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Original Article

Prevalence of Diabetic Nephropathy among Patients of Type 2 Diabetes at Tertiary Care Hospital Lahore

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ABSTRACT

Background: Diabetic nephropathy is a significant complication of Type 2 Diabetes Mellitus, often leading to chronic kidney disease (CKD) and potentially progressing to End-Stage Renal Disease (ESRD). Approximately 90% of individuals with diabetes and hypertension may develop ESRD in the later stages of the disease.

Objective: The study aimed to determine the prevalence of diabetic nephropathy among patients with type 2 diabetes at a tertiary care hospital in Lahore.

Methods: This retrospective study included 100 reports from the chemical pathology and microbiology laboratory at Fatima Memorial Hospital, Lahore, covering renal function tests (RFT) such as Urea, Blood Urea Nitrogen (BUN), Creatinine, and estimated Glomerular Filtration Rate (eGFR), as well as HbA1c levels and Albuminuria. Data collection involved accessing electronic medical records (EMRs) to obtain comprehensive clinical data, including patients' medical history, duration of diabetes, glycemic control measurements, blood pressure, and prescribed medications. The study included patients with type 2 diabetes and kidney disease, excluding those without renal disease. Ethical approval was obtained from the Institutional Review Board (IRB) of FMH College of Medicine and Dentistry, adhering to the principles of the Declaration of Helsinki. Data were analyzed using IBM SPSS version 25, with categorical variables expressed as frequencies and percentages and continuous variables as mean ± standard deviation (SD). Correlation analysis was conducted, with a p-value of less than 0.05 indicating statistical significance.

Results: The study included 100 participants, with 53% being male and 47% female. The mean age was 59.19 years (SD = 18.812), ranging from 18 to 91 years. Albuminuria was present in 88% of participants. Elevated serum creatinine was observed in 93%, HbA1c levels >6.4% in 68%, high urea levels in 87%, and eGFR <60 in 14%. Correlation analysis showed a significant positive correlation between HbA1c and eGFR (Spearman's rho = 0.432, $p < 0.001$) and between urea and serum creatinine (Spearman's rho = 0.701, $p < 0.001$).

Conclusion: The high prevalence of albuminuria and elevated renal function markers among individuals with type 2 diabetes underscores the importance of early detection and comprehensive management. Regular screening for urinary albumin, stringent glycemic control, and optimal blood pressure management are crucial for preventing the progression of diabetic nephropathy.

Keywords: Diabetic Nephropathy, Type 2 Diabetes, Albuminuria, Chronic Kidney Disease, Renal Function Tests.

INTRODUCTION

Diabetes mellitus is a complex metabolic disorder characterized by elevated blood sugar levels and encompasses various types, including Type 1 diabetes mellitus (T1DM), Type 2 diabetes mellitus (T2DM), gestational diabetes, neonatal diabetes, maturity-onset diabetes of the young (MODY), and other forms related to endocrine disorders and steroid usage. T1DM typically results from insulin secretion defects and is more commonly diagnosed in childhood or adolescence, while T2DM arises from insulin action defects and

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is frequently linked to middle-aged and older adults due to chronic hyperglycemia influenced by dietary and lifestyle choices (1). The significant pathophysiological differences between T1DM and T2DM lead to variances in their causes, symptoms, and treatment approaches.

Diabetic nephropathy, a critical complication of diabetes mellitus, results in chronic kidney disease (CKD) and poses a major global public health challenge. The global prevalence of CKD is estimated to be around 13.4%, with a range from 11.7% to 15.1%, and the number of patients requiring renal replacement therapy for end-stage renal disease (ESRD) is estimated to be between 4.902 and 7.083 million (2). According to the International Diabetes Federation (IDF), individuals with diabetes are at a significantly higher risk of developing end-stage kidney failure, with approximately 40% of diabetics potentially encountering this condition (3). This underscores the necessity for early detection and management strategies to mitigate the progression of renal impairment in diabetic patients.

Kidney complications in diabetes can be identified early through the detection of microalbuminuria, which is a marker of kidney involvement in diabetes. Within ten years of being diagnosed, over 20% of patients with diabetes experience kidney issues, and nearly 20% progress to severe kidney disease. Without timely intervention, 20% of individuals with Type 1 diabetes may develop kidney failure within ten years, and 75% may face this outcome within two decades. Similarly, in Type 2 diabetes, kidney problems may become evident soon after diagnosis, emphasizing the need for regular monitoring of renal function (4). Microalbuminuria, increased renal workload, and early structural changes in the kidneys, such as collagen accumulation and glomerular basement membrane thickening, are early indicators of diabetic kidney disease. The progression of these changes can lead to macroalbuminuria, declining renal function, and damage to renal tissues and filters, complicating diabetes management beyond mere blood sugar control (5).

