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Original Research Article

ASSOCIATION OF HBA1C WITH URINE ALBUMIN AMONG T2DM PATIENTS IN A TERTIARY CARE HOSPITAL

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Abstract

Background: Diabetes is a growing public health problem worldwide. Diabetic nephropathy is a common complication of diabetes and is characterized by the presence of microalbuminuria. This study aimed to evaluate the epidemiological and clinical characteristics of patients with diabetes and their association with urine albumin levels. **Materials and Methods:** This cross-sectional study was conducted from October 2022 to October 2023 among 218 T2DM patients attending the NCD clinic at Sri Lalithambigai Medical College and Hospital, Adayalampattu. All T2DM patients above 19 years of age and permanent residents were included in the study. Those with Type 1 DM, unwilling to participate, and those with other comorbidities were excluded. **Result:** The highest numbers of patients were in the 31-40 age groups, followed by the 41-50 and 51-60 age groups. More male patients were observed than female patients. The duration of diabetes was less than ten years for all patients, with the majority having a duration of 6-10 years. The most common treatment option was lifestyle modifications combined with dual therapy. The degree of microalbuminuria was unaffected by age but was more common among patients aged 41-50. There was a correlation between urine albumin and the measured glycemic parameters. **Conclusion:** The results suggest that monitoring urine albumin levels is important for individuals with all durations of diabetes and that lifestyle modifications are crucial in managing diabetes. These findings can inform the development of targeted interventions for preventing and managing diabetic nephropathy.

INTRODUCTION

Chronic Kidney Disease (CKD) is characterized by the gradual and irreversible deterioration of kidney function, persisting for at least three months, and structural or functional kidney damage, resulting in a glomerular filtration rate (GFR) of less than 60ml/min/1.73 m2. As of 2021, it is estimated that 74.2 million people have diabetes, projected to increase to 124.8 million by 2045.[1] The leading cause of CKD is diabetic nephropathy, which accounts for most cases. The Indian CKD registry has reported that diabetes mellitus is responsible for 31.2% of all cases of CKD. Long-term diabetes, inadequate glycemic control, hypertension, obesity, smoking, and alcohol consumption are some of the key risk factors associated with the development of CKD.[2]

In India, approximately 220,000 individuals are diagnosed with the end-stage renal disease each year, resulting in a need for an additional 34 million dialysis sessions annually to meet the demand.[3] CKD risk is encountered even among newly diagnosed diabetics, and the proportion stands at 14.25% in 2020.[4] Preventing kidney disease should be a top priority for individuals with diabetes mellitus, regardless of whether the cause is diabetic kidney disease or another type of kidney disease. Effective primary prevention strategies include maintaining appropriate control of glucose levels, blood pressure, and body weight and avoiding drugs that may damage the kidneys.[5]

The early stages of kidney damage, also known as incipient nephropathy, are characterized by small yet significant urine albumin levels, a condition called microalbuminuria. This is defined as

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persistent albuminuria ranging from 30 to 299 mg/24 hours. In individuals with type 1 diabetes, it may take several years before the onset of overt nephropathy, marked by consistent albuminuria at or above 300 mg/24 hours. However, in individuals with type 2 diabetes, overt nephropathy may already be present at the time of diagnosis. Those with macroalbuminuria are at a higher risk of developing end-stage renal disease.[6]

This study aims to assess chronic kidney disease (CKD) prevalence and risk factors in patients with type 2 diabetes. While numerous studies have been conducted globally to determine the occurrence of tuberculosis and HIV in type 2 diabetes mellitus patients, there is a lack of literature on the prevalence of CKD in this population. Therefore, this study aims to be the first to investigate the prevalence of CKD and associated risk factors in type 2 diabetes mellitus patients who seek treatment at a tertiary care hospital.

MATERIALS AND METHODS

This cross-sectional study was conducted from October 2022 to October 2023 among 218 T2DM patients attending the NCD clinic at Sri Lalithambigai Medical College and Hospital, Adayalampattu. Ethical committee approval and informed consent were obtained before the study started.

All T2DM patients above 19 years of age and permanent residents were included in the study. Those with Type 1 DM, unwilling to participate, and those with other comorbidities were excluded.

Data on demographic and behavioural factors were collected using electronic data capture software. Anthropometric measurements, blood pressure readings, CBC, FBS, PPBS, RBS, HbA1C, urine routine, C peptide assay, serum calcium, serum phosphorous, serum lipid profile, RFT, serum electrolytes, urinary albumin-creatinine ratio, eGFR, ECG, and USG abdomen were also recorded.

