MICROALBUMINURIA AND ITS CORRELATION WITH GLYCEMIC CONTROL IN TYPE 2 DIABETIC PATIENTS

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ABSTRACT

Objective: To find out the frequency of microalbuminuria and its correlation with glycemic control in type 2 diabetic patients presenting to a teaching hospital.

Methodology: This descriptive study was carried out from March 2011 to April 2012, in the Department of Medicine, Lady Reading Hospital, Peshawar. The study included 121 type 2 diabetic patients of both genders above 30 years of age. Frequency of microalbuminuria was detected among these patients. Demographic and clinical details were recorded regarding microalbuminuria, duration of diabetes, glycated hemoglobin (HbA1c), blood glucose, gender and age. For data entry and analysis, SPSS version 21.0 was utilized. Chi-square test and boxplots were used for comparison of data and determining the relationship of microalbuminuria with glycemic control.

Results: There were 47 (38.8%) males and 74 (61.2%) females in the present study. Mean age of study patients was 54.21 ±10.27 years (range 30-80 years). Microalbuminuria was present in 73 (60.3%) patients. Average duration of diabetes was 5.809 ±3.55 years and average HbA1c was 8.55 ±1.24%. There was significantly increased frequency of microalbuminuria in poorly controlled diabetics (83.56%) compared to diabetics with good glycemic control (16.44%), p value 0.015.

Conclusion: Microalbuminuria was found with increased frequency in type 2 diabetic patients. The relationship of microalbuminuria with glycemic control and duration of diabetes mellitus was statistically significant.

Key Words: Microalbuminuria, Glycated hemoglobin, Diabetes mellitus, HbA1c

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INTRODUCTION

Type 2 diabetics are at risk of developing several serious complications including diabetic nephropathy. Microalbuminuria is considered an independent predictor of nephropathy as well as cardiovascular disease[1]. It progresses at a rate of 5-10% per year to overt nephropathy and with continued decline in glomerular filtration rate will end up in end stage renal disease. Endothelial damage is proposed as the likely mechanism for appearance of albumin in urine. If the renal glomerulus had high permeability for albumin, it will be leaked into the urine. When this excretion of urinary albumin is 30-300 mg/24 hours or 20-200 µg/min, it is known as microalbuminuria[2].

In type 2 diabetic patients, the reported prevalence of microalbuminuria varies from 19.7% to 28.5% in India[3]. However, in Pakistan, as high as 72% frequency of microalbuminuria has been shown which may reflect a very poor glycemic control in our country[4]. Good glycemic control is shown to significantly reduce renal damage[5]. On the other hand, increased prevalence and severity of microalbuminuria are linked to poor glycemic control. Glycated hemoglobin or HbA1c gained popularity as the preferred test for glycemic control assessment in diabetics because no special preparation (fasting or post-prandial) is required and it gives an estimate of glycemic control over the preceding 8-12 weeks period[6].

Diabetes mellitus is a major health issue in Pakistan with a prevalence of 3-14%[7]. Though microalbuminuria is linked to adverse renal and cardiovascular complications, still its regular screening in type 2 diabetics is not a common clinical practice[8-9]. The current study was designed with the following objectives: (i) to find out the frequency of microalbuminuria in type 2 diabetics

presenting to a teaching hospital; (ii) to compare it with glycemic state in poor and well controlled diabetics; and (ii) to find out the relationship between duration of diabetes and microalbuminuria. If found to be significantly high in type 2 diabetics and in those with poor controlof diabetes, routine screening for microalbuminuria and measures for glycemic control will be suggested in diabetic patients. Early detection of diabetic nephropathy is important so that progression to end stage renal disease could be prevented and thus help in reducing the associated morbidity and mortality.

METHODOLOGY

This descriptive study was carried out from March 2011 to April 2012, in the Department of Medicine, Lady Reading Hospital, Peshawar. The study included 121 type 2 diabetic patients of both genders above 30 years of age. The patients were enrolled in the study by consecutive sampling technique. Calculated sample size was 121; using WHO sample size calculations and keeping 19% prevalence of microalbuminuria in diabetic patients[3], at 95% confidence interval and 7% margin of error. Ethical approval of hospital ethical review board was taken. An informed consent was obtained from the enrolled patients. Confidentiality of all information was assured to them.