The pathogenesis of diabetic nephropathy involves multiple factors, including dyslipidemia, which is marked by an imbalance in blood lipid levels. Reduced levels of high-density lipoprotein (good cholesterol) and elevated levels of triglycerides, low-density lipoprotein, and very-low-density lipoprotein contribute to the development of diabetic kidney disease (6). Additionally, elevated levels of TNF-α receptors and serum uric acid serve as markers for the onset and progression of nephropathy in diabetes, indicating both genetic and metabolic influences (7). Genetic factors play distinct roles in the development of albuminuria and estimated glomerular filtration rate (eGFR) in diabetic kidney disease. While the genetic influences on eGFR are similar in individuals with and without diabetes, the genes associated with albuminuria are specifically linked to the activity of podocytes, which are crucial for blood filtration in the kidneys (8, 9). Furthermore, a family history of hypertension and cardiovascular disease is strongly associated with the risk of nephropathy in type 2 diabetes, with 73% of individuals with diabetic nephropathy reporting a familial predisposition compared to only 20% of those without nephropathy (10).

Given the intricate interplay of metabolic and genetic factors in diabetic nephropathy, early detection and intervention are critical. Regular screening for urinary albumin, strict glycemic control, and optimal blood pressure management are essential components of preventing and managing kidney complications in diabetic patients. This study aims to determine the prevalence of diabetic nephropathy among patients with type 2 diabetes in a tertiary care hospital setting in Lahore, highlighting the importance of comprehensive screening and intervention strategies to mitigate the burden of this serious complication.

MATERIAL AND METHODS

The study was conducted at Fatima Memorial Hospital, Shadman, Lahore, focusing on individuals diagnosed with type 2 diabetes who also had kidney diseases. The sample size was determined using a specific formula: n = (Z^2 * p * (1-p)) / d^2, where 'n' represents the necessary sample size, 'Z' is the Z-score corresponding to the chosen confidence level (1.96 for a 95% confidence level), 'p' is the estimated prevalence of diabetic nephropathy patients (7%), and 'd' denotes the margin of error or precision. This calculation yielded a sample size range of 90 to 100 patients.

This retrospective study was conducted from June 2023 to December 2023, following approval from the Institutional Review Board (IRB) of the FMH College of Medicine and Dentistry. The study utilized a non-probability convenience sampling method to select participants according to specific inclusion and exclusion criteria. Patients with type 2 diabetes and kidney disease were included, while those without renal disease were excluded. A self-designed proforma was used for data collection, ensuring a comprehensive approach to capturing relevant patient information (11).

The study incorporated reports of renal function tests (RFT), including Urea, Blood Urea Nitrogen (BUN), Creatinine, estimated Glomerular Filtration Rate (eGFR), HbA1c levels, and Albuminuria from the chemical pathology and microbiology laboratory at Fatima Memorial Hospital. Electronic medical records (EMRs) were accessed to extract pertinent clinical data such as patients' medical history, duration of diabetes, glycemic control measurements, blood pressure, and prescribed medications. The laboratory

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reports provided critical data on renal function indicators, including serum creatinine, eGFR, and urinary albumin-to-creatinine ratio (ACR). These data were instrumental in assessing the baseline characteristics and disease progression of the patients (12).

Ethical considerations were rigorously adhered to in this study, complying with the principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants or their legal guardians prior to data collection. Confidentiality and anonymity of the patient data were maintained throughout the study, ensuring ethical standards were upheld.

Data were meticulously entered and analyzed using IBM SPSS version 25. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD). Bar charts were utilized to display categorical data, and histograms were employed to illustrate continuous variables. Correlation analysis was performed to examine the relationships between different clinical parameters, with a p-value of less than 0.05 indicating statistical significance.

The demographic data of the participants, including age and gender distribution, were analyzed, revealing an average age of 59.19 years with a standard deviation of 18.812, and a gender distribution of 53% male and 47% female participants. The statistical analysis of the renal function test results indicated significant findings, with a high prevalence of albuminuria (88%) and elevated levels of urea (87%), creatinine (93%), and eGFR (86%). The correlation analysis demonstrated significant associations between HbA1c and eGFR, as well as between urea and serum creatinine, underscoring the interrelated nature of these clinical parameters in diabetic nephropathy.

RESULTS

In this retrospective study, a total of 100 individuals with type 2 diabetes and kidney disease were included. The demographic data revealed that the average age of the participants was 59.19 years with a standard deviation of 18.812. The minimum age was 18 years, and the maximum age was 91 years. The gender distribution showed 53% male (n=53) and 47% female (n=47) participants.

Table 1: Demographic Data for Age and Gender

Variable	Frequency	Percentage
Age (years)		
Minimum	18	
Maximum	91	
Mean (SD)	59.19 (18.812)	
Gender		
Male	53	53.0
Female	47	47.0

The laboratory findings indicated significant abnormalities in renal function tests and glycemic control among the participants. Notably, 93% had elevated serum creatinine levels, 68% had HbA1c levels above 6.4%, and 88% exhibited albuminuria.

