Assessment of Microalbuminuria with glycosylated haemoglobin (HbA1c) among type 2 diabetic patients

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Abstract

Background: The present study aimed to assess the relationship between Microalbuminuria and HbA1c among type 2 DM patients. **Materials and methods:** In the present study, 50 type 2 diabetic subjects and 50 healthy non-diabetic subjects were investigated for fasting blood sugar (FBG), and glycosylated hemoglobin (HbA1c), and urinary microalbuminuria (24hr) **Results:** The mean ± SDs of FBG, HbA1c, and urinary microalbumin, in controls, were in the range of 93.30 ± 10.09, 4.80 ± 0.192, and 25.14 ± 3.55, respectively. It is observed that the mean ± SDs of FBG, HbA1c, and urinary microalbumin, in cases, were in the range of 174.80 ± 9.57, 7.81 ± 1.58, and 120.7 ± 1.58, respectively. It was evident that FBG, HbA1c, and urinary microalbumin levels were increased in cases as compared to controls. The mean ± SD level of FBG, HbA1c, and urinary microalbumin were statistically significantly increased in diabetic cases compared to non-diabetic controls (P<0.0001). **Conclusion:** The present study concludes that poor glycemic control among type 2 DM patients may lead to the development of microalbuminuria, which in turn brings about changes resulting in progressive renal diseases. The situation can be averted by maintaining good glycemic control and adopting a healthy lifestyle. The study recommends regular screening of HbA1c, microalbuminuria among type 2 diabetic patients for identification and timely management of patients at risk.
Key Words: Diabetes Mellitus, Diabetic nephropathy, Glycosylated Haemoglobin (HbA1c), Microalbuminuria, American diabetic association (ADA)

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INTRODUCTION

Worldwide, Diabetes mellitus (DM) became one of the major health problems. The prevalence of DM is increasing rapidly in both developing and developed countries. According to WHO, India became the diabetic capital of the world. In India, type 2 DM is increasing rapidly due to lifestyle changes, including lack of physical activity, eating excessive junk foods, obesity, and stress.[1-4] According to the American diabetic association (ADA) and International Diabetic Association (IDA), by the year 2030, the incidence of type2 DM may reach 87 million. Type 2 DM increases morbidity and mortality and decreases the quality of life. At the same time, the disease and its complications cause a heavy economic burden for diabetic patients for themselves, their families, and society.[5-9] Globally, the prevalence of Type 2 DM is increasing rapidly with disease-associated complications. The complications of DM can be microvascular or macrovascular. Microvascular complications include retinopathy, nephropathy, peripheral neuropathy, and

autonomic neuropathy and macrovascular complications include myocardial infarction, transient ischemic attack, stroke, and limb ischemia. These complications can be prevented by adequate glycemic control.[10-14] Diabetic nephropathy (DN) is one of the most common causes of chronic kidney disease. Its prevalence is increasing because of type 2 DM.[10] For early detection of diabetic nephropathy, the American Diabetic Association (ADA) recommends screening for microalbuminuria once a year for diabetic patients.[11] Microalbuminuria is a resolute indicator of an early stage of DN. Microalbuminuria is a well-established and common risk factor for macrovascular diseases in type 2 diabetics. Microalbuminuria represents the simplest and most sensitive prognostic factor to evaluate the risk of overt nephropathy in diabetes, representing the first stage of progressive diabetic renal disease.[15] Glycosylated hemoglobin (HbA1c) is a diabetic marker and reflects average plasma glucose over the previous 6 to 8 weeks. An HbA1c level predicts the rick the risk for the development of diabetic complications. So the present study aimed to assess the relationship between Microalbuminuria and HbA1c among type 2 DM patients.

MATERIALS AND METHODS

The present study was carried out at Al - Azhar Medical College, situated in Thodupu, District Idukki. Kerala. Approval from the Institutional Ethics Committee was obtained to conduct the study. It was a single-center observational study. A total of 100 patients, fulfilling inclusion and exclusion criteria as listed below were enrolled in the study after obtaining informed consent in writing.

Inclusion Criteria: Diagnosed cases of type 2 diabetes mellitus. Age 30 to 70 years, either gender. Patients who are willing to participate and sign a consent document.

Exclusion Criteria: Pregnant or lactating women. Patients with alcohol or drug dependence.

- Patients who had any major surgery within 4 weeks of screening.
- Patients with acute illness, fever, and urinary tract infection.

Collection of Blood Sample:

A total of 100 subjects with type 2 DM was enrolled. Patients enrolled in the study were recommended not to have heavy exercise at least 24 hours before the examination. This study was a one-shot visit; no follow-ups had been done. Each enrolled patient was subjected to detailed medical history, general physical examination, and biometrics. Fasting blood samples were collected by venipuncture for biochemical analysis and 24 hours urine samples were also collected for estimation of microalbuminuria. Because of measuring urinary albumin concentration correctly, patients were given necessary instructions regarding the collection of urine samples. When no evidence of infection and/or haematuria was found in the urinalysis, urine samples were examined for microalbuminuria.

