Original Article

Prevalence and Causes of Renal Disorders in Patients Undergoing Ultrasound-Guided Renal Biopsy: A Cross-Sectional Study

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ABSTRACT

Objective: To assess the prevalence and causes of renal disorders in patients undergoing renal biopsies, with a focus on assessing the safety and adequacy of the biopsy procedure.

Study Design: A cross-sectional study

Place and Duration of Study: This study was conducted at the Nephrology Department of Central Park Teaching Hospital, Lahore in collaboration with Department of Nephrology, Choudhary Muhammad Akram Teaching Hospital, Lahore from December 2022 to June 2023.

Methods: Seventy-eight participants aged 15 to 60 years, undergoing renal biopsy for definitive diagnosis, were recruited after obtaining prior written informed consent. Sociodemographic details, medical history, and biopsy-related information were recorded. Renal biopsies were assessed for safety and adequacy, including pre- and post-biopsy hemoglobin levels. Statistical analysis was performed using SPSS version 26.0.

Results: The study population comprised 64.1% females, with 10.25% being hypertensive and 5.12% diabetic. Renal biopsies were deemed safe, with a mean glomeruli count of 19.49 and minimal blood loss (mean difference: 0.79 mg/dL). Lupus nephritis (30.8%) and nephrotic syndrome (12.80%) were major reasons for biopsies, with various other causes identified. Biopsy-proven diagnoses included focal segmental glomerulosclerosis, membranous glomerulonephritis, and lupus nephritis of varying classes.

Conclusion: This study underscores the importance of renal biopsies in diagnosing CKD and guiding treatment, with a focus on safety and adequacy of the procedure. Prevalent causes of CKD included autoimmune conditions such as lupus nephritis and nephrotic syndrome.

Key Words: Chronic kidney disease, renal biopsy, lupus nephritis, nephrotic syndrome, glomerulonephritis.

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INTRODUCTION

Chronic kidney disease (CKD) is a relentless and increasingly prevalent global health crisis, casting a shadow over healthcare systems and the lives of individuals worldwide.(1) Among the countless medical conditions that afflict humanity, few are as insidious and quietly devastating as CKD.

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The kidneys, those unassuming bean-shaped organs nestled in the lower back, perform a crucial role in our physiological symphony. They are the body's natural filters, ensuring that waste products and excess fluids are excreted as urine, maintaining the body's delicate balance.(2) However, this orchestration can go awry, and when it does, the consequences are profound. CKD is a progressive condition in which the kidneys gradually lose their ability to function, leading to a buildup of waste and fluids in the body. The early stages of CKD may be asymptomatic, which makes it a silent threat. As the disease advances, symptoms like fatigue, swelling, and changes in urine output may appear, but often it's in the later stages, when kidney function is severely compromised, that these signs become unmistakable. (3,4)

One of the critical tools in diagnosing the underlying causes of renal disorders, including CKD, is the renal biopsy.(5) This procedure, often referred to as the "gold standard" in nephrology, provides vital insights into the microscopic structure of the kidneys. By examining tiny

samples of kidney tissue, nephrologists can pinpoint the exact nature of the disease and formulate targeted treatment plans. Renal biopsy has transformed the landscape of nephrology, enabling the early diagnosis of kidney diseases and guiding the management of CKD.[6] While CKD represents a significant burden, not only in medical terms but also in terms of the human experience, the path to accurate diagnosis and effective treatment is often fraught with uncertainties. The silent progression of the disease, lurking in its early stages, underscores the urgency of understanding its triggers and manifestations. By honing in on the role of renal biopsy, we aim to illuminate the complexities that underlie renal disorders and provide a roadmap toward early intervention and improved patient outcomes.[7] In this journey, we transcend the boundaries of conventional nephrology to explore the dynamic interplay between clinical practice, diagnostic innovation, and the lived experiences of individuals confronting the challenge of CKD.

At the heart of our investigation lies a commitment to erasing the shadows that shroud CKD. The transformative power of renal biopsy, as the guardian of precision and the harbinger of targeted therapies, offers a glimmer of illumination on this intricate path. Our study delves into the panoramic landscape of renal disorders, aiming to decipher their enigmatic causes and map the territory where the silent foe, CKD, is confronted and ultimately vanquished. We acknowledge that our exploration is but a single step on this journey, yet every step carries the potential to unveil insights that can benefit not only our patient population but also the global community grappling with the challenge of CKD. In this multifaceted narrative, we embrace the scientific inquiry that paves the way for more precise diagnoses, timely interventions, and, ultimately, better outcomes for those affected by CKD.

