RESEARCH ARTICLE

The spectrum of biopsy proven glomerular disease in a tertiary hospital

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Abstract

Objective: To analyse the spectrum of biopsy-proven glomerulonephritis and associated demographic and clinical characteristics in patients undergoing ultrasound-guided renal biopsy.

Method: The prospective, cross-sectional, descriptive study was conducted at the Department of Nephrology, Ayub Teaching Hospital, Abbottabad, Pakistan, from April 5, 2023, to December 30, 2024, and comprised adult patients with biopsy-proven glomerulonephritis. Clinical, demographic and laboratory data was recorded. Biopsies were performed under ultrasound guidance, and analysed via light microscopy and immunofluorescence. Estimated glomerular filtration rate was calculated using the Chronic Kidney Disease Epidemiology Collaboration equation. Data was analysed using SPSS 23.

Results: Of the 180 patients with mean age 36.79±16 years, 98(54.44%) were males and 82(45.56%) were females. There were 115(63.9%) cases of primary glomerulopathy, followed by secondary glomerulopathy 53(29.4%), vascular diseases 7(3.9%) and tubulointerstitial disease 5(2.8%). The distribution of glomerulonephritis subtypes differed significantly by age group (p<0.001). Oedema 135(74.9%) and acute kidney injury 78(43.3%) were the most common presentations, with nephrotic syndrome 129(71.7%) as the leading biopsy indication. Histopathology showed crescents 21(11.7%), post-infectious glomerulonephritis 22(12.2%), mild interstitial fibrosis and tubular atrophy 56(31.1%), and moderate-to-severe interstitial fibrosis and tubular atrophy 22(12.2%). Hypertension 81(42.5%) and diabetes 17(9.2%) were the frequent comorbidities.

Conclusion: Primary glomerulopathies were predominant, while oedema and nephrotic syndrome were common findings.

Keywords: Glomerulonephritis, Renal biopsy, Proteinuria, Histopathology. (JPMA 76: 562; 2026)

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Introduction

Glomerulonephritis (GN) is a significant contributor to kidney dysfunction globally, involving inflammation of the glomeruli, the kidney's filtration units. It encompasses a wide spectrum of clinical presentations, from isolated haematuria to rapidly progressing renal failure, and remains a leading cause of chronic kidney disease (CKD) and end-stage renal disease (ESRD) worldwide.[1] In recent years, the global outlook on GN has shifted due to advancements in diagnostic techniques, particularly renal biopsy, which remains the gold standard for diagnosing and classifying different types of GN.[2] The use of biopsy to confirm GN not only aids in precise diagnosis, but also guides appropriate treatment, improving patient outcomes.[3]

The disease burden of CKD due to GN has increased globally, especially in areas and nations with lower socioeconomic status (SES).[4] Despite these alarming trends, data on the epidemiology and histopathological spectrum of GN in Pakistan, to our knowledge, remains limited. Several hospital-based studies have been conducted to better understand the prevalence and types of biopsy-proven GN across different regions of Pakistan, offering valuable insights into the patterns and clinical presentations of the disease.[5]

Diseases, such as focal segmental glomerulosclerosis (FSGS), membranous nephropathy, and immunoglobulin-A (IgA) nephropathy (IgAN), are now being increasingly reported, largely due to enhanced biopsy practices and improved diagnostic techniques.[6] Studying the patterns of GN through biopsy helps researchers understand their incidence and prevalence, how they vary from region to region, and how these patterns change over time.[7] These changes have been seen both within a country and across the world.[8] This change in the spectrum of GN mirrors global trends, where lifestyle changes, environmental factors, and improved healthcare access are influencing disease patterns. Furthermore, infections and autoimmune diseases remain important contributors to GN in Pakistan, especially in rural and underserved populations.[9] Despite the rising GN burden in Pakistan, which is among the low- and middle-income countries (LMICs), there is a significant lack of comprehensive data on its epidemiology and histopathological spectrum, especially across diverse regions and populations. The current study was planned to

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address the knowledge gap by analysing the spectrum of biopsy-proven GN and associated demographic and clinical characteristics in patients undergoing ultrasound-guided renal biopsy.

Patients and Methods

The prospective, cross-sectional, descriptive study was conducted at the Department of Nephrology, Ayub Teaching Hospital, Abbottabad, Pakistan, from April, 2023 to December, 2024. After approval from the ethics review board of the Medical Teaching Institution, Abbottabad, the sample was raised using convenience sampling technique. Those included were adult patients with biopsy-proven GN. Written informed consent was obtained from all patients before performing the biopsies. Patients were excluded if they were aged <18 years, had inadequate biopsy sample, had incomplete clinical or laboratory data, or declined consent.

