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Clinical Spectrum and Epidemiology of Renal Diseases: Insights from Renal Biopsy: A Single Hospital Study

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Abstract

Introduction: Diagnosis of renal diseases through renal biopsy exhibits variability influenced by factors such as geographical location, ethnicity, age, gender and observer subjectivity. **Aims:** This study aimed to ascertain the frequency and distribution of various renal diseases diagnosed via renal biopsy at a tertiary care hospital in Lucknow, India. **Materials and Methods:** The study enrolled 187 patients who underwent renal biopsy between January 2020 and January 2023. Biopsies were conducted using percutaneous ultrasound-guided core needle biopsy, yielding two renal biopsy cores per patient. **Results:** The mean age of the patients was 35.7±16.8 years with a male predominance of 2.46:1. Primary glomerular diseases constituted 61.5% of cases, with IgA nephropathy as the most prevalent (21.4%), followed by focal and segmental glomerulonephritis (13.9%). Secondary glomerular diseases comprised 12.3% of cases with diabetic nephropathy being the most frequent (4.8%). **Conclusion:** The findings underscore the regional variability in renal disease patterns and highlight the crucial role of renal biopsy in accurate diagnosis and treatment decision-making. Further research is warranted to validate these observations and establish a national renal biopsy registry in India.

Keywords: C3 Glomerulopathy, Crescentic Glomerulo Nephritis (GN), FSGS (Focal and Segmental Glomerulonephritis), IgA N (IgA Nephropathy), MCD (Minimal Change Disease), MN (Membranous Nephropathy), MPGN (Membranoproliferative Glomerulonephritis)

1. Introduction

Renal diseases identified through renal biopsy exhibit regional, racial, age and sex disparities, alongside being subject to observer bias. The glomerular disease ranks as the third most prevalent cause of chronic kidney disease and carries significant clinical implications due to the potential for reversal and cure with early detection and intervention[1,2]. In India, the rise in renal diseases correlates with the increasing prevalence of conditions like Diabetes Mellitus (DM), hypertension, and an ageing population. Socioeconomic factors, dietary habits and environmental factors contribute to the diverse patterns of kidney diseases identified via renal biopsy[3,4].

Renal biopsy serves as the definitive diagnostic modality for kidney diseases, offering crucial insights into disease activity, severity, treatment selection and prognosis assessment[5]. Indications for renal biopsy encompass various clinical presentations such as nephrotic syndrome, nephritic syndrome, acute kidney injury and systemic diseases affecting the kidneys. The histopathological examination provided by renal biopsy

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aids in accurate diagnosis, treatment planning and prognostic determination, including the evaluation of genetic kidney disorders[6].

Epidemiological studies shed light on the racial and geographic distribution of kidney diseases, with variations observed across different regions and ethnicities. For instance, IgA Nephropathy (IgAN) predominates in certain regions like Asia and Southern Europe, while Focal Segmental Glomerulosclerosis (FSGS) and Membranous Nephropathy (MN) are more prevalent in specific populations such as the Middle East and Northern European Caucasians, respectively[7,8].

Registry data, clinical practices and environmental factors influence the prevalence rates and characteristics of kidney diseases. The lack of national renal biopsy registries in certain regions, like India, underscores the need for more extensive studies to understand the epidemiology of renal diseases comprehensively[9]. The present study conducted in a tertiary care hospital in central India aims to elucidate the current prevalence and types of renal diseases based on histopathological findings, contributing to a better understanding of regional disease patterns and informing healthcare strategies accordingly.

2. Methods

We investigated the forms of renal diseases diagnosed via renal biopsy over three years at a tertiary care hospital in Lucknow, India. The study encompassed 195 participants who underwent renal biopsy from January 2019 to January 2022. Eight cases were omitted from the conclusive examination owing to inadequate biopsy specimens or incomplete documentation. Renal biopsies were administered to individuals presenting symptoms inclusive of microscopic hematuria and/or persistent proteinuria, nephrotic syndrome, acute nephritic syndrome, unexplained acute kidney injury or presumed renal implication in systemic ailments such as systemic lupus erythematosus. Biopsies were performed using percutaneous ultrasound-guided core needle biopsy, yielding two renal biopsy core samples. Glomerular diseases were categorised into primary, secondary and other forms. Primary glomerular disease was subdivided into nine groups, including MCD, IgA N, MN, FSGS, MPGN, crescentic glomerulonephritis, C3 glomerulopathy, Diffuse Proliferative Glomerulonephritis (DPGN), and fibrillary glomerulopathy.

