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## Author's contributions

SS and PRN had full access to all the data and take full responsibility for the integrity of the data and the accuracy of data analysis. SS and PRN conceptualized, designed, acquired, analyzed, and interpreted the data, as well as drafted the manuscript. Critical revision of the manuscript: All authors.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

## Conflicts of interest

There are no conflicts of interest.

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# Kidney Disease Pattern in Tribal Belt of Rajasthan: Kidney Biopsy Experience of Seven Years

Dear Editor,

The glomerular diseases are important contributor of CKD burden and their prevalence also varies with race, age, geographical location, cultural and economical status worldwide.[1,2] A kidney biopsy is needed to characterize various types of glomerular diseases correctly. India does not have a National Registry of Glomerular Diseases, and there is scattered data on the prevalence of glomerular diseases from different parts of India. Beniwal *et al*. is the only study on biopsy-proven kidney disease patterns from the eastern part of Rajasthan.[3]

Rajasthan is located in the north-western part of India, has been a major route of human migration since ancient times, and includes the tribal belt of Northwest India. The origin of people living here stems from the Harappa civilization (3500 BC–2500 BC).[4] Studies have documented high genetic heterozygosity among the populations of Rajasthan, possibly because of gene flow from different directions.[5,6] The districts draining our hospital have large tribal populations, with Udaipur district having the highest proportion of tribal population in the state. We are presenting the kidney disease pattern on kidney biopsy for 7 years in patients who attended our center. The study was approved by the Local Institutional Ethics Committee at RNT Medical College, Udaipur (RNT/ ACAD/ IEC/2023/558).

A total of 415 renal biopsies performed between 2013 and 2019 were reviewed, of which six were excluded due to insufficient sample and interpretation. A total of 409 kidney biopsy samples were analyzed. Due to a lack of in-house reporting, all kidney biopsy samples were sent to the SRL Renal Pathology Diagnostic Laboratory. All the renal biopsies were evaluated with light microscopy and immunofluorescence. Electron microscopy facility was not

**Table 1: Renal histology in different age groups**

| | Total (409) (%) | <18 years (79) (%) | 18–40 years (238) (%) | 41–60 years (71) (%) | >60 years (21) (%) | Adults >18 years (330) (%) |
|---|---|---|---|---|---|---|
| Primary GN | 305 (74.57%) | 69 (87.34) | 168 (70.59) | 50 (70.42) | 18 (85.71) | 236 (71.52) |
| MCD | 52 (17.05) | 13 (18.84) | 32 (19.01%) | 04 (08.0) | 03 (16.67) | 39 (16.53) |
| FSGS | 94 (30.82) | 15 (21.74) | 53 (31.55) | 20 (40.0) | 06 (28.57) | 79 (33.47) |
| MGN | 38 (12.46) | 06 (08.7) | 20 (11.91) | 10 (20.0) | 02 (09.52) | 32 (13.56) |
| IgAN | 12 (03.93) | 02 (02.9) | 09 (05.36) | 01 (02.0) | - | 10 (04.24) |
| PIGN/IRGN | 26 (08.52) | 14 (20.3) | 06 (03.57) | 04 (08.0) | 02 (09.52) | 12 (05.08) |
| MPGN | 17 (05.57) | 07 (10.14) | 08 (04.76) | - | 02 (09.52) | 10 (04.24) |
| MesPGN | 20 (06.56) | 06 (08.8) | 11 (06.55) | 02 (04.0) | 01 (04.76) | 14 (05.93) |
| Crescentic GN | 12 (03.93) | 02 (2.9) | 06 (03.57) | 03 (06.0) | 01 (04.76) | 10 (04.24) |
| CSGN | 34 (11.15) | 04 (0.5.6) | 23 (13.69) | 06 (12.0) | 01 (04.76) | 30 (12.71) |
| Secondary GN | 82 (20.05) | 08 (10.1) | 58 (24.37) | 13 (18.31) | 03 (14.29) | 74 (22.42) |
| Amyloidosis | 27 (32.93) | - | 15 (25.86) | 09 (69.23) | 03 (100) | 27 (36.49) |
| LN | 36 (43.90) | 06 (75) | 28 (48.28) | 02 (15.38) | - | 30 (40.54) |
| DN | 01 (01.22) | - | 01 (01.72) | - | - | 01 (01.35) |
| RCN | 09 (10.98) | 01 (12.5) | 08 (13.79) | - | - | 08 (10.81) |
| Cryoglobulinemic GN (MPGN) | 02 (02.44) | - | 02 (03.45) | - | - | 02 (02.70) |
| HTN/NS | 06 (07.32) | - | 04 (06.9) | 02 (15.38) | - | 06 (08.12) |
| Other GN | 02 (02.44) | 02 (25) | - | - | - | - |
| Tubulointerstitial Damage | 21 (05.13) | 01 (0.13) | 12 (05.04) | 06 (08.45) | - | 18 (05.45) |
| Acute (ATN/AIN/both) | 15 (71.43) | 01 (100) | 09 (75) | 05 (83.33) | | 14 (77.78) |
| CTIN | 04 (19.05) | | 03 (25) | 01 (16.67) | | 04 (22.22) |
| Others | 01 (00.24) | - | - | 01 (01.41) | - | 01 (00.30) |

