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Original Article

Correlation between Glycosylated Haemoglobin (HbA1c) and Urinary Microalbumin with Complications of Diabetes

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Abstract

Background: *Diabetes complications are the major reason for the mortality in type 2 diabetes mellitus (T2DM). The biochemical parameters play an important role in the prediction of micro and macrovascular complications in diabetes mellitus.*

Aims and Objectives: *To investigate the role of biochemical markers such as serum creatinine, glycosylated haemoglobin (HbA1c) and microalbuminuria in the prediction of microvascular complications in patients with T2DM.*

Materials and Methods: *Hundred T2DM patients with diabetic nephropathy were studied at JAH and groups of hospital from May 2014 to November 2015 for their fasting blood sugar (FBG), post prandial blood glucose (PPBG), HbA1c, serum creatinine and microalbuminuria levels and they were also correlated with other diabetic complications. Results were categorized based on the presence or absence of the microvascular complications. All the analysis was performed using IBM SPSS Ver. 20. Significance is assessed at 5 % level of significance.*

Results: *Male preponderance (58.67%) was observed with mean age of cohort being 52.4±15.2 years. Increased micturation frequency (48%) was the mostly recorded presenting symptoms. Mean HbA1c, duration of diabetes, blood pressure, microalbuminuria and serum creatinine was 9.03±2.1%, 9.37 ±5.96 years, 132±22.4/84±12.5 mmHg, 118.6± 86.7 mg/day and 1.33±0.64 mg/dl respectively. Neuropathy was reported in 32% patients, 8% had retinopathy whereas 13.33%had cardio vascular disease. Significant positive correlation was observed for duration of diabetes ($r=0.43$, $p<0.05$), microalbuminuria ($r=0.34$, $P<0.05$) and HbA1c ($r=0.28$, $p<0.05$) with other micro and macrovascular complications.*

Conclusion: *Increased HbA1c, longer duration diabetes and increased microalbuminuria level were associated with progression of micro and macrovascular complications in T2DM patients.*

Keywords: *Microvascular complications, glycosylated haemoglobin, microalbuminuria, diabetic retinopathy, diabetic neuropathy, diabetic nephropathy.*

Introduction

Diabetes mellitus is the leading cause of morbidity associated with macrovascular complications including coronary artery disease, cerebro-vascular disease and peripheral arterial disease and microvascular complications including retinopathy, nephropathy and neuropathy. [1] In diabetes mellitus patient, risk of chronic complication depends upon the duration of diabetes and usually apparent in the 2nd decade of diabetes development.[2]

Glycosylated haemoglobin (HbA1c) is the gold standard to measure severity of diabetes mellitus. Incipient diabetic nephropathy is the early phase of diabetic renal disease which characterized by increased albumin excretion (30-300 mg/L). Once incipient diabetic nephropathy transform in to overt nephropathy, progression can be stopped. Hence, it is more important to screen the patients for early nephropathy.[3]

The possible mechanism behind increased albumin excretion due to chronic hyperglycaemia may be due to podocyte (cells in the Bowman's capsule in the kidneys) dysfunction leading to apoptosis finally leading to depletion of podocytes at the glomerular level.[4]

Relation between microalbuminuria, HbA1c and duration of diabetes are not clear and studies relating these parameters are few in our country. Present study was carried out to compare the relationship between all these parameters.

Materials and Methods

The present observational study was performed on 75 patients having diabetic nephropathy at JAH and groups of hospital from May 2014 to November 2015.

Institutional Ethics committee approval and written informed consent from each patient was obtained before starting study.

Patients with age >18 years and HbA1c >6.5% were included in the study. Patients having acute and chronic inflammatory conditions, pre-existing chronic kidney disease (CKD), chronic renal failure, chronic glomerulonephritis, nephrotic syndrome, smokers, alcoholics, patients on nephrotoxic drugs, preeclamptic patient, patients with psychiatric disorders and primary hypertensive's were excluded from the study.

Detailed medical history including duration of diabetes, complications history and relevant clinical examination including, HbA1c, blood urea, serum creatinine, and urinary microalbumin was analysed in each patient. Correlation was obtained between each clinical investigation.

All the analysis was performed using IBM SPSS Ver. 20. Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± standard deviation (SD) and results on categorical measurements are presented in number (%).Correlation coefficient was used to establish correlation. Significance is assessed at 5 % level of significance.