Secondary glomerular diseases were categorised into four distinct groups, namely Lupus nephritis, diabetic nephropathy, hypertensive nephropathy and amyloidosis. The data acquisition involved demographic and clinical profiles, pathology reports and laboratory findings obtained during the biopsy procedure. Institutional ethical clearance was obtained and the study conformed to the principles outlined in the Declaration of Helsinki. Data underwent analysis employing descriptive statistical methods and were presented as mean ± standard deviation or median (interquartile range) utilising SPSS version 26.0.

3. Results

A total of 187 kidney biopsies were examined, out of which 133 (71.1%) were males and 54 (28.9%) were females. The mean age of the patients was 35.7 ± 37.1 years for men and 32.3 ± 33.4 years were women. In the present study, the male-to-female ratio was 2.46. Nearly two-thirds of the patients (63.1%), as depicted in Figure 1, belonged to younger age groups (less than 40 years). 22 (11.7%) participants in the study were senior age group i.e., >40 years.

Table 1 presents the pathological distribution of renal diseases identified through kidney biopsy. Primary glomerular disease accounted for 61.5% of the cases reviewed. The most prevalent primary glomerular disease was IgAN (21.4%), followed by FSGS (13.9%), MCD (8.6%), MN (8.6%), DPGN (2.7%), MPGN (2.1%), Crescentic GN (2.1%), C3 Glomerulopathy (1.1%), and Fibrillary Glomerulopathy (1.1%). Secondary glomerular disease comprised 12.3% of the total cases, with diabetic nephropathy being the most common (4.8%), followed by amyloidosis (3.7%), Lupus nephritis (2.1%), and

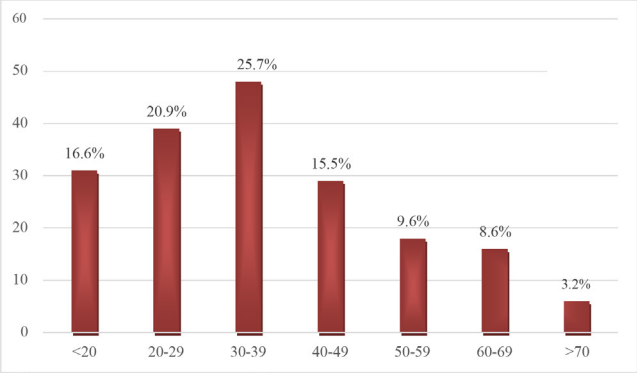

Figure 1. Age distribution of study participants.

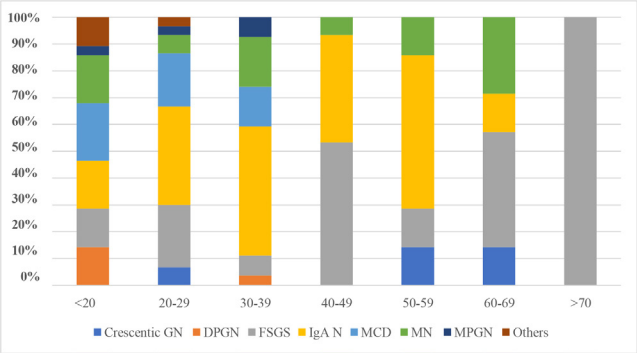

Figure 2. Distribution of primary glomerular disease by age.

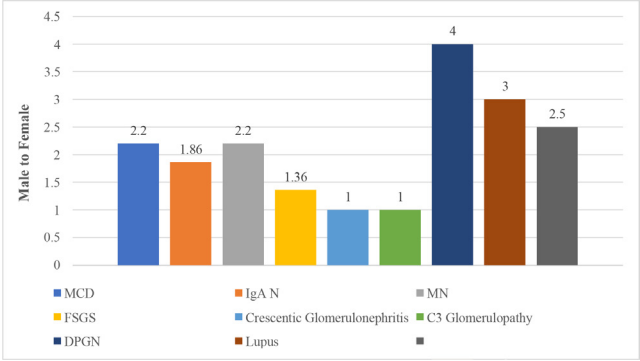

Figure 3. Distribution of renal disease by sex.

Table 1. Pathological distribution of renal disease

Major Group		Frequency	Percentage
Primary Glomerular Disease		115	61.5
	MCD	16	8.6
	IgA N	40	21.4
	MN	16	8.6
	FSGS	26	13.9
	MPGN	4	2.1
	Crescentic GN	4	2.1
	C3 Glomerulopathy	2	1.1
	DPGN	5	2.7
	Fibrillary Glomerulopathy	2	1.1
Secondary Glomerular Disease		23	12.3
	Lupus Nephritis	4	2.1
	Diabetic Nephropathy	9	4.8
	Amyloidosis	7	3.7
	Hypertensive Nephropathy	3	1.6
Others	TIN	10	5.3
	Thrombotic Microangiopathy	7	3.7
	Acute Pyelonephritis	1	0.5
	ATN	12	6.4
	Focal Tubular Calcification	1	0.5
	Graft Rejection	12	6.4
	Multiple Myeloma	6	3.2

hypertensive nephropathy (1.6%). Acute Tubular Necrosis (ATN) constituted 6.4% of all biopsies, while Tubular Interstitial Nephritis (TIN) accounted for 5.3%. Thrombotic Microangiopathy was observed in 3.7% of cases and multiple myeloma in 3.2%. Graft rejection occurred in 6.4% of all the participants.

