

Original Research Article

Correlation of microalbuminuria with glycosylated haemoglobin in patients of diabetes having nephropathy

Mayank Gupta*, Jagat Pal Singh

Department of Medicine, GR Medical College, Gwalior, Madhya Pradesh, India

Received: 11 April 2017

Accepted: 08 May 2017

*Correspondence:

Dr. Mayank Gupta,

E-mail: makgupta51@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Diabetes mellitus is the leading cause of end stage renal disease (ESRD) and is responsible for 30-40% of all ESRD. Objectives of the study were to assess the renal functional status in diabetic nephropathy patients by evaluating and correlating glycosylated haemoglobin levels in diabetic with microalbuminuria.

Methods: Present observational study was done including 75 patients having diabetic nephropathy, who attended JAH and attached groups of hospitals from May 2014 to November 2015. Detailed medical history including duration of diabetes and relevant clinical examination including glycated haemoglobin, blood urea, serum creatinine, and urinary microalbumin were recorded for each patient. All the analysis was performed using IBM SPSS Ver. 20. Significance is assessed at 5% level of significance.

Results: Mean age of study population was 52.4 ± 15.2 years with male preponderance (58.67%). Increased micturition frequency (48%) was the most common presenting symptoms. Mean fasting blood sugar (FBS), post prandial blood sugar (PPBS), HbA1c, duration of diabetes, blood pressure, microalbuminuria and serum creatinine was 151.5 ± 48.5 mg/dL and 240.3 ± 59.7 mg/dL, $9.03 \pm 2.1\%$, 9.37 ± 5.96 years, $132 \pm 22.4/84 \pm 12.5$ mmHg, 118.6 ± 86.7 mg/day and 1.33 ± 0.64 mg/dl respectively. Microalbuminuria ($r=0.91$, $p \leq 0.05$), HbA1c ($r=0.67$, $p \leq 0.05$) and serum Creatinine ($r=0.33$, $p \leq 0.05$) were positively correlated with duration of diabetes.

Conclusions: Level of microalbuminuria increase with increase in duration of diabetes and worsening of diabetes.

Keywords: Diabetic nephropathy, End stage kidney disease, HbA1c, Microalbuminuria

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterized by persistence hyperglycemia resulting from the defects in insulin secretion, action or both. Diabetes mellitus is not a single disease but a group of several metabolic disorders which shares a common feature of hyperglycemia.¹

DM is associated with dyslipidemia, atherosclerosis and predispose to certain specific microvascular complications including retinopathy, nephropathy and neuropathy. It also increases the risk of stroke,

myocardial infarction and peripheral vascular diseases.² DM is the leading cause of end stage renal disease (ESRD). Although both type 1 and type 2 DM can lead to ESRD, the majority of patients are those with type 2 DM.³

In diabetic nephropathy, microalbuminuria is the earliest manifestation which is the predictor of incipient nephropathy in diabetic patients.⁴ HbA1c is the gold standard to measure severity and level of control of diabetes mellitus. Incipient diabetic nephropathy is the early phase of diabetic renal disease which is characterized by increased albumin excretion (30-300

mg/L). Once incipient diabetic nephropathy transform in to overt nephropathy, progression cannot be stopped. Hence, it is more important to screen the patients for early nephropathy.⁵ The present study was performed to establish the relationship of HbA1c, microalbuminuria and serum creatinine with duration of diabetes

METHODS

An observational study was done on 75 clinically diagnosed cases of diabetic nephropathy having age >18 years who attended JAH and attached groups of hospitals for 18 month from May 2014 to November 2015.

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

Patients with HbA1c >6.5% were included in the study. Patients suffering from acute and chronic inflammatory conditions, other metabolic conditions like pre-existing chronic kidney disease, chronic renal failure, chronic glomerulonephritis, nephrotic syndrome, smokers, alcoholics, patients on nephrotoxic drugs, preeclamptic patient, patients with psychiatric disorders and primary hypertensives were excluded from the study. Detailed medical history including duration of diabetes and relevant clinical examination including glycated

haemoglobin, blood urea, serum creatinine, and urinary microalbumin were analysed in each patient.

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) (Min-Max) 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 study cohort 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. Out of 75 patients, 44 (58.67%) were male and 31 (41.33%) were female.