Parameters measured:

In the present study following parameters were investigated:
1. Blood Glucose (Fasting)
2. HbA1c
3. Urinary Microalbuminuria

Blood glucose estimated by using GOD-POD method [ERBA-semi auto-analyser) and HbA1c was estimated by using direct enzymatic assay method by using Ion exchange chromatography (Crest A Coral clinical system, USA).micro albumin was estimated by turbidimetric immunoassay method.

Statistical analysis:

The collected data were analyzed by SPSS software version 16.0. All results were presented as mean ± standard deviation (SD). A p-value of less than 0.0001 ($p < 0.0001$) was considered significant.

RESULT

In the present study, a total of 100 subjects were divided into two groups, 50 controls (non-diabetic) and 50 cases (diabetic) with the age range of 35 – 70 years. Out of 50 non-diabetic controls, 32 were females and 18 males and in 50 diabetic cases, 17 were females and 33 males as shown in Table – 1.

Table 1: Age and Gender wise distribution of controls and cases

Age	Controls (Non-Diabetic) (n=50)		Cases (Diabetic) (n=50)	
	Males (n=18)	Females (n=32)	Males (n=33)	Females (n=17)
35- 40	04	07	09	02
41-50	05	10	12	05
51-60	07	12	04	07
61-70	02	03	08	03
Total	18	32	33	17

Table 2 : Various parameters for cases and control

Parameters	Controls (Non-Diabetic) Mean ± SD	Cases (Diabetic) Mean ± SD	Student 't' test	P-Value
FBG (mg/dl)	93.30 ± 10.09	174.80 ± 9.57	41.44	<0.0001 s**
HbA1c (%)	4.80 ± 0.192	7.81 ± 1.58	13.33	<0.0001 s**
U. Microalbumin (mg/24 hr)	25.14 ± 3.55	120.70 ± 66.59	10.13	<0.0001 s**

S** = extremely statistically significant

The mean ± SDs of FBG, HbA1c, and urinary microalbumin, in controls, were in the range of 93.30 ± 10.09, 4.80 ± 0.192, and 25.14 ± 3.55, respectively. It is observed that the mean ± SDs of FBG, HbA1c, and urinary microalbumin, in cases, were in the range of 174.80 ± 9.57, 7.81 ± 1.58, and 120.7 ± 1.58, respectively. It was evident that FBG, HbA1c, and urinary microalbumin levels were increased in cases as compared to controls. The mean ± SD level of FBG, HbA1c, and urinary microalbumin was statistically significantly increased in diabetic cases compared to non-diabetic controls (P<0.0001) as shown in Table - 2.

DISCUSSION

In type 2 DM patients, the development of DN is associated with several factors, includes poor glycemic control, age, hypertension, and duration of diabetes (16-18). Among type 2 diabetic patients, HbA1c consider being an indicator of poor glycemic control which in turn is a risk factor for DN. The present study was therefore planned to assess the association of HbA1c with microalbuminuria and hence with the progression of DN in Type 2 patients. The results obtained in the two groups were expressed as mean ± SD. The mean ± SDs of FBG, HbA1c, and urinary microalbumin, in controls, were in the range of 93.30 ± 10.09, 4.80 ± 0.192, and 25.14 ± 3.55, respectively. It is observed that the mean ± SDs of FBG, HbA1c, and urinary microalbumin, in cases, were in the range of 174.80 ± 9.57, 7.81 ± 1.58, and 120.7 ± 1.58, respectively. It was evident that FBG, HbA1c, and urinary microalbumin levels were increased in cases as compared to controls. The mean ± SD level of FBG, HbA1c, and urinary microalbumin was statistically significantly increased in diabetic cases compared to non-diabetic controls (P<0.0001) as shown in **Table - 2**. Similar results were reported by Naveen *et al.*,2012.[19] DN is said to be a common consequence of long-standing type 2 DM. Elevated glucose levels in the blood lead to the binding of glucose to protein resulting in excessive protein glycosylation which in turn leads to elevated glycated end products. Increased deposition of these glycated end products on the glomerulus resulting in renal and glomerulohypertrophy and thickening of the glomerular basement membrane. This allows leakage of albumin (a low molecular weight protein).[19] This condition is turned into incipient nephropathy [microalbuminuria].

CONCLUSION

The present study concludes that poor glycemic control among type 2 DM patients may lead to the development of microalbuminuria, which in turn brings about changes resulting in progressive renal diseases. The situation can be averted by maintaining good glycemic control and adopting a healthy lifestyle. The study recommends regular screening of HbA1c, microalbuminuria among type 2 diabetic patients for identification and timely management of patients at risk.

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