Patients with urinary tract infection, hypertension, congestive cardiac failure, smoking, obesity, pregnant ladies, bed ridden patients for more than one month and chronic NSAIDs users were excluded. As anemic patients could affect HbA1c levels, they were also excluded. These were excluded clinically and by relevant investigations, as needed. Relevant laboratory tests were carried out in the laboratory of Lady Reading Hospital, Peshawar.

Demographic and clinical details were recorded regarding microalbuminuria, duration of diabetes, glycated hemoglobin, blood glucose, gender and age. Venous blood samples were collected and analyzed for blood glucose, HbA1c and serum creatinine. Mid-stream urine samples from the patients were collected after explaining the procedure and necessary instructions regarding the collection of urine samples. Microalbuminuria was estimated by immersing the strip in urine for five seconds.

Operational definitions of key terms included: diabetes mellitus (random blood sugar $\geq$200 mg/dl, fasting blood sugar level of $\geq$126 mg/dl or patient was taking anti-diabetic medications); microalbuminuria (20-200 µg/min in spot urine, according to the change of color in the strip); and diabetes control (well controlled if HbA1c <7% & poorly controlled if HbA1c $\geq$7%).

All the above mentioned information was recorded in a pre-designed proforma. All the data were entered and analyzed by SPSS version 21.0. For quantitative variables (HbA1c levels, duration of diabetes and age) mean and SD were calculated; while for qualitative variables (frequency of microalbuminuria, glycemic control and gender) frequency and percentages were calculated. Microalbuminuria was stratified according to age and gender to see the effect modifications. Chi-square test and boxplots were used for comparison of data and determining the relationship of microalbuminuria with glycemic control. Statistical significance was considered at p value <0.05. Figures and tables were used for presentation of data.

Table 1: Baseline characteristics (n=121)

Qualitative Variables	**Distribution**	**Frequency**	**Percentages**
Gender	Male	47	38.8
	Female	74	61.2
Age (in Years)	upto 50	54	44.6
	51-60	34	28.1
	61-70	31	25.6
	>70	2	1.7
Quantitative Variables	**Minimum**	**Maximum**	**Mean ± SD**
Glycated Hemoglobin	6.0	10.9	8.555 ± 1.24
Blood Sugar Level	101	472	224.36 ±69.29
Duration of Diabetes	.25	16.00	5.8091 ± 3.55

Table 2: Albuminuria and control of diabetes (n=121)

Albuminuria	Control of Diabetes		Total	Significance
	Yes	No		
Yes	12	61	73	p value= .015
No	17	31	48	
Total	29	92	121	

