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Spectrum of renal biopsy findings in pediatric renal diseases at a tertiary care hospital, Nepal

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Abstract

Introduction: Renal biopsy is an important investigation in pediatric nephrology, as it helps in establishing a definite diagnosis when clinical features and laboratory findings are inconclusive. It plays a key role in guiding treatment decisions and predicting outcomes in children with kidney diseases. Renal biopsy findings differ between populations, but data in Nepali children are limited. This study describes biopsy indications and findings in children at a tertiary care hospital.

Method: Ethical approval was obtained from the Institutional Review Committee of Patan Academy of Health Sciences (IRC-PAHS). This prospective study was conducted from 5 February 2020 to May 2024. Data were collected using a structured proforma from children fulfilling the inclusion criteria and undergoing renal biopsy. Clinical indications for biopsy were recorded and compared with the corresponding histopathological diagnoses using descriptive analysis.

Result: Among 49 children undergoing renal biopsy (26 males; age 0-14 years), the main indications were lupus nephritis 15(30.6%), suspected rapidly progressive glomerulonephritis 13(26.5%), and steroid resistant nephrotic syndrome 9(18.4%). Histopathology showed lupus nephritis most frequently 15(33.3%), followed by minimal change nephrotic syndrome 9(20%), diffuse proliferative glomerulonephritis and Immunoglobulin A nephropathy each 6 (13.3%). Henoch-Schönlein purpura nephritis 4(8.9%).

Conclusion: Lupus nephritis was the most frequent indication and finding in pediatric renal biopsies, followed by rapidly progressive glomerulonephritis and nephrotic syndrome. Renal biopsy remains crucial for accurate diagnosis and optimal management of pediatric kidney diseases in tertiary care.

Keywords: Biopsy, Child, Lupus Nephritis, Nephrotic Sydrome

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Introduction

Childhood renal diseases consists a heterogeneous spectrum of conditions, with considerable variation across geographic regions shaped by genetic, environmental, and epidemiological factors.[1] While advances in laboratory and imaging modalities have expanded diagnostic capabilities, renal biopsy remains an indispensable tool in paediatrics nephrology, providing definitive histopathological diagnoses, characterizing disease severity, and guiding treatment decisions.[2] Glomerular diseases predominate in paediatric renal biopsies and remain a leading cause of end-stage renal disease worldwide.[3]

The clinicopathological spectrum of paediatric renal disease varies considerably between regions, demanding the importance of locally generated data in understanding disease patterns and informing clinical practice.[4,5]

In Nepal, no centralized renal biopsy registry exists, and data on paediatric renal diseases remain limited. Available institutional studies suggest that glomerular diseases, particularly focal segmental glomerulosclerosis, lupus nephritis, and IgA nephropathy, are the most frequent histopathological diagnoses in children undergoing biopsy.[4,5] However, these findings reflect limited institutional experiences and may not fully represent the broader disease spectrum. Therefore, this study aimed to describe the spectrum of histopathological diagnoses among children undergoing renal biopsy at Patan Hospital.

Method

This prospective observational study was conducted in the Department of Pediatrics at Patan Hospital, Patan Academy of Health Sciences (PAHS), Lalitpur, Nepal. It took place from February 2020, to May 2024. Data were collected using a structured proforma, recording clinical details, biopsy indications, laboratory findings, and histopathological results at admission, biopsy, and follow up. The data were stored in printed proforma in a secure location with access limited to the research team, ensuring confidentiality and anonymisation before analysis.

The sample included all eligible children who underwent renal biopsy during the study period, no formal sample size calculation was performed, and consecutive sampling was used to include all cases meeting the inclusion criteria.

Ethical approval was taken from the Institutional Review Committee (IRC) of Patan Academy of Health Sciences (PAHS) (Ref. drs2002141346).

The study aimed to analyze the frequency of different histopathological patterns of renal disease in children, with specific objectives to examine the frequency of indications for renal biopsy and the distribution of histopathological patterns in various renal diseases-including nephrotic syndrome, acute glomerulonephritis, Henoch-Schoenlein Purpura (HSP), IgA nephropathy, Lupus nephritis, Acute Tubular Necrosis (ATN), anti- glomerular basement membrane disease (Anti-GBM), Chroninc Kidney Disease (CKD) and Rapidly progressive glomerulonephritis (RPGN), across different age groups (0-4, 5-9, and 10-14 years), as disease presentation and patterns vary with age.

All children up to 14 years of age admitted with renal disease and meeting criteria for renal biopsy during the study period were included. Indications for biopsy were steroid-resistant nephrotic syndrome, suspected rapidly progressive glomerulonephritis, systemic lupus erythematosus or vasculitis and undiagnosed acute or chronic kidney disease. Children were excluded if parents did not consent or if there were contraindications to biopsy such as bleeding disorders, uncontrolled hypertension, severe anemia, solitary kidney, hydronephrosis, pyelonephritis, perinephric abscess, cystic kidney disease.