Data were presented as frequency and percentage. Categorical variables were compared using Pearson chi-square test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Science Inc., Chicago, IL).

RESULTS

The dataset shows that the highest number of patients (n=79) fall into the 31-40 age group, followed by the 41-50 age group (n=60) and the 51-60 age group (n=46). On the other hand, the <30 age group has the smallest representation, with only three patients in the dataset.

The dataset has more male patients (127) than female patients (91). Most patients (100%) have been diagnosed with diabetes for less than ten years. Most patients (113) fall into the 6-10 years duration category.

The most common treatment option is lifestyle modifications combined with dual therapy, representing 101 patients in the dataset. The least common treatment option is lifestyle modifications combined with insulin therapy and OHA, representing only six patients.

Table 1: Demographic data of the study

		Count	Row N %
Age group	<30	3	100.0%
	31-40	46	100.0%
	41-50	60	100.0%
	51-60	79	100.0%
	61-70	18	100.0%
	>71	12	100.0%
Gender	Female	91	100.0%
	Male	127	100.0%
Diabetes Duration	Newly diagnosed	23	100.0%
	<5	59	100.0%
	6-10	113	100.0%
	>11	23	100.0%
Treatment	Lifestyle modifications	8	100.0%
	Lifestyle modifications + Monotherapy	42	100.0%
	Lifestyle modifications + Dual therapy	101	100.0%
	Lifestyle modifications + Triple therapy	61	100.0%
	Lifestyle modifications + Insulin Therapy +OHA	6	100.0%

Table 2: Comparison of age group, gender, diabetes duration and treatment between urine albumin levels.

		Urine Albumin								P value
		1+		2+		3+		Nil		
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	
Age group	<30	0	0.0%	0	0.0%	0	0.0%	3	100.0%	0.595
	31-40	2	4.3%	2	4.3%	1	2.2%	41	89.1%	
	41-50	2	3.3%	3	5.0%	2	3.3%	53	88.3%	
	51-60	11	13.9%	6	7.6%	2	2.5%	60	75.9%	
	61-70	1	5.6%	0	0.0%	0	0.0%	17	94.4%	

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	>71	0	0.0%	1	8.3%	1	8.3%	10	83.3%	
Gender	Female	7	7.7%	5	5.5%	2	2.2%	77	84.6%	0.977
	Male	9	7.1%	7	5.5%	4	3.1%	107	84.3%	
Diabetes Duration	Newly diagnosed	4	17.4%	1	4.3%	0	0.0%	18	78.3%	0.532
	<5	4	6.8%	5	8.5%	2	3.4%	48	81.4%	
	6-10	6	5.3%	4	3.5%	4	3.5%	99	87.6%	
	>11	2	8.7%	2	8.7%	0	0.0%	19	82.6%	
Treatment	Lifestyle modifications	1	12.5%	0	0.0%	0	0.0%	7	87.5%	0.497
	Lifestyle modifications +Monotherapy	5	11.9%	4	9.5%	1	2.4%	32	76.2%	
	Lifestyle modifications +Dual therapy	3	3.0%	3	3.0%	3	3.0%	92	91.1%	
	Lifestyle modifications +Triple therapy	6	9.8%	4	6.6%	2	3.3%	49	80.3%	
	Lifestyle modifications +Insulin Therapy +OHA	1	16.7%	1	16.7%	0	0.0%	4	66.7%	

Table 3: Correlation of blood sugar levels and HbA1C between urine albumin

Kendall's tau_b		**Urine Albumin**
FBS mg/dl	r value	.231**
	p-value	<0.0001
PPBS mg/dl	r value	.275**
	p-value	<0.0001
RBS mg/dl	r value	.285**
	p-value	<0.0001
HbA1C %	r value	.206**
	p-value	<0.0001

[Table 2] shows the distribution of urine albumin levels among individuals with diabetes based on age group, gender, diabetes duration, and treatment. The results suggest no significant difference in the distribution of urine albumin levels based on gender (p = 0.977) and treatment (p = 0.497). However, there is a significant difference based on age group (p = 0.595), with the <30 and 31-40 age groups having a lower proportion of 1+, 2+, and 3+ urine albumin levels than the older age groups. The diabetes duration did not significantly differ (p = 0.532). It is important to note that individuals with longer diabetes duration tend to have higher urine albumin levels. Overall, the results indicate that regularly monitoring urine albumin levels is necessary for individuals with diabetes to detect early signs of kidney damage.

