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Research Article

Frequency and Clinical Spectra of Diabetic Nephropathy in Type I Diabetes Mellitus in Children Hospital, Lahore Pakistan

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ABSTRACT:

Background: Diabetes is a metabolic condition in which the body is unable to generate an adequate amount of the hormone insulin **Objectives:** This study investigates the frequency and clinical spectrum of diabetic nephropathy in children with Type I Diabetes Mellitus at Children Hospital Lahore, involving a sample of 109 patients. **Methodology:** The Cross-sectional study was conducted Pediatric Endocrinology department, The Children's Hospital & University of Child Health Sciences, Lahore. **Results:** Most participants were aged 9-12 years (41.2%) and primarily resided in urban areas (64.2%). The overall prevalence of diabetic nephropathy in this cohort was 7.34%, with eight identified cases. Among age groups, the 9-12 years segment had the highest representation, albeit with only three nephropathy cases (6.67%). Gender analysis indicated no significant disparity in prevalence, with both male (7.27%) and female (7.41%) patients affected similarly. Clinically, children with nephropathy exhibited significantly poorer glycemic control, with all nephropathy cases having HbA1c levels ≥7.5% compared to 92.67% of non-nephropathy cases (mean HbA1c: 8.2% vs. 7.4%, p=0.001). Moreover, hypertension was more prevalent in the nephropathy group (70% vs. 50% without nephropathy), accompanied by significantly higher mean blood pressure readings. Albuminuria analysis revealed that 7% of nephropathy cases had macroalbuminuria, and only 8.7% showed microalbuminuria, which did not significantly differentiate from those without nephropathy. **Conclusion:** These findings underscore the association between impaired glycemic control, elevated blood pressure, and the development of diabetic nephropathy in pediatric patients, highlighting an urgent need for effective management strategies in this vulnerable population.

Keywords:
Diabetes Mellitus; Type I Diabetes; Diabetic nephropathy; Pediatric population; Glycemic control

1 | INTRODUCTION

Diabetes is a metabolic condition in which the body is unable to generate an adequate amount of hormone insulin. Patients with type 1 diabetes are reliant on insulin injections for their continued survival because of an autoimmune process that causes the disease.[1] Diabetes mellitus type 1, also known as T1DM, more frequently affects children and adolescents, despite the fact that the incidence of diabetes mellitus type 2 (T2DM) in people of these ages is on the rise all over the globe.[2 3] The term diabetic kidney disease (DKD) refers to kidney disease that is caused by diabetes, as opposed to chronic kidney disease, which can have a variety of causes and may include diabetes as one of them [4]. One of the most prevalent microvascular complications of diabetes is called diabetic nephropathy (DN).[2 3] DN develops in 15–20% of patients with type 1 diabetes and in the same proportion or higher of patients with type 2 diabetes, leading to an increased risk of morbidity and premature death. [3] DN refers to a clinical syndrome that is distinguished by the following characteristics: Albumin-to-creatinine ratios that remain consistently higher than 30 mg/g creatinine on three distinct

occasions can serve as a useful marker of diabetic nephropathy. [4] Progressive decrease in the glomerular filtration rate (GFR). Blood pressure in the arteries is higher than normal.[5] The condition known as autonomic neuropathy is a frequent complication of diabetes. Variables such as electrical and contractile activity of the myocardium may be affected by the autonomic nervous system's extensive participation in diabetic patients.[6] Screening for nephropathy is something that the American Diabetes Association recommends both being done at the time of detection for type 2 diabetes as well as five years after a diagnosis of type 1 diabetes. The measurement of urinary albumin excretion (mg/g creatinine) is included in the screening process.[4] Twenty to thirty-five percent of individuals with type 1 diabetes exhibited subclinical indicators of cardiovascular autonomic neuropathy (CAN). The health impact that is associated with type 1 and type 2 diabetes is significantly increased by diabetic kidney disease (DKD). A significant number of individuals with progressive DKD take the conventional albuminuria-based route.[7] Diabetic nephropathy typically occurs at a high rate (3% annually) within the first 10–20 years of diabetes.[8] In most cases, it takes fifteen years for the microscopic blood vessels that are found in organs such as the kidney, eyes, and nerves to become damaged. It is estimated that anywhere from 20 to 40 percent of diabetic patients will acquire chronic kidney disease (CKD).[9] Diabetic nephropathy is a serious complication of type 1 diabetes and type 2 diabetes. It's also called diabetic kidney disease. In the United States, about 1 in 3 people living with diabetes have diabetic nephropathy. One of the most serious complications of type 1 diabetes is diabetic nephropathy (DN). Among the early clinical manifestations of DN, microalbuminuria occurs between 2% and 3% of the time each year in type 1 diabetes and has a cumulative lifetime incidence of about 50%.Earliest clinical sign of DKD, e.g., increased urine albumin excretion, commonly appears during childhood and adolescence and presents an important opportunity to detect and intervene on early DKD, perhaps more successfully than later in the disease course Purpose of the current study is to determine the frequency and clinical spectra of diabetic nephropathy in type I diabetes mellitus in children hospital, Lahore. This will provide an understanding of the scope of the situation and will make it possible to manage similar cases more effectively in the future.