Parents were informed about the study purpose, procedures and written consent was obtained. Pre-biopsy investigations included complete blood count, coagulation profile, blood grouping, HBsAg screening, and kidney ultrasonography.

Patients fasted for four hours, and their bladders were emptied by putting urinary catheterization. The biopsy, performed by a pediatric nephrologist in the pediatric ward of Patan Hospital, under local anesthesia (2% lignocaine) with sedation (midazolam) using specific sized biopsy gun on the lower pole of the left kidney. Two tissue cores were obtained, one for light microscopy and one for immunofluorescence. The biopsy specimens were sent to a private laboratory outside of country, as this service was not available at Patan Hospital, where histopathological analysis was performed following standard operating procedures. Post-procedure monitoring included vital signs, observation for bleeding or complications, and follow-up ultrasound for hematoma.

Light microscopy sections were stained with hematoxylin and eosin (H&E), Masson's trichrome, Periodic acid Schiff stain (PAS-stain), and Gomori's silver stain; Congo red was used when amyloid was suspected. Immunofluorescence employed Fluorescein isothiocyanate (FITC) conjugated antisera for Immunoglobulin G (IgG), Immunoglobulin A (IgA), Immunoglobulin M (IgM), Complement component 3 (C3), and Complement component 1q (C1q), graded 0-3^{+} and described as membranous or mesangial in granular or linear patterns.

Data were analyzed using SPSS version 15. Descriptive statistics, including frequencies and percentages,

were calculated for histopathological findings across different age groups and renal disease categories.

Result

During the study period, 49 children aged 0-14 years underwent renal biopsy. All biopsies yielded adequate tissue for histopathological evaluation, and all 49 biopsies were included in the final analysis.

The most common clinical indication for renal biopsy was lupus nephritis, seen in 15(30.61%) children. This was followed by suspected rapidly progressive glomerulonephritis (RPGN) in 13(26.53%) children and steroid resistant nephrotic syndrome (SRNS) in nine (18.36%) children. Less frequent indications were IgA nephropathy and Henoch Schönlein purpura (HSP), each observed in four (8.16%) children. Anti glomerular basement membrane (anti-GBM) disease and chronic kidney disease (CKD) were the indications in two (4.08%) children each, Table 1.

Among the ones included in our study, renal biopsy was mostly done in age group of 5-9 years and least in 0-4 years age group, 22(44.90%) and seven (14.29%), respectively, Table 1.

Histopathological analysis showed lupus nephritis as the most common diagnosis, identified in 16(32.65%) children, predominantly in the 10-14 years age group. Nephrotic syndrome was found in ten (20.40%) children, with minimal change nephrotic syndrome (MCNS) being the most frequent subtype, followed by focal segmental glomerulosclerosis (FSGS). Diffuse proliferative glomerulonephritis (DPGN) was observed in eight (16.32%) children, while IgA nephropathy was identified in six (12.24%) children, most in older children. Henoch Schönlein nephritis was seen in four (8.16%) children, limited to the 5-9 years age group. Less frequent histopathological diagnoses included anti-GBM disease and CKD, each seen in two (4.08%) children. Acute tubular necrosis (ATN) was rare, occurring in only one (2.04%) child, Table 2.

Discussion

In this cohort, lupus nephritis was the most common indication for renal biopsy and the most frequent histopathological diagnosis. Similar findings have been reported in pediatric renal biopsy studies from South Asia, where lupus nephritis forms a large proportion of biopsy proven glomerular diseases.[6,9] Although previous studies report class III and IV lupus nephritis as the most common histological subtypes, subclassification was not performed in our study; therefore, comparison is limited to overall frequency. Lupus nephritis was observed only in children older than 5 years, predominantly in the 10-14 years age group. This pattern may be due to delayed presentation, referral bias, or under-recognition of early pediatric systemic lupus erythematosus.

Suspected rapidly progressive glomerulonephritis (RPGN) was a clinical indication for renal biopsy in 13(26.5%) children. However, histopathological features consistent with diffuse proliferative glomerulonephritis or cresentic pattern were identified in 8(16.3%) children, indicating a discrepancy between clinical suspicion and biopsy findings. Similar clinicopathological differences have been reported in pediatric studies from North India,

Table 1. Age-group wise distribution of clinical indication for renal biopsy (N=49)

Clinical Indication	0-4 years n(%)	5-9 years n(%)	10-14 years n(%)	Total n(%)
Lupus nephritis	-	7(14.29%)	8(16.33%)	15(30.61%)
Rapidly progressive glomerulonephritis (RPGN)	3(6.12%)	6(12.24%)	4(8.16%)	13(26.53%)
Steroid-resistant nephrotic syndrome	4(8.16%)	3(6.12%)	2(4.08%)	9(18.37%)
IgA nephropathy	-	-	4(8.16%)	4(8.16%)
Henoch–Schönlein purpura (HSP)	-	4(8.16%)	-	4(8.16%)
Anti-GBM disease	-	-	2(4.08%)	2(4.08%)
Chronic kidney disease	-	2(4.08%)	-	2(4.08%)
Column Total	7(14.3%)	22(44.90%)	20(40.80%)	49(100.00%)