Figure 1: Microalbuminuria and duration of diabetes

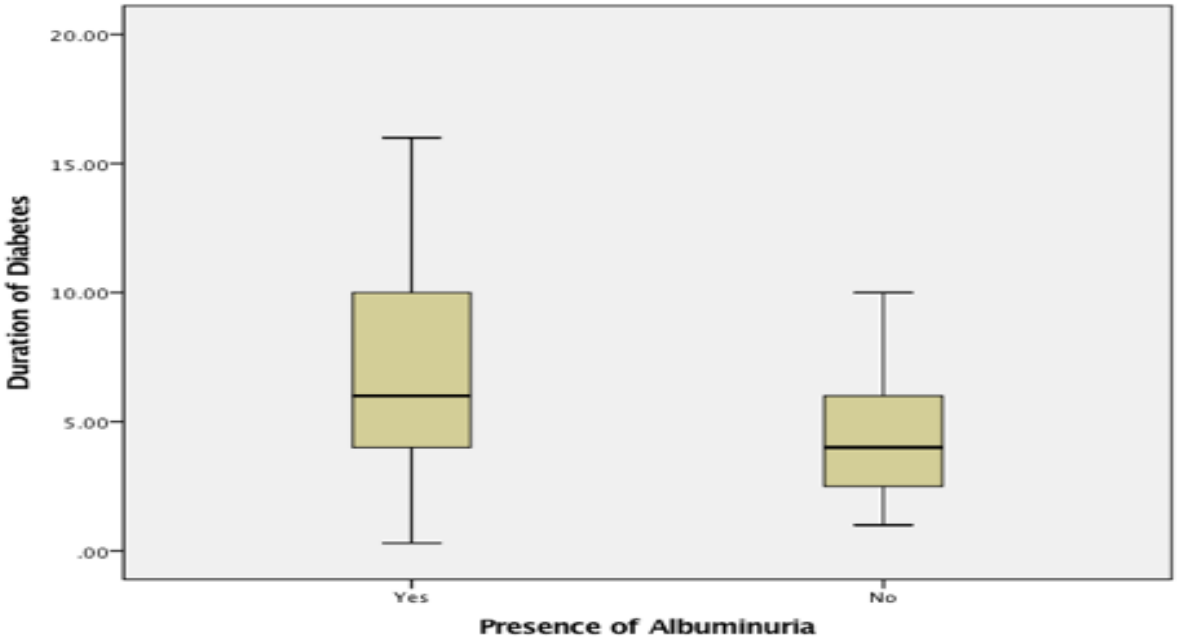
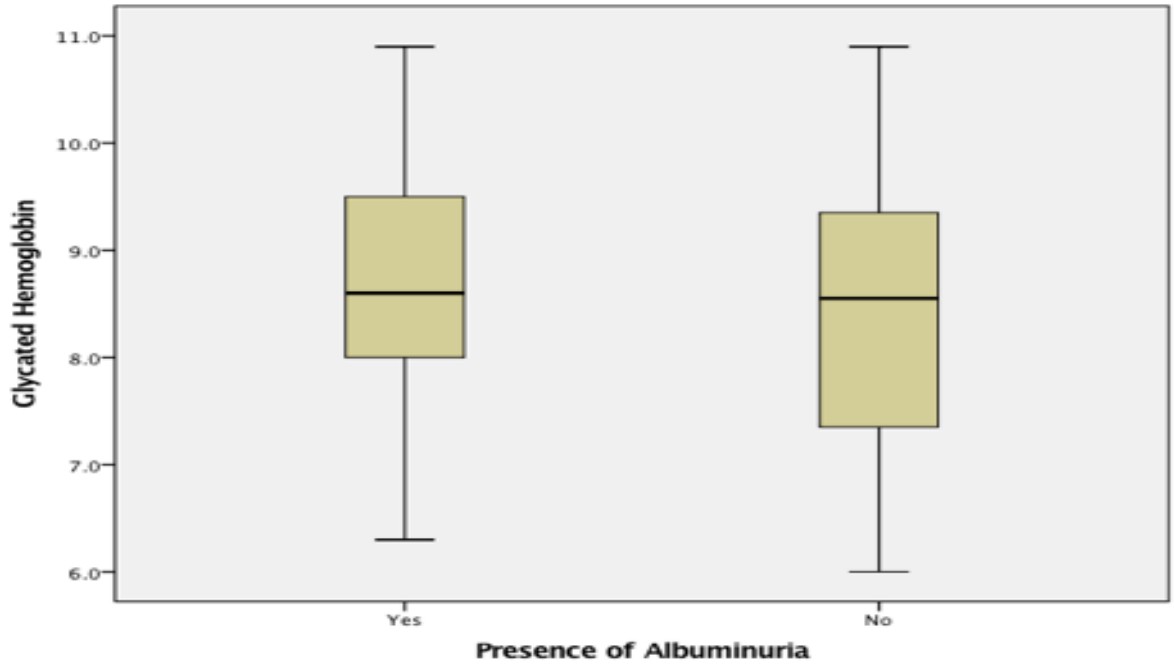


Figure 2: Microalbuminuria and HbA1c



RESULTS

In the present study, there were 74 (61.2%) females. Mean age of study patients was 54.21 ±10.27 years. Baseline demographic details are shown in Table 1. Microalbuminuria, when cross tabulated with different age groups, was found statistically insignificant (p=0.795).

Microalbuminuria was present in 73 (60.3%) patients. Among these, 28 (38.36%) were males and 45 (61.64%) females, p value= 1.000.

Average duration of diabetes was 5.809 ±3.55 years. Figure 1 shows that microalbuminuria was significantly related with duration of diabetes mellitus.