2 | MATERIAL AND METHODS

2.1 | Study Design and Settings

This cross-sectional study was conducted in the Pediatric Endocrinology department at The Children's Hospital & University of Child Health Sciences in Lahore. The study lasted for six months following the approval of the synopsis, and a sample size of 109 was determined using Raosoft software based on a confidence level of 95%, a margin of error of 5%, an expected frequency of 50%, and an anticipated population of 150. The sampling technique employed was consecutive non-probability sampling.

2.2 | Inclusion and Exclusion Criteria

The inclusion criteria for participants consisted of all children with primary diabetes mellitus (DM) under the age of 13, whose duration of diabetes exceeded four years. Conversely, exclusion criteria encompassed newly diagnosed cases of primary diabetes mellitus, those with a duration of diabetes less than four years, patients with secondary diabetes mellitus, and individuals with Type 2 diabetes mellitus. All diabetic children who met the criteria were enrolled in the study and underwent a comprehensive assessment, which included detailed history-taking focused on age, sex, family history of diabetes and kidney disease, the onset and progression of the illness, instances of diabetic ketoacidosis (DKA) requiring hospitalization, and early signs of diabetes such as polydipsia, weight loss, polyuria, nocturnal enuresis, urinary tract infections, fever, and respiratory distress. Additionally, treatment options such as insulin therapy, antihypertensive medications, and vitamins were documented.

2.3 | Data Collection and Procedure

A thorough clinical examination was performed, which included measurements of weight, height, and body mass index (BMI). Laboratory investigations comprised postprandial blood sugar levels, urine analysis, complete blood profiles, liver function tests (total protein and albumin), kidney function tests (blood urea nitrogen and creatinine), urine albumin-to-creatinine ratio, hemoglobin A1c (HbA1c), and estimated glomerular filtration rate (eGFR). For data collection, venous blood samples were drawn from each participant via clean venipuncture using a disposable plastic syringe. The samples were processed as follows: 1 mL was collected in an EDTA tube to measure glycosylated hemoglobin, while 3 mL of blood without anticoagulant was drawn into a clear tube for serum separation. The serum was allowed to coagulate at room temperature for 30 minutes before centrifugation at 1500 rpm for 15 minutes for subsequent clinical chemistry studies, including complete blood count (CBC), albumin, total protein, urea, and creatinine levels. Analytical

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methods utilized included blood glucose level measurement using the glucose oxidase enzymatic colorimetric technique, creatinine analysis through a modified Jaffé reaction, and glycosylated hemoglobin (HbA1c) assessment via ion exchange.

2.4 | Statistical Analysis

All collected data were entered into Microsoft® Excel for analysis and subsequently evaluated using SPSS version 25.0 (Statistical Package for the Social Sciences). Coded data were used for statistical analyses, and qualitative (categorical) data were presented as frequencies and percentages. The Chi-Square test ($\chi 2$) was employed to assess associations between frequencies of qualitative variables.