Most of the diabetic nephropathic patients were type 2 diabetics [72 (96)] followed by 3 (4%) patients who were type 1. Most common presenting symptoms was increased micturition frequency [36 (48%)] followed by blurring sensation in limb [20 (26.7%)]. Mean FBS and PPBS was 151.5±48.5 mg/dL and 240.3±59.7 mg/dL respectively.

Table 1: correlation of diabetes duration with different patient's parameters.

Parameters		Duration of diabetes (years)			Correlation
		<10	10-15	16-20	
Microalbuminuria (118.6±86.7 mg/day)	30-150 (n=52)	46 (88.46)	6 (11.53)	0 (0)	r=0.91 p≤0.05
	151-249 (n=15)	0 (0)	6 (40)	9 (60)	
	250-299 (n=8)	0 (0)	0 (0)	8 (100)	
HbA1c (9.03±2.1%)	6.5-8 (n=32)	30 (93.75)	1 (3.12)	1 (3.12)	r=0.67 p≤0.05
	8-10 (n=22)	13 (59.09)	6 (27.27)	3 (13.63)	
	>10 (n=21)	3 (14.59)	5 (23.80)	13 (61.90)	
Serum creatinine (1.33±0.64 mg/dl)	<1.5 (n=50)	35 (70)	7 (14)	8 (16)	r=0.33 p≤0.05
	1.5-2.0 (n=12)	7 (58.33)	3 (25)	2 (16.66)	
	2.0-2.5 (n=9)	2 (22.22)	2 (22.22)	5 (55.55)	
	2.5-3.0 (n=4)	1 (25)	2 (50)	1 (25)	

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

Mean blood pressure was 132±22.4/84±12.5 mmHg. Maximum patients had BP between 91-120/70-79 mmHg [32 (42.7%)] followed by 121-139/80-89 mmHg [30 (40%)]. Mean microalbuminuria was 118.6±86.7 mg/day. Maximum patients had microalbuminuria between 30-150 mg/day [52 (69.3%)] followed by 151-249 mg/day [15 (20%)]. Mean HbA1c among study cohort was 9.03±2.1%. Most of the patient had HbA1c between 6.5-8% [32 (42.7%)] followed by 21 (28%) patients who had HbA1c >10%. Microalbuminuria was positively correlated with HbA1c (r=0.82, p<0.05).

Mean serum creatinine was 1.33±0.64 mg/dl which ranged from less than 1.5 to 3.0 mg/dl. Maximum patients had serum creatinine <1.5 mg/dL [50 (66.7%)]. Mean blood urea was 43.2±15 mg/dL which ranged from 20 mg/dl to 80 mg/dl. Most of the patients had blood urea between 20-40 mg/dl [36 (48%)] followed by 28 (37.3%) patients who had it between 40-60 mg/dl.

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

Mean duration of diabetes among study cohort was 9.37 ± 5.96 years which ranges from 10 to 20 years. 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.

DISCUSSION

Present study has highlighted the relationship of duration of T2DM with microalbuminuria and higher level of HbA1c level. Hyperglycemia is responsible for the pathogenesis of diabetic nephropathy. Glycated compounds are formed when glucose reacts with primary amines of proteins non-enzymatically. Hyperglycemia exerts harmful effects on kidney functioning by directly changing the signalling pathways of cells.^{6,7}

Alamdari et al studied risk factors for microalbuminuria in T2DM patients and reported 30.5% prevalence of microalbuminuria. Alamdari et al also reported significantly high HbA1c levels in patients with microalbuminuria.⁶ Similar to that, present study also found a significant positive correlation of microalbumin with HbA1c level ($r=0.82$, $p<0.05$).

Baig et al studied 60 patients to compare duration of T2DM with microalbumin, concluded that in patients with T2DM, long duration of diabetes and poor glycemic control (depicted by high HbA1c level) significantly correlated with high level of microalbumin.⁷ Similar to Baig et al, in present study also, patients with poor glycemic control (higher HbA1c) had higher level of microalbumin. This fact is further supported by higher level of serum creatinine in T2DM in present study. Present study findings are in agreement with previous studies suggesting that higher value of HbA1c in diabetes patient is strongly associated with microalbuminuria.^{7,8}

In a study performed on 8,260 subjects at 9 centres reported that prevalence of microalbuminuria and decreased eGFR was highest when HbA1c was above the median and prevalence was lowest when HbA1c median was at lowest.⁹

The present study showed a significant correlation between HbA1c, microalbuminuria, duration of diabetes and serum creatinine. Kumar et al studied 100 T2DM patients and reported similar correlation.¹⁰ Based on the observations of present study level of glycemic control seems to be the strongest factor determining conversion from normoalbuminuria to microalbuminuria in patients with T2DM.