Table 2: Statistics for Serum Creatinine, HbA1c, Albuminuria, Urea, BUN, and eGFR

Variable	N	Range	Frequency	Percentage
Serum Creatinine	100	0.55-1.02	7	7.0
		>1.02	93	93.0
HbA1c	100	<5.7	12	12.0
		5.7-6.4	20	20.0
		>6.4	68	68.0
Albuminuria (Protein in Urine)	100	Nil	12	12.0
		+	88	88.0
Urea	100	<10	1	1.0
		10-50	12	12.0
		>50	87	87.0
BUN (Blood Urea Nitrogen)	100	<8	6	6.0
		8-22	24	24.0
eGFR (Glomerular Filtration Rate)	100	<60	14	14.0
		>60	86	86.0

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Correlation analysis demonstrated significant associations between various clinical parameters. There was a positive correlation between HbA1c and eGFR (Spearman's rho = 0.432, $p < 0.001$), indicating that higher HbA1c levels were associated with higher eGFR values. Similarly, a significant positive correlation was found between urea and serum creatinine (Spearman's rho = 0.701, $p < 0.001$), suggesting that elevated urea levels were closely related to increased serum creatinine.

Table 3: Correlation between HbA1c and eGFR

Variable	HbA1c	eGFR
HbA1c	1.000	0.432**
eGFR	0.432**	1.000

**p < 0.001, highly significant

Table 4: Correlation between Urea and Serum Creatinine

Variable	Urea	Serum Creatinine
Urea	1.000	0.701**
Serum Creatinine	0.701**	1.000

**p < 0.001, highly significant

The findings of this study indicate a high prevalence of renal abnormalities among individuals with type 2 diabetes, underscoring the importance of early detection and management of diabetic nephropathy. The high rates of albuminuria and elevated renal function markers highlight the need for regular monitoring and comprehensive management strategies to prevent the progression of kidney disease in diabetic patients.

DISCUSSION

The study aimed to determine the prevalence of diabetic nephropathy among individuals with type 2 diabetes, revealing that a substantial proportion of participants exhibited renal abnormalities. The findings underscored the significant burden of diabetic nephropathy in this population, aligning with previous research that highlights the high prevalence and serious implications of kidney disease in diabetic patients (13,14).

A key finding was the high prevalence of albuminuria, present in 88% of the study participants. This result is consistent with earlier studies indicating that albuminuria is a common early marker of kidney damage in diabetes (Moyad et al.). The presence of albuminuria is particularly significant as it serves as a predictive marker for the progression to more severe renal impairment and end-stage renal disease (ESRD) (Lv and Zhang). This study's results emphasize the critical need for early screening and intervention to mitigate the risk of progression to ESRD, which has profound implications for patient outcomes and healthcare systems (15).

The correlation analysis demonstrated significant relationships between HbA1c and eGFR, as well as between urea and serum creatinine, highlighting the interconnected nature of glycemic control and renal function. These correlations suggest that poor glycemic control, as indicated by higher HbA1c levels, is associated with compromised renal function, reinforcing the importance of stringent glycemic management in preventing or delaying the onset of diabetic nephropathy (16).

The study's retrospective design, relying on electronic medical records (EMRs) and laboratory reports, provided a comprehensive dataset for analysis but also introduced certain limitations. One limitation was the reliance on existing records, which may not have captured all relevant patient data or changes over time (17). Additionally, the non-probability convenience sampling method, while practical for this study, may limit the generalizability of the findings to the broader population of individuals with type 2 diabetes. Despite these limitations, the study offers valuable insights into the prevalence and clinical characteristics of diabetic nephropathy in a tertiary care setting (18).

Strengths of the study included the thorough collection and analysis of clinical data, which provided a detailed overview of the participants' renal and glycemic status. The use of well-established laboratory markers for kidney function and glycemic control enhanced the reliability of the findings (11,13). Furthermore, the study's setting in a tertiary care hospital ensured that the participants had access to comprehensive medical care, which may have contributed to more accurate and complete data.

Future research should aim to address the limitations of this study by employing prospective designs and larger, more diverse samples. Additionally, there is a need for studies that explore the effectiveness of various interventions in preventing the progression of diabetic nephropathy. This includes investigating the impact of lifestyle modifications, pharmacological treatments, and regular monitoring on renal outcomes in diabetic patients.

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CONCLUSION

In conclusion, this study highlighted the high prevalence of diabetic nephropathy among individuals with type 2 diabetes, emphasizing the importance of early detection and comprehensive management strategies. The findings support the need for regular screening for albuminuria and other markers of kidney function, as well as stringent glycemic control to prevent the progression of renal disease in this population. These measures are crucial for improving patient outcomes and reducing the burden of diabetic nephropathy on healthcare systems (18). The study contributes to the growing body of evidence underscoring the critical need for targeted interventions and ongoing research in this area.

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