Microalbumin Status in Relation to Glycated Haemoglobin and Duration of Type 2 Diabetes Mellitus

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BACKGROUND: Diabetes mellitus (DM) is one of the most common endocrine disorders, characterized by hyperglycemia. Diabetic nephropathy is a consequence of long- standing diabetes and urinary microalbumin (Uma) status predicts progression to diabetic nephropathy. This study was conducted to know the status of Uma in relation to duration of diabetes and HbA1c level in patients with Type 2 diabetes mellitus (T2DM).

METHODS: This prospective cross-sectional descriptive study was conducted from July 1, 2014 to January 15, 2015 at TUTH, Kathmandu. Ninety-six known T2DM patients with age 35– 83 years were included in the study. EDTA venous blood and spot urine sample were collected for analysis of HbA1c and Uma respectively. Only those patients having HbA1c concentration ≥ 6.3% and duration of diabetes ≥ 6 months were included under the study.

RESULTS: Overall prevalence of microalbuminuria (MAU) was 39.6 %. MAU had a highly significant correlation with duration of diabetes (r =0.471, p<0.05). Present study has shown positive correlation of MAU with HbA_{1c} level, although statistically insignificant (r=0.245, p>0.05).

CONCLUSIONS: Prolonged exposure to hyperglycemia-induced advanced glycosylation end products accumulations contributes for the development of MAU. So, duration of diabetes mellitus is main contributing factor for the development of MAU rather than HbA1c level alone. Screening for MAU to prevent renal impairment and measuring HbA_{1c} level on a regular basis for good glycemic control are important in diabetic patients.

Key words: Diabetes mellitus, Microalbuminuria, HbA_{1c}

Introduction

Diabetes Mellitus (DM) is a chronic, widely prevalent endocrine disease, which is characterized by hyperglycemia due to defects in insulin secretion, insulin action or both [1]. Diabetic nephropathy is most common complication of long-standing diabetes mellitus [2]. Persistent microalbuminuria (MAU) is the best predictor of progression to end-stage renal disease (ESRD) as well as cardiovascular complications [3]. Till date, different studies have been performed to find out the relationship between MAU, glycosylated haemoglobin (HbA_{1c}) and duration of diabetes. All the studies have not shown similar results and the relation between these parameters are not clear. This study was conducted to explore the underlying relationship between these parameters in our context.

Methods

This prospective cross sectional study was conducted on total 96 patients with T2DM. This study was carried out in Biochemistry Laboratory, Tribhuvan University Teaching hospital (TUTH) from July 1, 2014 to January 15, 2015. In this study, T2DM subjects having HbA_{1c} value >6.3%, who gave written consent were included under this study. Simultaneously, history of duration was taken and required informations were noted. HbA1c was estimated using NyCocard boronate affinity assay and Uma concentration was measured in spot urine sample using NyCocard immunometric assay. NyCocard Reader II was used for measurement of both HbA_{1c} and urinary microalbumin. Before performing microalbumin test, the urine sample was tested by uristrip method to exclude overt proteinuria from this study. MAU was diagnosed if albumin was between 20-200 mg/L.

Statistical analysis was done using SPSS version 17.0. Pearson's correlation was applied to observe associations of microalbuminuria with duration of diabetes and HbA_{1c} level. All p-values <0.05 were considered as statistically significant.

Results

A total of 96 patients 54 males and 42 females

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were included in this study. Overall prevalence of MAU in the present study was 39.6 % (38/96). Among total 54 males, prevalence of UMA was 44.4% (24/54). And among 42 females, prevalence of UMA was 33.3 % (14/42). Mean age of patients with UMA was 61.42±7.45 years and in normoalbuminuric patients it was 59.21±8.49 years.

Duration of diabetes ranged between 6 months and 18 years. Out of total 96 patients, 52 had duration of diabetes <5 years and among them 18 (34.6 %) had MAU. Twenty six had duration of diabetes ≥5 to 10 years, among them 10 (38.5 %) had MAU. Twelve had duration of diabetes ≥10 to 15 years, among them 6 (50.0 %) had MAU, and six had duration of diabetes ≥15 years, among them 4 (66.7 %) had MAU [Table. 1]. Mean duration of diabetes in microalbuminuric patients was 7.71±5.65 years while in normoalbuminuric patients it was 5.17±4.32 years, which was statistically significant. Pearson correlation analysis showed statistically significant correlation of MAU with duration of diabetes (r= 0.471, $p < 0.05$) [Table 3].