Demographic and clinical characteristics of the patients were collected at baseline using a predesigned proforma. The variables included age, gender, clinical presentation, indication of biopsy, presence of comorbidities and clinical syndrome. Laboratory parameters included serum creatinine and albumin levels, urinalysis, 24-hour urinary protein and screening. Serological tests for GN or vasculitis included anti-nuclear antibody (ANA), anti-double stranded deoxyribonucleic acid (dsDNA), serum complement levels C3 and C4 (expressed as low or normal), anti-phospholipase A2 receptor (anti-PLA2R) antibodies, anti-neutrophil cytoplasmic antibodies (ANCA) and anti-glomerular basement membrane (anti-GBM) antibodies. Biopsy findings included histological classification, type of primary and secondary glomerulopathy, interstitial fibrosis and tubular atrophy (IFTA) and post-infectious glomerulopathy. The estimated glomerular filtration rate (eGFR) was calculated using the CKD Epidemiology Collaboration (CKD-EPI) creatinine equation.[10]

The biopsies were analysed using two methods: light microscopy (LM) and immunofluorescence (IF). For LM, special stains like haematoxylin and eosin (H&E), Periodic Acid Schiff (PAS), Masson's trichrome, and silver stains were used. IF was done with polyclonal antibodies to detect IgG, IgM, IgA, C3, and C1q, following the common manufacturer's guidelines. Specific manufacturer details of the laboratory equipment, reagents, and diagnostic kits were not included in the reports provided to the authors and therefore could not be specified. The biopsies were analysed using light microscopy (LM) and immunofluorescence (IF). For LM, special stains like haematoxylin and eosin (H&E), Periodic Acid Schiff (PAS), Masson's trichrome, and silver stains were used. IF was done with polyclonal antibodies to detect IgG, IgM, IgA, C3 and C1q, following the manufacturer's guidelines.

Data was analysed using SPSS 23. Continuous variables were expressed as mean±standard deviation, and were compared using independent samples *t*-test, while categorical variables were presented as frequencies and percentages, and chi-square test was used to compare these variables. P≤0.05 was considered statistically significant.

Results

Of the 180 patients with mean age 36.79±16 years, 98(54.44%) were males and 82(45.56%) were females, with the male-to-female ratio being 1.2:1. Oedema 135(74.9%) and acute kidney injury (AKI) 78(43.3%) were the most common presentations, with nephrotic syndrome being the leading biopsy indication 129(71.7%). Histopathology showed crescents 21(11.7%), post-infectious glomerulo-

Table-1: Demographic and clinical characteristics of the patients (n=180).

Parameters	Overall (n=180) [n(%)]	Female (n=82) [n(%)]	Male (n=98) [n(%)]	*p*-value
Mean Age (years)	36.79±16.02	37.11±16.48	36.52±15.70	0.9
Gender	180 (100)	82 (45.56)	98 (54.44)	
Clinical presentation				0.6
Oedema	135 (74.9)	64 (47.4)	71 (52.59)	
AKI	78 (43.3)	32 (41.02)	46 (58.98)	
Haematuria-Oliguria	8 (4.4)	3 (37.5)	5 (62.5)	
Mean Serum Albumin (3.5-5.5g/dl)	2.79g±0.86	2.78g±0.8	2.81g±0.91	0.09
Mean eGFR (90-125 ml/min/1.73 m^2)	61.87± 45.47	61.51±43.95	62.18±46.92	0.84
Indication of biopsy				0.67
Nephrotic syndrome	129 (71.6)	61 (47.28)	68 (52.7)	
Nephritic syndrome	32 (17.8)	14 (43.75)	18 (56.25)	
Nephritic/Nephrotic	10 (5.6)	5 (50)	5 (50)	
Unexplained AKI	9 (5)	2 (22.2)	7 (77.7)	
Degree of proteinuria				0.10
Nephrotic range (>3.5g/24hr)	107 (59.44)	54 (50.46)	53 (49.53)	
Sub-nephrotic range (<3.5g)	73 (40.6)	28 (38.35)	45 (61.64)	
Comorbidities (n=91)				0.05
Hypertension	81 (42.5)	33 (40.7)	48 (59.25)	
Diabetes	17 (9.2)	9 (52.9)	8 (47.05)	
Mean 24-hour urinary protein	4.76g±3.84	4.36g±2.92	5.09g±4.46	0.009
Crescents	21 (11.7)	4 (19.04)	17 (80.95)	0.009
Haematuria	35 (19.44)	18 (51.4)	17 (48.6)	0.86
Post infectious GN	22 (12.2)	9 (40.9)	13 (59.09)	0.64
IFTA				0.94
Mild	56 (31)	28 (50)	28 (50)	
Moderate-Severe	22 (12.3)	10 (46.6)	12 (54.4)	
Complement levels				0.08
Low C3	39 (21.7)	22 (56.42)	17 (43.58)	
Low C4	19 (10.6)	14 (73.6)	5 (26.31)	