METHODS

Under the guidelines of Helsinki Declaration, a cross-sectional study was conducted at the department of nephrology of Central Park Teaching Hospital in collaboration with Department of Nephrology, Choudhary Muhammad Akram Teaching Hospital, Lahore from December 2022 to June 2023 after taking ethical approval from institutional review board. In this study, 78 study participants with age range of 15 to 60 years presenting for definitive diagnosis via renal biopsy were recruited after taking prior written informed consent. Patients being referred by nephrologist and rheumatologist for renal biopsy were included in the study while those patients who were not referred or having thrombocytopenia (platelet count > 50000/mm^3) were excluded from this study.

In a detailed study Performa, sociodemographic details including age gender history of hypertension, diabetes mellitus was recorded and biopsy was performed to make a definitive diagnosis. Hemoglobin levels, a vital indicator of blood loss during the biopsy procedure, were meticulously recorded both before and after the biopsy. For the biopsy, patient was lying in supine position, and ultrasound guided biopsies were done out of which 10 biopsies were under real time ultrasound and rest were ultrasound guided and all the biopsies were taken by nephrologists. All the biopsies were taken using a 16-gauge biopsy needle and two samples were taken after injecting local injection at the site of biopsy. Both samples were persevered in formalin and normal saline for electron microscopy and immunofluorescence.

Statistical Analysis

After dual assessment for errors and omissions, data was entered and verified into Microsoft Excel 2019 and after validation were exported into Statistical Packages Software for Social Sciences version 26.0. Qualitative data like gender, disease histories were expressed in terms of frequencies and percentages and was presented as bar charts and graphs. Normality of the data for number of glomeruli and pre and post hemoglobin levels were assessed and parametric analysis was employed. Paired sample t test was employed for the assessment of change in hemoglobin levels during the curse of biopsy. Independent sample t test was used for the assessment of number of glomeruli taken in the sample. For significance, a cut off of 0.05 of p value was set.

RESULTS

A total of 78 referrals from department of nephrology and rheumatology were received for definitive diagnosis with mean age of 32.00 + 12.95 with age range of 15 to 60 years of age. Out of 78 patients, 28 were males (35.9%) and 50 were females (64.1). In study population 4 (5.12%) were diabetic and 8 (10.25%) were hypertensive as explained in table 1.

Table No. 1: Assessment of Qualitative Study Variables in Study Population.

Variables	n	Percentages (%)
Gender		
Male	28	35.9%
Female	50	64.1%
Diabetic	4	5.12%
Hypertensive	8	10.25%

Number of the glomeruli taken on renal biopsy were noted and were assessed by employing independent sample t test which showed 19.49 + 8.22 with t value of 20.93 and p value 0.000 showing adequate number of glomeruli on renal biopsies. Similarly, assessment of pre and post change in hemoglobin levels (blood loss during biopsy) were also noted by employing independent sample t test and no significant blood loss (mean difference: 0.79 mg/dL) with p value of 0.543 as explained in the table 2. On appliance of paired sample correlation, a significant positive correlation was noted between pre and post hemoglobin levels with r value of

0.829 with p value of 0.0001 suggestive of good pre-hemoglobin levels lead to good post biopsy hemoglobin levels.

Table No. 2: Comparison of Pre-& Post Hemoglobin Levels in Renal Biopsies.

Variables	Mean + St. Dev	Mean Difference	T-value	p-value
Pre-Hemoglobin	11.086 + 1.73	0.793	0.612	0.543
Post-Hemoglobin	11.007 + 1.61			

Causes were established and compared for the being reason of renal biopsy as explained in table 3. Systemic Lupus erythematosus (18%) and lupus nephritis (30.8%) has been the major reason behind the biopsies with overall percentage of 48.8%. After SLE and nephritis, nephrotic syndrome has been the second major reason behind the renal biopsies with the percentage of 12.80% as explained in table 3. After nephrotic syndrome, Hakeem medication (5.10%) and nephritic syndrome (5.10%) have been the culprit behind the renal biopsies. All the other causes for renal biopsies have also been discussed in table 3 including raised ASO titers and infections. Biopsy proven diagnosis were made and confirmed on electron microscopy were made as explained in table 3 section 2.

Table No. 3: Description of Causes and Biopsy Proven Diagnosis in Study Population.