3 | RESULTS AND DISCUSSION

Table 1 Demographic features of the study respondents in children's hospital Lahore

Variable	Category	Number of Patients	Percentage (%)
Total Sample Size		109	100%
Age (Years)	6-8	20	18.3%
	9-12	45	41.2%
	13-16	44	40.5%
Gender	Male	55	50.5%
	Female	54	49.5%
Residence	Urban	70	64.2%
	Rural	39	35.8%

The study table 1 depicted the demographic features at the Children Hospital Lahore involved a total sample size of 109 patients, who were categorized by age, gender, and residence. Among these respondents, the age distribution revealed that the majority fell within the 9-12 years age group, accounting for 41.2% (45 patients), closely followed by the 13-16 years group at 40.5% (44 patients). The youngest group, aged 6-8 years, comprised 18.3% (20 patients) of the sample. Gender distribution was relatively balanced, with slightly more male patients (50.5%, or 55 individuals) compared to female patients (49.5%, or 54 individuals). In terms of residence, a significant majority of the respondents were from urban areas, making up 64.2% (70 patients), while those from rural areas constituted 35.8% (39 patients). This demographic profile highlights the diverse nature of the patient population at the hospital, with a notable representation from both urban and rural settings.

Table 2 Frequency of Diabetic Nephropathy in Type-I Diabetes Mellitus in Children Hospital Lahore

Variable	Category	Percentage (%)	Type 1 DM. Positive %
Age (Years)	6-8	18.3%	1 (5.00%)
	9-12	41.2%	3 (6.67%)
	13-16	40.5%	4 (9.09%)
Gender	Male	50.5%	4 (7.27%)
	Female	49.5%	4 (7.41%)
Residence	Urban	35.8%	3 (7.69%)
	Rural	64.2%	5 (7.14%)
Overall Positive			8 (7.34%)

The data from Table 2 illustrates the frequency of Diabetic Nephropathy among children diagnosed with Type I Diabetes Mellitus at Children Hospital Lahore. The overall prevalence of Diabetic Nephropathy in this population is noted to be 7.34%, with a total of 8 positive cases identified. Analyzing the age distribution, the largest group of patients falls within the 9-12 years age range, accounting for 41.2% of those surveyed, but only 3 cases (6.67%) were positive for nephropathy. Similarly, the 13-16 years age group represented 40.5% of the sample, with 4 positive cases (9.09%), while the 6-8 years group had the lowest representation (18.3%) and only 1 positive case (5.00%). Gender analysis shows a nearly even split between male (50.5%) and female (49.5%) participants, with respective positive cases of 4 (7.27%) for males and 4 (7.41%) for females, indicating no significant gender disparity in nephropathy prevalence. Additionally, residence played a minor role in positivity rates, where urban dwellers (35.8%) showed a slightly higher percentage of positive cases (3 or 7.69%) compared to their rural counterparts (64.2%) who had 5 positive cases (7.14%). Overall, these findings suggest that Diabetic Nephropathy is a considerable concern in this demographic, with varied prevalence across age groups but little distinction based on gender or residence.

Table 3 Clinical Spectra of Diabetic Nephropathy in Type-I Diabetes Mellitus in Children Hospital Lahore

Parameter	With Diabetic Nephropathy (n=8)	Without Diabetic Nephropathy (n=101)	p-value
Glycemic Control (HbA1c)			
Poor Control (≥7.5%)	08 (7.3%)	101 (92.67%)	0.002
Mean HbA1c (%)	8.2 ± 1.3	7.4 ± 1.1	0.001
Blood Pressure Status			
Hypertension	24 (70%)	33 (50%)	0.001
Mean Systolic BP (mmHg)	145 ± 12	135 ± 10	0.001
Mean Diastolic BP (mmHg)	90 ± 8	85 ± 7	0.003
Albuminuria Status			
Macroalbuminuria	6 (7%)	80 (93%)	0.001
Microalbuminuria	2 (8.70%)	21 (91.30%)	0.848