AKI: Acute kidney injury, eGFR: Estimated glomerular filtration rate, IFTA: Interstitial fibrosis and tubular atrophy, GN: Glomerulonephritis; For continuous variables independent t-test and for categorical variables, chi-square test was applied.

nephritis 22(12.2%), mild IFTA 56(31.1%), and moderate-to-severe IFTA 22(12.2%). Hypertension 81(42.5%) and diabetes 17(9.2%) were the frequent comorbidities. Detailed clinical and laboratory findings were noted (Table 1).

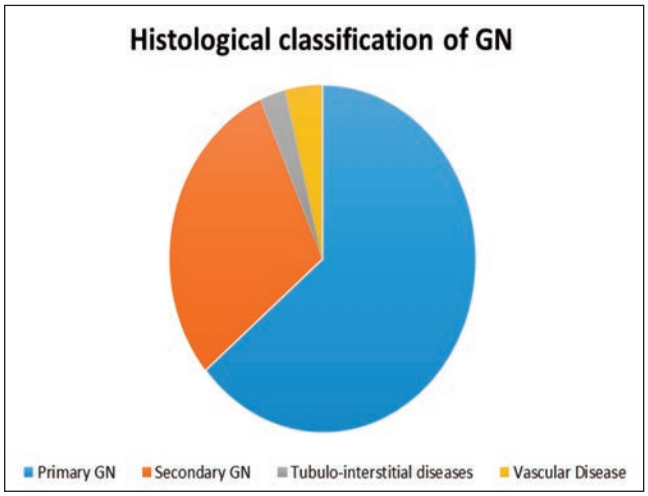

Figure: Histological classification of glomerular diseases.

Table-2: Demographic and clinical characteristics of the patients (n=180).

Histopathological spectrum	Age Groups (years)				p-value
Primary Glomerulonephritis	**115 (63.88%)**	**18-35 (72)**	**36-50 (24)**	**51-65 (13)**	**>65 (6)**	***p*<0.001**
Focal segmental glomerulosclerosis (FSGS)	31 (17.2%)	17	6	7	1	
Imuunoglobulin-A (IgA) nephropathy	28 (15.5%)	24	3	1	0	
Membranous GN	22 (12.2%)	9	8	3	2	
Membranoproliferative glomerulonephritis (MPGN)	13 (7.2%)	6	2	2	3	
IgM nephropathy	9 (5%)	9	0	0	0	
C3 Glomerulopathy	7 (3.8%)	5	2	0	0	
C1q Nephropathy	3 (1.7%)	2	0	1	0	
Minimal change disease	1 (0.5%)	1	0	0	0	
Membranous GN with IgA Nephropathy	1 (0.5%)	1	0	0	0	
Secondary Glomerulonephritis	**53 (29.44%)**	**22**	**18**	**10**	**3**	
Lupus nephritis	14 (7.7%)	9	4	1	0	
Diabetic nephropathy	9 (5%)	0	5	2	2	
Secondary Membranous GN	8 (4.4%)	4	4	0	0	
Post infectious GN	7 (3.8%)	4	0	3	0	
Amyloidosis	6 (3.3%)	2	3	1	0	
Secondary FSGS	3 (1.66%)	1	1	1	0	
Secondary MPGN	3 (1.66%)	1	1	1	0	
ANCA Associated GN	1 (0.55%)	0	0	0	1	
Multiple Myeloma	1 (0.55%)	0	0	1	0	
Chronic Allograft Nephropathy	1 (0.55%)	1	0	0	0	
Tubulo-Interstitial Disease (TID)	**5 (2.77%)**	**1**	**1**	**3**	**0**	
Tubulo-interstitial Nephritis	1 (0.55%)	0	0	1	0	
Acute Tubular Necrosis	3 (1.66%)	0	1	2	0	
Acute Cortical Necrosis (ACN)	1 (0.55%)	1	0	0	0	
Vascular Disease	**7 (3.88%)**	**0**	**5**	**0**	**2**	
Hypertensive Vasculopathy	3 (1.66%)	0	2	0	1	
Thrombotic Microangiopathy (TMA)	4 (2.22%)	0	3	0	1	

GN: Glomerulonephritis, ANCA: Anti-neutrophil cytoplasmic antibodies; The association between age groups and GN classification was assessed using chi-square test.