There was significantly increased frequency of microalbuminuria in poorly controlled diabetics (83.56%) compared to diabetics with good glycemic control (16.44%) with p value 0.015, as shown in Table 2.

Average HbA1c was 8.55 ±1.24%. Figure 2 shows that microalbuminuria was significantly high in patients with higher HbA1c levels.

DISCUSSION

Our study showed higher frequency (60.3%) of microalbuminuria in type 2 diabetics as compared to reported prevalence in different studies (19.7-28.5%[3] and 25-30%[10-12]). The possible reasons for this difference could be the increased number of patients with poor glycemic control (76.03%) and relatively smaller sample size in our study. Similarly, ethnic susceptibility to develop nephropathy and laboratory method of estimation of microalbuminuria have also been shown as likely possibilities regarding frequency differences in various studies[13].

There were more females as compared to males (61.64% vs. 38.36%, respectively) who had microalbuminuria. However, the difference was statistically insignificant (p value= 1.000). Similar results have also been shown by other studies[14,15]. On the contrary, another study reported increased prevalence of microalbuminuria in males as compared to females (53.7% vs. 46.3%, respectively) and the adjusted OR was 1.89, p value= 0.192)[16]. Similarly, Amini et al[17] observed an association between microalbuminuria and male gender. Severity of microalbuminuria was also recorded more in males as compared to females[18]. The differene in results of these studies might be due to diffrence in sample selection and size.

In our study, majority of patients with microalbuminuria were young i.e. 44.6% were <50 years of age. However, microalbuminuria, when cross tabulated with different age groups, was found to be statistically insignificant (p=0.795). Our results were in accordance with other studies[12,19]. This might be explained on the basis of increased prevalence of diabetes in patients between 40–50 years of age[13].

The risk of chronic complications increases with the duration of hyperglycemia[20]. The average duration of diabetes mellitus was 5.809 ±3.55 years in our patients; and duration of diabetes was found to be significantly related with microalbuminuria. Hyperglycemia-induced advanced glycosylation end products may be responsible for increased frequency of microalbuminuria with increased duration of diabetes. Moreover, there is augmented degree of microalbuminuria with increased duration of diabetes, which necessitates early detection and timely taken measures to retard the progression of renal damage and prevent overt nephropathy[2,8]. The degree of microalbuminuria was shown to be significantly associated (p <0.05) with numbers of years of diabetes in the study by Rathore et al[10]. Other studies have also shown a significant correlation between duration of diabetes and microalbuminuria[21,22]. Ramanathan[23] observed that 54% patients with diabetic nephropathy had duration of diabetes >15 years.

In our study, average HbA1c was 8.55 ±1.24% and microalbuminuria was significantly high in patients with higher HbA1c levels. There was significantly increased frequency of microalbuminuria in poorly controlled diabetics (83.56%) compared to diabetics with good glycemic control (16.44%) with p value 0.015. Our results were consistent with findings of previous studies[14,21,22,24-26]. Other studies have shown that the levels of microalbumin were linearly correlated with HbA1c[16,27,28]. The prevalence as well as progression of microalbuminuria can be decreased by achievement of good glycemic control[22,25,29]. Lowering of HbA1c by 0.9% has been shown in the UKPDS to result in 30% decreased development of microalbuminuria[30].

LIMITATIONS

Our research was hospital based and was a non-randomized study with small samples size but it does validate the findings of other studies that are available in the literature, which have shown association of microalbuminuria with poor glycemic control.

CONCLUSION

Microalbuminuria was found with increased frequency in patients with type 2 diabetes mellitus. The relationship of microalbuminuria with glycemic control and duration of diabetes was statistically significant.

RECOMMENDATIONS

All type 2 diabetic patients need to be screened for microalbuminuria. Its early detection and timely taken measures are recommended to retard the progression of renal damage and prevent overt nephropathy.

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CONTRIBUTORS

RM conceived the idea, planned the study, and drafted the manuscript. MARA, ZA, MA, SKUR and LH helped acquisition of data and did statistical analysis. IA supervised the study and critically revised the manuscript. All authors contributed significantly to the submitted manuscript.