Out of total 96 patients, 60 had HbA_{1c} level < 8.0 % , among them 20 (33.3 %) had MAU. 20 had HbA_{1c} level ≥ 8.0 – 10.0 % , among them 10 (50 %) had MAU. 12 had HbA_{1c} level ≥ 10.0–12.0 % , among them 6 (50 %) had MAU 4 had HbA_{1c} level ≥ 12.0 % , among them 2(50%) had MAU [Table 2]. Mean HbA_{1c} level in microalbuminuric patients was 8.63±1.89 % while in normoalbuminuric patients it was 8.02±1.77 %. Although MAU positively correlated with HbA1c but statistically was insignificant. Pearson correlation analysis did not show statistically significant correlation of MAU with HbA1c level (r= 0.245 $p > 0.05$) [Table 3].

Table 1 :Prevalence of microalbuminuria in relation to duration of T2DM

			Group for Uma		Total
			Normoalbuminuria	microalbuminuria	
Duration (years)	<5 years	N	34	18	52
		Percent	65.4%	34.6%	100.0%
	≥5-10 years	N	16	10	26
		Percent	61.5%	38.5%	100.0%
	≥10-15 years	N	6	6	12
		Percent	50.0%	50.0%	100.0%
	≥15 years	N	2	4	6
		Percent	33.3%	66.7%	100.0%
Total		No.	58	38	96
		Percent	60.4%	39.6%	100.0%

Table 2:Prevalence of microalbminuria in relation to HbA1c level in T2DM

			Group for Uma		
			Normoalbuminuria	Microalbuminuria	Total
HbA1c level (%)	<8	N	40	20	60
		Percent	66.7%	33.3%	100.0%
	≥8-10	N	10	10	20
		Percent	50.0%	50.0%	100.0%
	≥10-12	N	6	6	12
		Percent	50.0%	50.0%	100.0%
	≥12	N	2	2	4
		Percent	50.0%	50.0%	100.0%
Total		N	58	38	96
		Percent	60.4%	39.6%	100.0%

Table 3: Correlation microalbuminuria with duration and HbA1c level in T2DM

Variable	Normoalbuminuria	Microalbuminuria	P value	Correlation coefficient (r)
Mean duration (years)	5.17 ± 4.32	7.71 ± 5.65	0.001*	0.471
Mean HbA1c level (%)	8.02 ± 1.77	8.63 ± 1.89	>0.05 **	0.245

*Statistically significant
**Statistically insignificant

Discussion

The aim of present study was to explore the prevalence and associations of MAU with different parameters in T2DM in our context. Present study has shown overall prevalence of MAU to be 39.6 %. Wu et al has reported slightly higher prevalence of MAU (39.8 %) in Asian population, [4] whereas, another Asian study has shown 36.3% MAU in T2DM Indian population [5] The overall prevalence of MAU in present study is higher than the study done in Kathmandu valley, Nepal by Maharjan et al, [6] which was 36.79% but was lower than the study done in Pokhara, Nepal by Sigdel et al, [7] which was 45.5%. Prevalence of MAU was reported 25 % in one study conducted by Ghai et al. [8]. This marked variation in results for prevalence of MAU might be due to sample size, sample selection, study design, hypertension, poor glycemic control, duration of diabetes, age and gender structure of study population.

Present study has shown significant correlation of MAU with duration of diabetes which is in accordance with many previous reports [9]. Chowta et al showed statistically significant correlation of MAU with duration of diabetes ($r = 0.839$, $p < 0.0001$) [10].Naz et al had reported similar type of result in patients from Islamabad and Rawalpindi [11].

This study has shown positive correlation of MAU with HbA1c, but statistically insignificant ($r = 0.245$, $p > 0.05$). In a study conducted by Maharjanet al in Kathmandu valley, Nepal comparison of HbA1c level between microalbuminuric and normoalbuminuric was not statistically significant [6].ShonimaVenugopal and Uma M lyer showed statistically significant correlation of UMA and HbA1c level ($p < 0.05$) [12].Manjrekar et al has reported gradual increase in prevalence of MAU with similar increase in HbA1c level [13].Similarly, Gupta et al performed an independent study and reported strong association of HbA1c level with urinary microalbumin excretion [14]. The difference in results may be due to limited sample size. Hence, further study with a larger sample is necessary in order to confirm the result obtained in present study.

This study shows conclusive evidence that urinary microalbumin excretion was significantly correlated with duration of the disease and level of HbA1c positively correlated with urinary microalbumin although statistically insignificant. Duration of diabetes contributes for the development of MAU and then diabetic nephropathy by prolonged exposure to hyperglycemia induced advanced glycosylation end products.

Conclusion

Overall prevalence of microalbuminuria in T2DM was 39.6%. Urinary microalbumin excretion correlated significantly with duration of diabetes. Increased HbA1c level positively correlated with MAU, although statistically insignificant. Regular screening for urinary microalbumin as well as HbA1c and good glycemic control is recommended in such patients.

Acknowledgement

We are grateful to the entire team of Department of Biochemistry, TU Teaching Hospital, Kathman-du, Nepal for their great support throughout the study.

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