MCD: Minimal change disease; FSGS: Focal segmental glomerulosclerosis; MGN: Membranous glomerulonephritis; IgAN: IgA nephropathy; PIGN/IRGN: Post-infectious/infection-related GN; MPGN: Membranoproliferative GN; MesPGN: Mesangioproliferative GN; CSGN: Chronic sclerosing GN; LN: Lupus nephritis; DN: Diabetic nephropathy; RCN: Renal cortical necrosis; HTN/NS: Hypertensive nephrosclerosis; ATN: Acute tubular necrosis; AIN: Acute interstitial nephritis; CTIN: Chronic tubule-interstitial nephritis; NS: Nephrotic syndrome; AGN: Acute glomerulonephritis; CKD: Chronic kidney disease; RPRF/RPGN: Rapidly progressive renal failure/glomerulonephritis, GN: glomerulonephritis.

done. The study has been approved by the local institute ethical committee (RNT/ACAD/IEC/2023/558).

The mean age of patients undergoing kidney biopsy was 31.16 ± 15.18 years; 230 (56.23%) were male, and 179 (43.77%) were female. Focal segmental glomerulosclerosis (FSGS) was the most common primary glomerular disease (94, 30.82%) in both adults and pediatric age groups (79, 33.47% and 15, 21.74 %, respectively), followed by minimal change disease (MCD) (39, 16.53%) and membranous glomerulonephritis (GN) (32, 13.56%) in adults. Infection-related/post-infectious glomerulonephritis (IRGN/PIGN) (14, 20.3%) was more frequent in the pediatric age group than in adults (12, 5.08%). In secondary GN, lupus nephritis (LN) was the most common both in pediatrics and adults (75% vs. 40.54%, respectively) followed by amyloidosis in adults [Table 1].

Nephrotic syndrome was the most common clinical presentation (172, 42.1%), followed by RPRF/RPGN (144, 35.2%) for doing kidney biopsy [Figure S1]. Among nephrotic syndrome, FSGS was the most common PGN (56, 32.26%), followed by MCD (40, 23.26%) and membranous GN (31, 18.02%). Amyloidosis was the most common cause of nephrotic syndrome in secondary GN followed by LN (21, 12.21% and 05, 2.91%). In RPRF/RPGN presentation, chronic sclerosing GN (CSGN) was the most common histological lesion (32, 22.22%), followed by FSGS (27, 18.75%) and membranoproliferative GN (MPGN) (11, 7.64%) [Table S1]. In acute GN, mesangioproliferative GN followed by PIGN/IRGN was the most frequent lesion in PGN, and LN was the most frequent cause in SGN. Interestingly, in patients with asymptomatic urine abnormalities, non-proliferative GN such as FSGS and or MCD was the most common presentation, followed by crescentic GN or LN [Table 1].