Histopathological analysis revealed there were 115(63.9%) cases of primary glomerulopathy, followed by secondary glomerulopathy 53(29.4%), vascular diseases 7(3.9%) and tubulointerstitial disease (TID) 5(2.8%) (Figure). Among primary glomerulopathy cases, FSGS 31(17.2%) and IgAN 28(15.5%) were the most common, while lupus nephritis (LN) 14(7.7%) and diabetic nephropathy (DN) 9(5%) were the most common among secondary glomerulopathies (Table 2). The association between age groups and GN classification was significant, with a higher prevalence of primary GN in younger patients, and secondary/vascular forms in older patients (p<0.001).

Discussion

GN, a leading cause of CKD worldwide, encompasses a diverse group of disorders characterised by immune-mediated injury to the glomeruli, with histopathological diagnosis remaining the cornerstone for accurate classification and management.[11]

The current study provides an overview of biopsy-proven GN in a region with limited data on the spectrum of renal diseases. Primary glomerulopathies represented the majority (63.9%) of biopsies, with FSGS being the most common subtype (17.2%), followed by IgAN (15.5%). These findings align with global trends of increasing FSGS prevalence due to improved recognition and rising risk factors, such as obesity and hypertension.[12,13] A study in Karachi reported similar results.[14]

IgAN, the second most common primary GN globally, is prevalent worldwide, but has historically been under-diagnosed in South Asia due to limited availability of renal biopsy facilities, particularly those offering IF.[15] IgAN is the most common glomerular disease among Europeans and Americans, while studies have shown that the incidence has increased in East Asia.[16]

Secondary glomerular diseases accounted for 29.4% of the current cases, with LN and DN being the most frequent subtypes. LN, a leading cause of secondary GN worldwide, showed a prevalence consistent

with other regional studies, such as one from Islamabad.[6] DN reflects the growing burden of diabetes in Pakistan, ranked third globally for diabetes prevalence, and aligns with other reports identifying DN as a major cause of CKD.[17,18]

Non-glomerular diseases, including TID and vascular nephropathies, were found to be rare (6.7%), which is consistent with international trends.[19]

The current findings are consistent with regional studies from South Asia, where FSGS and IgAN predominate as primary GNs14 and LN and DN as secondary causes.[17,18] However, differences exist, such as a higher prevalence of membranous nephropathy (MN) in India,[20] or IgAN in East Asia,[21] reflecting geographical and genetic variability. Nationally, earlier studies from Karachi showed MN as the leading primary GN, but more recent data reflect a shift toward FSGS.[14]

The current findings of FSGS and LN predominance align with trends from North America, Europe and the Middle East, emphasising universal challenges in GN management while highlighting the need for region-specific strategies.[13] Consistent with other studies, nephrotic syndrome was the leading biopsy indication in the current study, reflecting the burden of proteinuria and hypoalbuminemia in South Asia.[14]

The current study has several limitations, including its single-centre design, and a relatively small sample size, which may have limited the generalisability of the findings. Besides, the sample size was not calculated.

Despite these limitations, however, the study highlights a critical need for enhanced diagnostic capabilities and tailored healthcare strategies to combat the GN burden in Pakistan, particularly in the Hazara region. Addressing these gaps will be instrumental in improving patient outcomes and reducing the socioeconomic impact of GN in this region. Besides, the findings also underscore the urgent need to improve access to renal biopsy services and strengthen clinician training programmes, as timely and accurate GN diagnosis has direct implications for patient outcomes, health system planning, and resource allocation in LMIC settings, such as Pakistan.

Conclusion

Primary glomerulopathies, particularly FSGS and IgAN, were predominant, while oedema and nephrotic syndrome were common findings. The significant association of secondary glomerulopathy with LN and DN underscored the need for multidisciplinary care.

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Author Contribution:
AA: Performed the renal biopsies, design, data interpretation and analysis.
AW: Concept, collected and assembled the data, drafting and revision.