Results

Mean age of population was 52.4±15.2 years. Most of the patients belong to age group of 40-59 years [32 (42.67%)] followed by 28 (37.3%) patients who belong to age group of ≥ 60 years. Most of the patients were male [44 (58.67%)] followed by 31 (41.33%) female.

Most common presenting symptoms was increa-sed micturation frequency [36 (48%)] followed by blurring sensation in limb [20 (26.7%)].

Mean HbA1c, duration of diabetes, blood pressure microalbuminuria and serum creatinine was 9.03±2.1%, 9.37 ±5.96 years, 132±22.4/84±12.5 mmHg, 118.6± 86.7 mg/day and 1.33±0.64 mg/dl respectively.

Most of the patient had HbA1c between 6.5-8 % [32 (42.7%)] followed by 21 (28%) patients who had HbA1c >10%. Most of the patients had diabetes duration <10 years [46 (61.3)] followed by 17 (22.7%) patients who had diabetes duration between 16-20 years. Maximum patients had microalbuminuria between 30-150 mg/day [52 (69.3%)] followed by 151-249 mg/day [15 (20%)].Maximum patients had serum creatinine <1.5 mg/dL [50 (66.7%)].

Neuropathy was reported in 24 (32%) patients whereas 10 (13.33%) had cardio vascular disease and 6 (8%) had retinopathy.

Table 1: Comparing different parameters with the present of other complications in study cohort

Parameter		With complication	Correlation
Duration of diabetes (9.37 ±5.96 years)	<10 (n=46)	18 (39.10)	r=0.43, p<0.05
	10-15 (n=12)	7 (58.3)	
	16-20 (n=17)	15 (88.24)	
Microalbuminuria (118.6± 86.7 mg/day)	30-150 (n=52)	22 (42.3)	r =0.34, P<0.05
	151-249 (n=15)	12 (80)	
	250-299 (n=8)	6 (75)	
HbA1c (9.03±2.1%)	6.5-8 (n=32)	15(46.8)	r=0.28, p<0.05
	8-10 (n=22)	9 (41)	
	>10 (n=21)	16 (76.2)	

Data is expressed as no of patients (%), r; correlation coefficients, HbA1c; glycated haemoglobin

Discussion

Urinary microalbuminuria is the earliest clinical evidence of diabetic nephropathy at which right interventions can slow, or reverse the advancement of diabetic micro and macrovascular complications. In the absence of particular intervention, 20-40% of the diabetic patients with microalbuminuria may progress to other microvascular complication.[4]

Similar to the present study, Samatha et al studied biochemical parameters such as microalbuminuria and HbA1c in 50 T2DM patients and found to be significant predictor of microvascular complication.[5] Results reported by Samatha et al are consistent with the present study data. Severity of microvascular complications was related to longer duration of diabetes and increased level of HbA1c. Diabetic retinopathy and neuropathy was significantly increased duration of diabetes and was linked to poor glycemic control (high HbA1c) as found by present study. Gaede et al and Klein et al reported similar findings.[6, 7]

Longer duration of diabetes mellitus was the most significant predictor of diabetic microvascular complication in the present study as around 88% of the patients who had diabetic complication were having diabetes since 16 to 20 years. PrzeglLek et al have also observed duration of diabetes as an important predictor of all forms of neuropathy. [8] Another study performed by Porta et al of EURODLAB Prospective Study Group reported that glycemic control and duration of diabetes was the strong predictor of proliferative retinopathy in T2DM patients.[9]

Bahman et al reported that in T2DM patients with duration of diabetes 10-14 years risk of developing microalbuminuria was 4.11 times higher compared to patients with diabetes duration of 0-4 years.[10] Kundu et al and Agarwal et al observed that poor glycemic control is the reason behind the risk of development of long term chronic complications. Also urine microalbumin and HbA1c levels were significantly higher in T2DM patients.[11,12]

Study done by Ramanathan on 500 T2DM patients at Ahmedabad showed significant correlation of longer duration of diabetes and poor glycemic control with microvascular complications of diabetes.[13]

Present study had few limitation of being less in sample size along with observational nature of the study. A large, randomized clinical trial is needed to confirm the present study findings.

Conclusion

Incidence and the progression of microvascular complication such as neuropathy and retinopathy and macrovascular complication such as cardiovascular disease increased with increasing HbA1c, longer duration of diabetes and increased microalbuminuria in T2DM patients. Hence, poor glycaemic control, a longer duration of diabetes and progression of microalbuminuria can anticipate the micro and macrovascular complication in patients with T2DM.

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