The prevalence of primary glomerular disease differed by age at presentation (Figure 2). MCD, MPGN and DPGN were observed only in those younger than 40 years. FSGS was the most common finding in the elderly over 60 years of age. IgA N was evenly distributed among all age groups.

When the renal diseases were analysed by sex ratio, the glomerular disease was male-dominant, with DPGN having a 4:1 (male: female) ratio of primary glomerular disease, while lupus nephritis had a 3:1 ratio of secondary glomerular disease (Figure 3)

4. Discussion

This research aimed to explore the pattern of renal diseases detected through biopsy within the population from central India. The study revealed a male-to-female ratio of 2.46:1, consistent with findings from various Indian and international investigations[10-12]. The average age in the study was 35.7±16.8 years, aligning with recent research outcomes[10-12]. However, some studies have reported lower mean ages, with figures as low as 15.4±12.0 years in certain cases[13-15].

The proportion of geriatric patients undergoing renal biopsy varies widely between developing and developed countries. In developing countries, this population accounts for only 2-10 % of all renal biopsy patients whereas the number increases to 14-29 % in developed countries[16,17]. One possible explanation for this discrepancy is the better availability of healthcare facilities and longer life expectancy in developed countries, which may contribute to more elderly patients undergoing biopsies for accurate diagnosis. In the study conducted, we found that the sex ratio (males: females) for renal disease ranged from 1:1 to 4:1.

In addition, males predominated in glomerular disease. These findings are consistent with prior research that has found a higher incidence of glomerular disease in men or a similar sex ratio for diseases such as MCD, FSGS, MN, MPGN and IgA N[8,18].

In this descriptive study of renal biopsies, we confirmed that IgA N was the most common primary glomerular disease (21.4%), whereas diabetic nephropathy was the most common secondary form of glomerular disease (4.8%). In addition, the frequency of primary glomerular disease varied by age. The results of this study are consistent with previous reports that IgA N is the predominant primary glomerular disease in various regions, including East Asia (Japan, China, Singapore and Hong Kong), Australia, North America and selected European countries such as Italy, Spain, Hungary, France, the Netherlands and the Czech Republic. However, the incidence of IgA N is relatively low in African Americans who are more likely to be affected by FSGS[17,19,20]. Geographic differences in IgA N frequency may be related to racial differences, as certain populations may be more or less susceptible to the disease.

For instance, Asians are believed to have a higher susceptibility while African Americans may exhibit lower susceptibility. These disparities likely stem from genetic variances in susceptibility loci for IgA nephropathy such as chromosome 6p21 as well as variations in disease prevalence across different populations[21]. Despite IgA nephropathy being the predominant primary glomerular disease in our investigation, its incidence varied across age groups. Within our study, MCD, MPGN, and DPGN exclusively affected patients under 40 years old, while FSGS was most prevalent in individuals aged 60 years and above. In contrast, IgA nephropathy occurred across all age groups without a discernible age-related pattern. Among patients under 20 years old, MCD emerged as the most prevalent primary glomerular disease. Similar trends were noted in other studies conducted in India, where MCD was the predominant primary glomerular disease among younger age groups[22,23].

Although FSGN was found in all age groups in the present study, it is not commonly reported in America and Europe[24]. The current study found DN to be the most prevalent secondary glomerular disease, consistent with several other studies conducted in the field[25,26]. Based on the data from the Indian Council of Medical Research, diabetes prevalence among Indian adults has increased to 7.1%, and both diabetes and hypertension are responsible for 40-60% of CKD cases[27].

Our study has some limitations. Firstly, due to its retrospective design, the quantity of data that could be gathered from the patient's medical records was restricted. Secondly, there is a possibility of selection bias, as the study was conducted only in a hospital setting.

5. Conclusion

In our study examining the prevalence of renal diseases identified through kidney biopsy, we discovered that IgA nephropathy was the most frequently diagnosed primary glomerular disease, with diabetic nephropathy being the most common secondary glomerular disease. Exploring renal disease patterns across various registries, considering factors like race, geography and clinical practices, could yield valuable insights.

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