Causes	N	(%)
ASO raised	2	2.5
ATN	2	2.6
CKD	2	2.5
Diabetic nephropathy	2	2.6
Glomerulonephritis	2	2.5
Hakeem medication	4	5.10
Interstitial nephritis	2	2.6
Lupus nephritis	24	30.8
Nephrotic syndrome	10	12.80
Nephritic Syndrome	4	5.10
Psoriatic arthritis	2	2.6
SLE	14	18
TB	2	2.6
Others	6	7.7
Biopsy Proven Diagnosis		
Advanced global glomerulosclerosis qith moderate tubulointerstitial nephritis	2	2.5
Crescentic glomerulonephritis	2	2.5
Diabetic nephropathy	2	2.5
Diabetic nephropathy class 2	2	2.5
Diffuse global lupus nephritis class 4	6	7.5
Early focal segmental glomerulonephritis	2	2.5
Focal lupus nephritis class 3	2	2.5
Focal proliferative lupus nephritis class 3	2	2.5
Focal segmental glomerulonephritis with advanced glomerulosclerosis	2	2.5
Focal segmental golmerulosclerosis	6	7.5
Lupus nephritis class 1	4	5.10
Lupus nephritis class 2	8	10.2
Lupus nephritis class 3	2	2.5
Lupus nephritis class 5	6	7.5
Memberanous glomerulonephritis	2	2.5
Membranous glomerulonephritis	4	5.10
Membranous lupus nephritis class 5	4	5.10
Membranous pattern glomerulonephritis with advanced golmerulosclerosis	2	2.5
Membranous pattern golmerulonephritis	2	2.5
Mesangio-proliferative glomerulonephritis	3	3.5
Mesangio-proliferative lupus nephritis class 2	3	3.5
Mild acute tubular necrosis	2	2.5
Minimal change disease	6	7.5
Normal glomeruli	2	2.5
Post infection glomerulonephritis	2	2.5

DISCUSSION

Our study comprised 78 participants aged 15 to 60 years, referred for renal biopsy, with a majority of 64.1% being females. Notably, 10.25% of the study population were hypertensive, and 5.12% were diabetic. These findings align with the ongoing concerns regarding the increasing prevalence of CKD associated with common risk factors like hypertension and diabetes. The relationship between hypertension, diabetes, and CKD has been well-established by Yin et al.

We evaluated the adequacy and safety of renal biopsies conducted in our study, noting that the mean number of glomeruli sampled was 19.49, indicating that an adequate number of glomeruli were obtained for diagnostic purposes. Importantly, the safety of the procedure was highlighted by the absence of significant blood loss during biopsy, with a mean difference of 0.79 mg/dL in pre- and post-biopsy hemoglobin levels. These findings are consistent with contemporary studies emphasizing the importance of optimizing biopsy procedures to obtain adequate tissue samples while ensuring patient safety [8,9].

The causes of renal disorders revealed in our study offer crucial insights into the landscape of CKD. Lupus nephritis, a condition associated with systemic lupus erythematosus (SLE), was a predominant reason for renal biopsies in our study, accounting for 30.8% of cases. Nephrotic syndrome and other causes such as medication-induced nephritis and infections also featured prominently. These findings are in line with the latest concerns in nephrology. SLE, in particular, has garnered attention due to its impact on kidney

health, and research continues to focus on early diagnosis and effective management to mitigate the progression of CKD in SLE patients[10,11]. The relationship between SLE, nephrotic syndrome, and various forms of glomerulonephritis has been well-documented [12].

The biopsy-proven diagnoses in our study further elucidate the underlying renal disorders. Focal segmental glomerulosclerosis (FSGS), membranous glomerulonephritis, and lupus nephritis of varying classes were among the confirmed diagnoses. Notably, minimal change disease and normal glomeruli were observed in our cohort. This corresponds with recent literature highlighting the significance of precise histopathological diagnoses. For instance, the accurate diagnosis of FSGS is essential for tailored treatments, given the heterogeneity in treatment responses and disease progression[13, 14]. Furthermore, advances in our understanding of podocytopathies, such as minimal change disease, have raised important questions about the pathogenesis and optimal management of these conditions [15].

While our study contributes valuable insights, it is not without limitations. The relatively small sample size and the single-center nature of our study may limit the generalizability of our findings. Additionally, longer-term follow-up data are needed to comprehensively assess patient outcomes.

CONCLUSION

In conclusion, our study provides a snapshot of the prevalence and causes of renal disorders in patients undergoing renal biopsies. The safety and adequacy of renal biopsies are critical in obtaining accurate histopathological diagnoses, which, in turn, guide treatment strategies. The high prevalence of lupus nephritis and nephrotic syndrome in our cohort underscores the ongoing challenges in managing CKD, particularly in patients with underlying autoimmune conditions.

Author's Contribution:

Concept & Design of Study:	Muhammad Azhar Waheed Khan
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