Original Research Article

Correlation of glycosylated hemoglobin with urinary albuminuria for early detection and progression of nephropathy in patients with type 2 diabetes millitus

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A B S T R A C T

Background: diabetic nephropathy is a one of the most leading disorder in patients with type 2 diabetes mellitus. Urinary albuminuria used for detection of nephropathy in type 2 diabetes mellitus but its not an a sensitive and specific biomarker for DN. Recent studies found some of the sensitive and specific biomarker for early detection and progression of nephropathy in type 2 diabetes mellitus patients.

Materials and Methods: A total 150 subjects included in the present study in that 100 patients diagnosed with type 2 diabetes mellitus and 50 healthy controls. All the subjects included after informed consent and blood, urine samples were collected from the all the subjects. FBS, PPBS, Urea, Creatinine, Uric acid, HbA1C and Urinary Albumin was analysed by using laboratory standard methods.

Results: statistically elevated levels of plasma FBS, PPBS, HbA1C in both the groups of type 2 diabetes mellitus when compared to healthy controls. Serum Urea, Creatinine and Uric Acid levels elevated in type 2 diabetes mellitus with microalbuminuria when compared to other two groups of study subjects. The Glycosylated hemoglobin positively correlated with urinary microalbuminuria in patients with two groups of type 2 diabetes mellitus.

Conclusion: This study suggest that the poor glycemic control leads to increased further complications in patients with type 2 diabetes mellitus. Continuous monitoring of HbA1C and Urinary Albumin Levels were useful for progression and treatment of patients with type 2 diabetes mellitus.

1. Introduction

Type 2 diabetes mellitus is a chronic metabolic disease due to hyperglycemia because improper secretion of insulin from the beta cells of pancreas and improper activation of insulin due to metabolism, lack of activators leads to insulin resistance.[1–3] The prevalence of T2DM is 300 million by the year 2015 and this number will raise up to 450 million by the year 2030 and Indian scenario 45 million peoples were effected this will also increase up to 80 million by the year 2030.[4,5] Hyperglycemia in the blood and hypoglycemia in the tissues leads to lipolysis and proteolysis in the tissues for maintaining energy.[6] Simultaneously production of free radicals and decreased anti oxidants leads to micro and macro vascular complications particularly on damage dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels.[7–9]

Nephropathy is also one of the microvascular complication in patients with T2DM increasingly frequent etiology of end-stage renal disease and dialysis. Moreover, the prevalence of diabetes related chronic kidney disease (CKD) has exceeded that of glomerulonephritis-related CKD to become the leading cause of CKD.[10] To date, the diagnosis of DKD is dependent on both albuminuria and estimated glomerular filtration rate (eGFR) according to the relevant guidelines. However, albuminuria does not directly

reflect the extent of renal injury, and few DM patients have had progressive renal decline before albuminuria and microalbuminuria (MA) among some patients with DKD can be regressed back to normoalbuminuria (NA). Glycosylated haemoglobin (HbA1c) is commonly used as a marker of glycaemic status. [11–13] Glycated haemoglobin (HbA1c) was called as unusual haemoglobin in patients with diabetes when it was first discovered. After that discovery, it was established that HbA1c could be used as an objective measure of glycaemic control and a validated relationship between A1C and average glucose across a range of diabetes types. [14] This study was carried out to correlation of glycosylated hemoglobin with urinary albuminuria for early detection and progression of nephropathy in patients with tpe 2 diabetes millitus.

2. Materials and Methods

This is a case control study was conducted at "Vydehi Institute of Medical Sciences and Research Centre", Karnataka. A total 150 subjects included in the present study, 100 cases diagnosed with T2DM according to American diabetes association (ADA) criteria [15] and The cases are sub grouped based on albumin creatinine ration, the 50 patients T2DM with normoalbuminuria (ACR Ratio: < 30 mg/dL) and 50 patients T2DM with Microalbuminuria (ACR Ratio: 30-299 mg/dL) along with that 50 healthy subjects were included. All the subjects were recruited in the study after obtaining their informed consent after obtaining of ethical clearance from the institute. Patients with T2DM and age more than 30 years were included in the present study. Whoever has Exclusion criteria's for both cases and controls were patients with history of hypertension, hypercholesterolemia, cardiovascular disease, hepatic disorders, acute and chronic renal insufficiency and alcohol abuse excluded from this study. From the all subjects, after overnight fasting (12hrs), 5mL of venous blood was collected and 2mL transferred into anticoagulant Tube contain fluoride and 3 mL transferred into plain tube. The second sample was collected for PPBS. Urine samples also collected from all the subjects. The collected samples were separated by centrifugation at 3000 rpm for 5 min and stored until biochemical analysis was done. The Plasma FBS, PPBS, HbA1C, Serum Urea, Creatinine, Uric Acid were analysed by laboratory standard methods, Urine Albumin Creatinine Ratio was measured by immunoturbidometric method.