Table 2. Histopathological findings in different renal diseases according to age

Histopathological Findings		0-4 years n(%)	5-9 years n(%)	10-14 years n(%)	Total n(%)
Lupus nephritis		-	7(14.29%)	9(18%)	16(32.65%)
Nephrotic Syndrome	Minimal Change Nephrotic Syndrome (MCNS)	4(8.16%)	-	2(4.08%)	6(12.24%)
	Focal segmental glomerulosclerosis (FSGS)	-	4(8.16%)	-	4(8.16%)
IgA nephropathy		-	2(4.08%)	4(8.16%)	6(12.24%)
Diffuse proliferative glomerulonephritis		3(6.12%)	2(4.08%)	3(6.12%)	8(16.32%)
Henoch–Schönlein nephritis		-	4(8.16%)	-	4(8.16%)
Anti-GBM disease		-	-	2(4.08%)	2(4.08%)
Chronic Kidney Disease		-	2(4.08%)	-	2(4.08%)
Acute tubular necrosis		-	1(2.04%)	-	1(2.04%)
Column Total		7(14.3%)	22(44.90%)	20(40.80%)	49(100.00%)

where renal biopsy helps distinguish true crescentic glomerulonephritis from immune complex-mediated proliferative lesions.[7] This highlights the essential role of renal biopsy in accurate diagnosis and appropriate treatment planning.

Steroid resistant nephrotic syndrome (SRNS) was a common indication for renal biopsy in our cohort, accounting for 9(18.4%) children. This proportion is lower than that reported in several pediatric studies, where SRNS constitutes nearly half of biopsy indications.[8,9] The lower frequency observed in our study may be related to different biopsy thresholds, early response to steroids, or referral patterns at our center, rather than a true difference in disease prevalence. Histopathology predominantly showed minimal change nephrotic syndrome (MCNS), with fewer cases of focal segmental glomerulosclerosis (FSGS), consistent with previous reports.[3,9-11] This supports the role of renal biopsy in guiding management in children with steroid-resistant disease.

IgA nephropathy and Henoch Schönlein purpura nephritis showed strong clinical-pathological alignment in our cohort, matching broader pediatric biopsy data from Nepal and beyond. In Nepal, IgA nephropathy accounted for 12.7% of pediatric glomerular diagnoses, second only to MCD, while FSGS ranked at about 10.3%.[5,9] Similarly, a large single-center study in China, including 13,519 pediatric renal biopsies, reported that MCD, IgA nephropathy, and FSGS collectively constituted nearly half of all biopsy diagnoses.[12]

Anti-glomerular basement membrane disease, chronic kidney disease (CKD), and acute tubular necrosis were uncommon findings, which is consistent with their known rarity in pediatric biopsy populations.[4,5,12] The incidental detection of acute tubular necrosis in even a minority of cases highlights the scope of biopsy beyond classical glomerular disease.

Overall, immune complex mediated diseases such as lupus nephritis and IgA nephropathy showed high clinicopathological concordance.[9,13] In contrast, among the 13 children clinically suspected of rapidly progressive glomerulonephritis (RPGN), histopathology revealed diffuse proliferative glomerulonephritis in 8 children, while the remaining 5 showed other histological patterns, illustrating variability between clinical suspicion and biopsy findings. Similarly, in children with steroid resistant nephrotic syndrome (SRNS), although all were clinically classified as SRNS, histology showed minimal change nephrotic syndrome in 6 children and focal segmental glomerulosclerosis in 4. These discrepancies highlight that clinical assessment alone may not reliably predict the underlying lesion. Clinically, our data suggest that renal biopsy should be strongly considered in children with suspected RPGN or SRNS to establish a precise diagnosis and guide individualized treatment, rather than relying solely on clinical features.

Conclusion

Overall, immune complex mediated diseases, such as lupus nephritis and IgA nephropathy, showed high clinicopathological concordance. In contrast, in cases of suspected RPGN and SRNS, clinical expectations did not always match histology, highlighting that renal biopsy can clarify diagnosis when clinical presentation is uncertain.

Conflict of Interest

None

Funding

None

Author Contribution

Concept, design, planning: MFA, AK, RK, SPS, PK, ARO, BS, PT, PS; Literature review: MFA, BS, PT, PS; Data collection: MFA, AK, RK; Data analysis: MFA, AK, RK; Draft manuscript: MFA, AK; Revision of draft: MFA, AK, RK, SPS,PK, ARO, BS, PT, PS; Final manuscript: MFA, AK, RK, SPS, PK, ARO, BS, PT, PS; Accountability of the work: MFA, AK, RK, SPS, PK, ARO, BS, PT, PS; Guarantor: MFA.

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