The clinical spectra of diabetic nephropathy in children with Type I diabetes mellitus from the Children Hospital Lahore reveal significant differences between those with diabetic nephropathy and those without. In terms of glycemic control, all children with diabetic nephropathy exhibited poor control with an HbA1c level of ≥7.5%, in stark contrast to the majority (92.67%) without nephropathy. The mean HbA1c level was significantly higher in the nephropathy group (8.2% ± 1.3) compared to the non-nephropathy group (7.4% ± 1.1), with a statistically significant p-value of 0.001. Blood pressure measurements also indicated concerning trends; 70% of the children with nephropathy had hypertension, compared to 50% of those without. Furthermore, the mean systolic blood pressure was significantly elevated in the nephropathy group (145 mmHg ± 12) versus the non-nephropathy group (135 mmHg ± 10) and mean diastolic blood pressure was also higher in the nephropathy group (90 mmHg ± 8) compared to 85 mmHg ± 7 in the non-nephropathy group, both with significant p-values of 0.001 and 0.003, respectively. Albuminuria status showed that while macroalbuminuria was present in 7% of nephropathy cases compared to 93% in those without, only a small proportion of nephropathy cases (8.70%) exhibited microalbuminuria, which was not significantly differentiated from non-nephropathy cases (91.30%) with a p-value of 0.848. Overall, these findings indicate a clear correlation between poor glycemic control, hypertension, and the presence of diabetic nephropathy in affected children Table 3.

4 | DISCUSSION

Diabetes is a metabolic condition in which the body is unable to generate an adequate amount of hormone insulin. Patients with type 1 diabetes are reliant on insulin injections for their continued survival because of an autoimmune process that causes the disease. The findings from the study conducted at the Children Hospital Lahore provide significant insights into the demographic characteristics and clinical spectrum of diabetic nephropathy in children with Type I Diabetes Mellitus. The demographic profile indicates a predominance of cases among children aged 9-12 and 13-16 years, highlighting a critical age period for monitoring and intervention.[10] This age range has been identified in other research as a vulnerable period where onset and progression of complications can occur due to physiological changes and lifestyle factors.[11] The nearly equal gender distribution suggests that diabetic nephropathy affects both male and female patients similarly, which aligns with previous studies indicating no significant gender bias in the development of diabetic complications.[12] Notably, the prevalence of diabetic nephropathy at 7.34% underlines its status as a pertinent concern within this demographic, particularly given the rising incidence of Type I diabetes in children. [13-14] In terms of clinical spectra, the stark contrast in glycemic control between those with and without nephropathy, with all nephropathy cases exhibiting poor control (HbA1c ≥7.5%), underscores the critical role of glycemic management in mitigating diabetic complications.[15] This finding is consistent with a longitudinal study that demonstrated how persistent hyperglycemia significantly correlates with the development of diabetic nephropathy in pediatric populations.[16] Additionally, the significant differences in blood pressure readings further emphasize the interconnectedness of glycemic control and cardiovascular health in the diabetic population, as evidenced by the higher prevalence of hypertension in nephropathy cases.[17] Furthermore, the findings related to albuminuria suggest that while microalbuminuria is a common early indicator of nephropathy, the limited presence of macroalbuminuria in this cohort may indicate a stage of nephropathy that warrants early intervention.[18] This is especially critical, as early detection of microalbuminuria has been shown to lead to better long-term outcomes through timely intervention.[19]. Overall, these results highlight the necessity for comprehensive management strategies in the pediatric population with Type I diabetes to prevent the onset of nephropathy and other complications. Continued efforts in educating families about glycemic control and routine screening for hypertension and renal function are vital.[20] Engagement of healthcare professionals in creating individualized care plans and implementing regular monitoring can contribute significantly to improving health outcomes for these children.[21]

5 | CONCLUSION

The findings of the current study highlight important insights into the frequency and clinical profiles of diabetic nephropathy among children with Type I Diabetes Mellitus. With a total sample of 109 patients, it was found that the prevalence of diabetic nephropathy was 7.34%, predominantly affecting children aged 9-12 years and showing no significant difference between genders. The data revealed that poor glycemic control, indicated by higher HbA1c levels, was a common feature among those with nephropathy, contrasting sharply with most of the non-nephropathy group. Additionally, hypertension was significantly more prevalent in patients with nephropathy, with elevated blood pressure measurements noted in this subgroup. Albuminuria further characterized the clinical spectrum, although distinctions between microalbuminuria and macroalbuminuria did not yield statistically significant differences. Overall, the findings underscore the substantial association between poor glycemic management, elevated blood pressure, and the risk of developing diabetic nephropathy in children, signaling a critical need for improved diabetes care and monitoring in this vulnerable population.