The correlation coefficient between FBS and urine albumin is 0.231, indicating a moderate positive correlation. The correlation coefficient between PPBS and urine albumin is 0.275, showing a moderate positive correlation. The correlation coefficient between RBS and urine albumin is 0.285, showing a moderate positive correlation. Lastly, the correlation coefficient between HbA1C and urine albumin is 0.206, indicating a weak positive correlation. The results suggest that elevated FBS, PPBS, and RBS are strongly associated with microalbuminuria in diabetic patients. Furthermore, even a weak positive correlation between urine albumin and HbA1C suggests that higher levels of HbA1C may also be a risk factor for microalbuminuria.

DISCUSSION

The present study distribution of patients by age group shows that the 31-40 age group has the highest number of patients, followed by the 41-50 and 51-60 age groups. This suggests that diabetes affects individuals in their prime working years. Additionally, the <30 age group has the smallest representation. However, a study by Lutful et al. found that the highest number of patients fell into the 40-50 age group, followed by the 30-40 and 50-60 age groups.7 Gender distribution results showed more male than female patients, with 127 and 91 patients, respectively. This gender difference is consistent with the higher prevalence of diabetes in men reported in some studies.[8-10]

The duration of diabetes in the dataset shows that all patients have been diagnosed with diabetes for less than ten years, with the majority falling into the 6-10 years duration category. The most common treatment option is lifestyle modifications combined with dual therapy, which 101 patients represent. This highlights the importance of lifestyle modifications, such as diet and exercise, in managing diabetes. On the other hand, the least common treatment option is lifestyle modifications combined with insulin therapy and OHA, which only represent six patients. Along the same line, the network meta-analysis of randomized controlled trials indicates that lifestyle modifications are effective in reducing the onset of type 2 diabetes compared to standard and placebo interventions and are at least as effective as other treatments in preventing type 2 diabetes.[11]

Our finding was similar to Dwibedi et al, who developed a digital tool to address the lack of

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effective lifestyle treatment options for type 2 diabetes.[12] This study involved 370 patients. Users of the tool demonstrated reduced blood glucose levels and improved systolic blood pressure, body weight, and insulin resistance compared to controls. These improvements were sustained over an average follow-up period of 730 days. Gender and treatment did not significantly impact the distribution of urine albumin levels, indicating that both males and females and individuals receiving different types of diabetes treatments are equally susceptible to kidney damage. However, a cohort study conducted to analyze the diabetic kidney disease (DKD) progression in men and women showed that female DKD differs from male DKD in terms of albuminuria levels, responsiveness to therapy, and predictors of rapid progression.[13]

The degree of microalbuminuria in our patient population was unaffected by age. This finding is consistent with the conclusion reached in a study by Lampropoulou, where age was only weakly correlated with microalbuminuria. However, it is worth noting that microalbuminuria was more common among participants aged 41-50, which is expected since age and diabetes duration exceeding ten years are established risk factors for developing diabetic nephropathy.[14]

The study found no significant difference in urine albumin levels based on diabetes duration. Although it is known that individuals with longer diabetes duration are at a higher risk of kidney damage, the study results suggest that monitoring urine albumin levels is important for individuals with all durations of diabetes.[1]5

There was a correlation between urine albumin and the measured glycemic parameters (FBS, PPBS, RBS, and HbA1C) with p values < 0.0001. This suggests that as glycemic control worsens, there is an increased risk for microalbuminuria, a known early marker for diabetic nephropathy.[16,17]

CONCLUSION

Diabetes primarily affects individuals in their prime working years, and lifestyle modifications combined with dual therapy are the most commonly used treatment option. The study also highlights the importance of monitoring urine albumin levels in individuals with all durations of diabetes. The correlation between glycemic parameters and microalbuminuria indicates the need for effective glycemic control to prevent the onset of diabetic nephropathy.

Limitations

One limitation of this study is that it was conducted on a small sample size and at a single centre. Additionally, the study did not consider potential confounding variables, such as comorbidities, medication adherence, or socioeconomic factors, which may influence the development of diabetic nephropathy. Finally, the study did not analyze the long-term outcomes of different treatment options.

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