Primary GN was equally seen in males and females; however, in secondary GN, amyloidosis was seen predominantly in males, and LN and renal cortical necrosis were seen more frequently in females [Figure S2a]. Those who presented with the need for dialysis, CSGN, and FSGS were more frequent lesions on the renal biopsy, followed by tubule-interstitial lesions and renal cortical necrosis [Figure S2b].

This study represents a kidney disease pattern in kidney biopsy seen in patients attending the public sector hospital in the tribal belt of Rajasthan. Glomerulonephritis was the predominant histological lesion in kidney biopsies (94.62% of total), similar to another study from the eastern part of

**Table 2: Comparison of our study with biopsy-proven glomerular disease spectrum seen in other centers in India and neighboring countries**

| Parameter | Present (Udaipur) | Eastern (SMS Medical College, Jaipur)[3] | AIIMS New Delhi[11] | IPGMER, Kolkata[7] | PGIMER, Chandigarh[9] | NIMS, Hyderabad[12] | CMC, Vellore[13] | Pakistan[8] |
|---|---|---|---|---|---|---|---|---|
| Period | 2013–2019 | 2008–2013 | 2006–2016 | 2010–2012 | 2002–2007 | 1990–2008 | 1990–2001 | 1995–2008 |
| Number of biopsies | 409 | 622 | 2898 | 666 | 364 | 1849 | 3703 | 1793 |
| PGD (%) | 74.57 | 79.4 | 82.5 | 79.13 | 89 | 69.1 | - | 73 |
| SGD (%) | 20.05 | 14.5 | 17.5 | 20.87 | 11 | 18.2 | - | 10.9 |
| MCD (%) | 17.05 | 21.1 | 16.8 | 20.12 | 14.8 | 15.1 | 11.8 | 5.8 |
| FSGS (%) | 30.82 | 10.5 | 18.2 | 18.02 | 30.6 | 10.5 | 18.28 | 21.2 |
| MGN (%) | 12.46 | 15 | 16 | 12.01 | 24.4 | 7 | 9.8 | 17.2 |
| MPGN (%) | 6.23 | 9.6 | 5.7 | 5.25 | 17.9 | 3.9 | 3.7 | 1.1 |
| IgAN (%) | 3.93 | 7.4 | 10.4 | 8.1 | 1.8 | 4.4 | 8.6 | 1.5 |
| MesPGN(%) | 6.56 | 6.4 | 2.6 | 0.6 | - | 5.2 | 20.2 | 1.9 |
| Crescentic GN (%) | 3.93 | 2.6 | 3.1 | 7.51 | 3.6 | 4.5 | 7.91 | 5.2 |
| DPGN (%) | 8.52 | 5.3 | 2.6 | 4.95 | 2.8 | 10.3 | 14.66 | 3.9 |
| CSGN (%) | 11.15 | 1.9 | 2.9 | 3 | 3.7 | 6.7 | 4.62 | 11.6 |
| Amyloid (%) | 6.6 | 5.9 | 3.7 | 1.2 | 3.3 | 1.5 | 1.11 | 4.6 |
| DN (%) | 0.02 | 0.6 | 1.6 | 0.3 | 0.2 | 1.2 | 2.99 | 0.9 |
| LN (%) | 8.8 | 7.6 | 10.6 | 15.32 | 6.8 | 14.6 | 7.53 | 4.9 |

PGD: Primary glomerular disease; SGD: Secondary glomerular disease; MCD: Minimal change disease; FSGS: Focal segmental glomerulosclerosis; MGN: Membranous nephropathy; IgAN: IgA nephropathy; PIGN/IRGN: Post-infectious/infection-related GN; MPGN: Membranoproliferative GN; MesPGN: Mesangioproliferative GN; CSGN: Chronic sclerosing GN; LN: Lupus nephritis; DN: Diabetic nephropathy; RCN: Renal cortical necrosis; HTN/NS: Hypertensive nephrosclerosis; DPGN: Diffuse proliferative glomerulonephritis; CKD: Chronic kidney disease; SMS: Sawai Man Singh; IPGMER: Institute of Post Graduate Medical Education & Research; PGIMER: Postgraduate Institute of Medical Education and Research; NIMS: Nizam's Institute of Medical Sciences; CMC: Christian Medical College, GN: glomerulonephritis.

the state by Beniwal *et al*.[3] FSGS was the most common lesion in our study in all age groups, including those more than 60 years, which is quite different from the state-eastern pattern of kidney disease, where MCD was the most commonly reported lesion in young people and membranous nephropathy (MGN) in more than 40 years.[3] MCD was more frequently reported in those < 18 years old in other studies.[3,7] However, Mubarak and Kazi reported a high incidence of FSGS in the pediatric age group similar to ours.[4,8] This might be due to differences in doing kidney biopsies in the pediatric age group in different centers [Table 2].