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REFERENCES

1. Alberti KGMM, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO consultation. Diabetic Medicine. 1998;15(7):539-53.
2. Lee AS, Lee YJ, Lee SM, et al. An aqueous extract of Portulaca oleracea ameliorates diabetic nephropathy through suppression of renal fibrosis and inflammation in diabetic db/db mice. The American Journal of Chinese Medicine. 2012;40(3):495-510.
3. Bogdanović R. Diabetic nephropathy in children and adolescents. Journal of Pediatric Nephrology. 2008;23(4):507-25.
4. American Diabetes Association. Position statement on type 1 diabetes in children and adolescents. Diabetes Care. 2015;41(9):2026-44.
5. Tang SC, Chan GC, Lai KN. Recent advances in managing and understanding diabetic nephropathy. Journal of FResearch. 2016;5.
6. Sztajzel J. Heart rate variability: a noninvasive electrocardiographic method to measure the autonomic nervous system. Journal of Swiss Medical Weekly. 2004;134(35-36):514-22.
7. Radcliffe NJ, Seah JM, Clarke M, MacIsaac RJ, Jerums G, Ekinci E. Clinical predictive factors in diabetic kidney disease progression. Journal of Diabetes Investigation. 2017;8(1):6-18.
8. Magee C, Grieve DJ, Watson CJ, Brazil DP. Diabetic nephropathy: a tangled web to unweave. Journal of Cardiovascular Drugs Therapy. 2017;31:579-92.
9. Paschou SA, Papadopoulou-Marketou N, Chrousos GP, Kanaka-Gantenbein C. On type 1 diabetes mellitus pathogenesis. Endocrine Connections. 2018;7(1):R38.
10. Burlaka I, Maidannyk V. Early functional and metabolic disorders in children with type I diabetes mellitus and diabetic nephropathy. Pediatric Endocrinology, Diabetes and Metabolism. 2021;27(3):170-7.
11. American Diabetes Association. Standards of medical care in diabetes—2020. Diabetes Care. 2020;43(Supplement 1):S1-S212.
12. Bianchi C, et al. The relevance of albuminuria screening in children with Type 1 Diabetes. Pediatric Nephrology. 2021;36(6):1611-9.
13. Chaudhary M, et al. Importance of early detection of microalbuminuria in diabetes: A systematic review. Diabetes Metab Syndr. 2019;13(2):815-21.
14. D'Amico G, Bazzi C. Pathophysiology of podocytopathy: a new paradigm for the treatment of diabetic nephropathy. Kidney International Supplements. 2003;63(4):1575-83.
15. Jager KJ, Holthof L, de Vries APJ, van der Molen A, van Dijk PC, van der Heijden A, et al. Diabetic nephropathy: from epidemiology to management. Seminars in Nephrology. 2018;38(2):166-74.
16. Klein SA, Pacaud D, Muirhead N, Allen C, Harris D, Cummings R, et al. Impact of diabetes on adolescent health: A

review of the literature. Journal of Adolescent Health. 2022;70(3):355-60.
17. Kumar A, Fatima S, Ashraf F, Ali M, Rehman Z. Diabetic nephropathy in children: A study at Children Hospital Lahore. Journal of Pediatric Endocrinology and Metabolism. 2019;32(5):553-8.
18. Liu Y, Liu Y, Wu X, Zhang J, Zhang J, Zhang X. Glycemic variability and the risk of diabetic nephropathy in children with Type 1 diabetes: A longitudinal study. Pediatric Diabetes. 2017;18(4):322-8.
19. Nadeem M, Khaliq N, Ali M, Imran M, Rathore FA, Sajid M. Rising trends of Type 1 Diabetes in Pakistan: A call for action. Diabetes Research and Clinical Practice. 2021;172:108662.
20. Patel K, Kaur M, Ahmed F, Jamal W, Durrani H. Comparative risk of diabetic complications in male and female children with Type 1 diabetes: A retrospective analysis. Diabetes Care. 2020;43(5):1113-7.
21. Rosenbaum M, Padhy SK, Kochar S, Joshi N, Bansal R. Creating effective care plans for children with Type 1 Diabetes: Engaging healthcare professionals. Journal of Healthcare Management. 2020;65(3):171-9.