen. The total 432 people were selected and divided into case and control groups. In addition, 139 (64.4%) male and 77 (35.6%) female from this sample size were assigned to the case group, whereas 141 (65.3%) male and 75 (34.7%) female were assigned to the control group. All the subject underwent tests to measure their pulmonary function.

The FEV1 values were 2.27 ±0.76 and 2.77 ±0.73 in the case and control groups, respectively, demonstrating that diabetes mellitus had significantly reduced FEV1. The FEV1% predict values were respectively 70.70±12.11 and 75.72±13.50 in the case and control groups, indicating that diabetic patients' FEV1% predict values were considerably ($p=0.0001$, $p<0.005$) lower.

Similar to this, the FVC were 2.94 ±0.88 and 3.37 ±0.88 in the case and control groups respectively, indicating that diabetic patients' FVC was considerably ($p=0.0001$ and $p<0.005$) lower. In the case and control groups, the FVC% predict values were 71.61±10.46 and 77.33±12.10, respectively. This indicated that diabetic patients FVC% predict values were considerably ($p=0.0001$, $p<0.005$) smaller. The FEV1/FVC ratios in the case and control groups, respectively, were 0.76±0.07 and 0.82±0.04, which indicated that diabetic patients FVC% predictions were considerably ($p=0.0001$, $p<0.005$) less. In the case and control groups, respectively, FEV1/FVC% Predicted were 93.94±9.18 and 98.33±9.39, indicating that diabetic patient's FEV1/FVC% Predicted were considerably ($p=0.0001$, $p<0.005$) less.

In comparison to matched controls, Meo et al's[3,4] research on Saudi diabetes patients revealed a significant decline in FVC, FEV1. A study from India [17] found that diabetic patient's spirometry parameters were significantly lower than those of the controls, but that there were no changes in the groups' maximal static inspiratory and expiratory pressures, FVC, or other pulmonary functions. The study's biggest limitation was the extremely low patient enrollment in each group.

In Western Australia, Davis et al's [2] extensive community-based research of type -2 diabetic patients revealed that the patients' FVC and FEV1were lowered. They said that type-2 diabetes is likely to be a long-term consequence of the diminished lung volumes and airflow restriction. Additionally, Asanuma [9] noted that Japanese diabetes people had lower FVC and FEV1 values compared to controls.

Although there have been some reports of histological abnormalities in the lungs of diabetes patients, including basal lamina thickening [22] and fibrosis, the aetiology behind decreased lung functioning in diabetics is still not entirely apparent. [23]. Patients with diabetes are thought to have impaired lung function as a result of biochemical changes in the proteins that make up the connective tissue in the lung, particularly collagen and elastin, as well as microangiopathy brought on by the nonenzymatic glycosylation of proteins brought on by long time hyperglycemia. [24,25,26].

Our study has a number of limitations. there aren't many patients, therefore we can't generalise the findings to indian's many ethnic groups. People of our country don't take diabetes as a serious health problem that's why they don't take routine checkup and its treatment from doctor. Type 2 diabetes is mostly detected suddenly. Due to potential cost of spirometry constraints not being present in the majority of developing nation settings. Spirometry is a test of maximal effort, therefore a slight hesitation or delayed start can effect results.

Conclusion

In conclusion, our research confirms findings from prior studies indicating diabetes patients have reduced lung function. When compared to their controls, the FVC, FEV1, FEV1/FVC ratio values were lower. The chronic consequence of diabetes mellitus that is causing this decreased lung function is most likely. To determine the degree of impairment, periodic evaluations of lung functions are required. To support these findings, a bigger prospective study with an extended period of observation is required. Sensitivity and specificity vary depending on the diagnostic test's cut-off and are not inherent to the test itself but rather heavily reliant on the clinical setting. The ideal attribute of a "rule-out" test and the highest sensitivity correlating to the highest negative predictive value can all be determined via ROC curve analysis.

Conflict of Interest: Nil

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