2.1. Statistical analysis

The mean and standard deviation about the arithmetic mean were used. The significance difference between FBS, PPBS, HbA1C and Urinary albuminuria analysed by using Analysis of variance (ANOVO). The Pearson correlation was used for between the HbA1C, Urinary Albumin with

FBS, PPBS, Urea, Creatinine and Uric acid. The Data was compiled in Microsoft excel spread sheets and analyzed using SPSS for windows version 16.0. A p value <0.05 was considered statistically significant.

3. Results

The plasma fasting blood sugar, post parandial blood sugar, serum urea, creatinine, uric acid, Glycosylated hemoglobin and urinary albumin levels were increased in two groups of T2DM Patients when compared to healthy controls. Significantly elevated levels of plasma fasting blood sugar, post parandial blood sugar, serum urea, creatinine, uric acid, Glycosylated hemoglobin and urinary albumin are observed in all the parameters elevated in between patients T2DM with Microalbuminuria when compared to patients T2DM Normoalbuminuria.(Table 1)

The plasma fasting blood sugar, post parandial blood sugar, serum urea, creatinine, uric acid with positively correlated with HbA1C and Urinary Albumin levels were in two groups of T2DM Patients.(Table 2)

4. Discussion

Hyperglycemia is a major risk factor for diabetes mellitus due to improper production and activation of insulin from the beta cells of pancreas results insulin resistance. [16] Diabetes associated hyperglycemia causes long-standing damage, dysfunction and collapse of many vital organs; mainly kidneys, eyes, nerves, heart and blood vessels. Long-term complications of DM include nephropathy which leads to renal failure, retinopathy which potentially causes loss of vision, autonomic neuropathy which causes gastrointestinal and cardiovascular dysfunction and peripheral neuropathy which causes foot ulcers. [17,18] Diabetic kidney disease (DKD) is a familiar and serious complication of DM. It is the primary cause of renal failure as well as mortality and morbidity in diabetic patients. DKD is caused by environmental and genetic factor interactions. DKD has an effect on 30-40% of type 2 DM patients and diagnosis of DKD at initial stage allows immediate management which improves disease prognosis. [19] Proteinuria is the marker of DKD and a primary indicator of kidney disorder progress. Microalbuminuria is a key biomarker of kidney injury. [20] It is the predictor of kidney disorder in DM individuals and associates with premature mortality and morbidity in diabetic, hypertensive and healthy people.

In the present study were analysed fasting blood sugar, post parandial blood sugar, serum Urea, Creatinine, Uric acid, HbA1C and Urinary Albumin statistically elevated in two groups of T2DM Patients when compared to healthy controls p- value is 0.0001**. In between the two groups of subjects there is increased levels of FBS, PPBS, Urea, Creatinine, Uric Acid, HbA1C and Urinary albumin elevated in patients T2DM with Microalbuminuria when

Table 1: Shows the distribution of data in between demographic and biochemical parameters in all the group subjects.

Parameter	Controls	T2DM Patients with Normoalbuminuria	T2DM Patients with Microalbuminuria	P value
Age (Years)	52.34± 9.42	46.30± 11.70	54.58± 07.29	0.054
Fasting Blood Sugar (mg/dL)	86.22± 14.20	127.16± 16.47	285.46± 32.16	0.0001**
Post Prandial Blood Sugar (mg/dL)	125.18± 23.79	164.07 ± 42.89	321 ± 29.64	0.0001**
Serum Urea (mg/dL)	34.06 ± 6.01	40.24± 6.90	104.68± 9.10	0.0001**
Serum Creatinine (mg/dL)	0.84 ± 0.21	1.1 ± 0.19	12.54 ± 1.24	0.0001**
Serum Uric Acid (mg/dL)	5.64± 2.35	7.13± 1.16	14.69± 0.43	0.0001**
HbA1C (%)	4.24± 1.71	7.43± 1.72	11.94± 9.87	0.0001**
Urinary Albuminuria (mg/dL)	15.13± 0.88	27.16± 1.09	197.66± 47.45	0.0001**

Table 2: Show the Pearson correlation in between the two groups of T2DM patients

Parameter	Name of The Parameters	r value	P value
Urinary Albuminuria (mg/dL)	Age (Years)	0.034	0.840
	Fasting Blood Sugar (mg/dL)	0.195	0.0001**
	Post Prandial Blood Sugar (mg/dL)	0.232	0.000**
	Serum Urea (mg/dL)	0.153	0.0001**
	Serum Creatinine (mg/dL)	0.871	0.0001**
	Serum Uric Acid (mg/dL)	0.694	0.0001**
	HbA1C (%)	0.645	0.0001**

compared to patients T2DM with Normoalbuminuria p-0.0001**. The Pearson correlation analysis HbA1C with urinary albumin in patients with two groups of type 2 diabetes mellitus. This study suggest continuous monitoring of these investigations were useful for detection as well as prognosis of nephropathy in patients with type 2 diabetes mellitus.

5. Conclusion

The study concluded that elevated levels of Glycated hemoglobin as well as Urinary albumin were useful for detection and progression of different stages of nephropathy in patients with type 2 diabetes mellitus and also this study suggest that continuous monitoring of these investigations were useful for treatment of different stages of type 2 diabetes mellitus.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare no conflict of interest.

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