Observational design was the main limitation of present study to assess diabetic nephropathy; we have also not examined the role of HbA1c variability on microvascular complication development. Microalbuminuria usually comes out after 5-15 year after the diagnosis of T2DM. In later stage GFR decreases with appearance of macroproteinuria along with clinical sign of nephropathy

and finally leads to end stage renal disease with diminished GFR.¹¹ Therefore microalbuminuria may not be linked with abnormal serum creatinine, but it can be an important warning alarm for renal damage. Liu et al and Khan et al also reported increase in microalbuminuria level with advancing age and duration of diabetes which has been again confirmed by the present study data.^{12,13}

CONCLUSION

The uncontrolled diabetes as evident by high HbA1c leads to micro vascular complications. High HbA1c and long duration was diabetes were found to be associated with presence of urinary microalbuminuria in diabetes patients.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Kumar R, Abbas A, Fausto N, Aster JC, eds. Robbins and Cotron "Pathologic basis of disease" 8th Ed. Saunders Elsevier Publishing Division; 2010:934-935, 1131-1146.
2. Robbins SL, Tucker AW. The cause of death in diabetes: a report of 307 autopsied cases. N Engl Med. 1944;231:865-8.
3. Daminov BT. The effects of eprosartan mesylate and lercanidipine on reducing microalbuminuria. Int J Bio Med. 2013;3(2):70-3.
4. Viberti GC, Jarrett RJ, Mahmud U, Hill RD, Argyropoulos A, Keen H. Microalbuminuria as a predictor of clinical nephropathy in insulin-dependent diabetes mellitus. Lancet. 1982;319(8287):1430-2.
5. Mogensen CE. Microalbuminuria predicts clinical proteinuria and early mortality in maturity-onset diabetes. N Engl J Med. 1984;310:356-60.
6. Alamdari MI, Aminisani N, Bashardoost B, Shamshirgaran SM, Khodamoradzadeh M, Shokrabadi M, et al. Prevalence and risk factors of microalbuminuria in type 2 diabetic patients in a diabetic clinic of Ardabil-Iran. Int J Endocrinol Metab. 2006;4:8-12.
7. Baig JA, Asif N, Sarfaraz A, Alam JM. Correlation of microalbuminuria with glycosylated hemoglobin (HbA1c) and duration of type 2 diabetes mellitus (T2DM) in male and female patients. Middle-East J Sci Res. 2016;24(9):2900-3.
8. Raman S, Dai H, DeLurgio SA, Williams DD, Lind M, Patton SR, et al. High hemoglobin A1c variability is associated with early risk of microalbuminuria in children with T1D. Pediatr Diabetes. 2016;17(6):398-406.
9. Penno G, Solini A, Bonora E, Fondelli C, Orsi E, Zerbini G, et al. HbA1c variability as an independent correlate of nephropathy, but not retinopathy, in

- patients with type 2 diabetes. *Diabetes Care*. 2013;36:2301-10.
10. Kumar S, Aneja GK, Trivedi A, Atam V, Shankhwar SN, Panwar A, et al. Correlation of diabetic nephropathy and hba1c in newly diagnosed type 2 diabetic patients of Western UP. *Int J Sci Res Publ*. 2014;4(12):1-4.
 11. Unuigbo EI, Omeife H, Edema T, Ukoli FA. Microalbuminuria and associated factors in newly diagnosed diabetics. *Niger Postgrad Med J*. 2001;8(4):187-92.
 12. Liu Z, Fu C, Wang W, Xu B. Prevalence of chronic complications of type 2 diabetes mellitus in outpatients-a cross-sectional hospital based survey in urban China. *Health and Quality of Life Outcomes*. 2010;8(1):62.
 13. Khan NJ, Farid MI, Hameed S, Aziz M. Frequency of microalbuminuria in newly diagnosed type 2 diabetics at Nishtar Hospital, Multan. *Ann King Edward Med Coll*. 2004;10(4):374-5.

Cite this article as: Gupta M, Singh JP. Correlation of microalbuminuria with glycosylated haemoglobin in patients of diabetes having nephropathy. *Int J Adv Med* 2017;4:805-8.