LN and RCN were more frequent in females, whereas amyloidosis was more frequent in males. The primary GN pattern in two gender in our study are highlighted in Figure S2a.[9,10] Studies by Balakrishnan *et al*. from South India and Mittal *et al*. from North India reported 10-year kidney biopsy data of 2898 patients from 2006 to 2016 and 5258 patients from 1990 to 2001, respectively, found that FSGS, IgA nephropathy, MGN, MCD, MPGN, and renal amyloidosis were more frequent in male compared to female and LN and renal cortical necrosis predominantly seen in females.[10,11] Interestingly, CSGN was more consistent with advanced renal failure [Figure S2b]. The biopsy proven glomerular disease pattern in different part of the nation and neighbouring country highlighted in Table 2.[3,7-9,11-13]

We had limitations as we lacked in-house renal pathology support and depended on other centers for biopsy interpretation. The lack of electron microscopy was also a limitation. It has been suggested that 10–20% of kidney biopsies need EM for correct diagnosis.[14] In addition, there are significant changes in the understanding and diagnosis of certain glomerular diseases, especially C3 GN; recently, its interpretation and representation are likely to be missed in our study.

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## Conflicts of interest

There are no conflicts of interest.

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# Histopathological Spectrum of Kidney Biopsy in Central India: A Two Center Retrospective Study

Dear Editor,

Kidney biopsy is indispensable in diagnosing glomerular, tubulointerstitial, and vascular disorders of the kidney. We report the frequency of various histopathological entities from two large centers from the central Indian state of Chhattisgarh. We analyzed native kidney biopsies performed in adult patients at All India Institute of Medical Sciences (AIIMS) Raipur (between June 2019 and June 2022) and Ramkrishna Care Hospital (RKC) (between June 2017 and June 2022) in the central Indian city of Raipur, Chhattisgarh. The study was approved by the Institutional Review Board at Institute Ethical Committee AIIMS Raipur, Chhattisgarh, number 1439/AIIMSRPR/IEC/2021/371, dated 29.01.2021.

During the study period, 906 kidney biopsies were performed, 800 of which were native kidney biopsies, and were included for final analysis. Three hundred Kidney biopsies were performed at RKC and five hundred at AIIMS, Raipur.

The mean age of the patients was 33.9 ± 16.1 years, and 365 (45.6%) were females. Three hundred and sixty (45%) had hypertension and 54 (6.75%) had diabetes. Three (0.4%) patients were positive for hepatitis B Antigen and one (0.1%) patient were positive for HIV. None were positive for hepatitis C. Eight (1.0%) patients who underwent biopsy had malignancy and 56 (7.0%) patients required dialysis before biopsy. The most common indication for renal biopsy was nephrotic syndrome (n = 399, 49.9%), followed by nephritic syndrome (n = 247, 30.9%) and acute kidney injury (AKI) (n = 65, 8.1%) [Table 1].

The size of the tissue core taken for biopsy was 0.89 ± 0.39 cm. Mean glomeruli in light microscopy sample was 16.2 ± 7.4 and in the immunofluorescence sample was 7.6 ± 3.9.

Seven hundred and twenty-four (90.5%) of the patients had predominantly glomerular disorders, 53 (6.6%) patients had predominantly tubulointerstitial disorders, and 23 (2.9%) had predominantly vascular pathology. The most common histopathological diagnosis was lupus nephritis (n = 139, 17.4%), followed by membranous nephropathy (MGN) (n = 124,15.5%), minimal change disease (MCD) (n = 110,13.7%), and IgA nephropathy (n = 106,13.2%).