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RENAL BIOPSY INSIGHTS INTO THE SPECTRUM OF GLOMERULAR LESIONS IN DIABETIC NEPHROPATHY

Pathology

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ABSTRACT

Background- Diabetic Nephropathy (DN) is a leading cause of chronic kidney disease and end-stage renal disease worldwide. While clinical and biochemical parameters aid diagnosis, Renal biopsy remains the gold standard for identifying specific glomerular lesions and assessing disease severity. **Objectives :** To evaluate the spectrum of glomerular lesions in patients with Diabetic Nephropathy using Renal biopsy. **Material & Methods-** A retrospective study was conducted at Karnataka Medical College & Research Institute (KMC&RI), Hubballi from Jan 2023 to Jan 2025 for a period of two years. A total of 64 cases were included. Biopsy specimens were examined by Light microscopy. Statistical analysis was done using SPSS version 16 and the data was analyzed and tabulated. **Results-** Among 64 Renal biopsies analyzed, the most frequent lesion was Diabetic Nephropathy (DN), with Class 4 DN in 22 cases (34.4%), Class 3 DN in 6 cases (9.4%), and Classes 2A and 2B DN in 1 case each (1.6%). Non-diabetic Renal Diseases (NDRD) included AIN/ATIN in 7 cases (10.9%), ATI/ATN in 6 cases (9.4%), MPGN in 4 cases (6.2%), IgA Nephropathy in 3 cases (4.7%), Hypertension 4 in cases (6.2%) and other lesions such as CTIN, MCD, FSGS, IRGN, and Pyelonephritis in smaller proportions. **Conclusion-** Renal biopsy provides valuable insights into the histopathological spectrum of Glomerular lesions in Diabetic Nephropathy. Recognition of characteristic and coexisting lesions aid in accurate diagnosis, prognostication, and guiding patient management.

KEYWORDS

Diabetic Nephropathy, Renal Biopsy, Glomerular Lesions, Histopathology, Chronic Kidney Disease

INTRODUCTION

Diabetic Nephropathy (DN) is one of the most common microvascular complications of Diabetes Mellitus and remains a leading cause of Chronic kidney disease (CKD) and End-stage Renal Disease (ESRD) worldwide. With the global burden of Diabetes rising steadily, DN poses a significant clinical and public health challenge, especially in developing countries where the prevalence of Diabetes is rapidly increasing. Although traditionally diagnosed based on clinical features such as Persistent proteinuria, declining Renal function, and the presence of Diabetic Retinopathy, Renal biopsy provides a unique opportunity to explore the underlying histopathological spectrum of DN and to differentiate it from other coexisting Renal pathologies.

Renal biopsy findings in DN typically reveal characteristic glomerular, tubular, interstitial, and vascular changes, including glomerular basement membrane thickening, mesangial expansion, nodular sclerosis, and arteriolar hyalinosis. However, not all Diabetic patients with renal impairment have DN, and a considerable proportion may present with Non-Diabetic Renal disease (NDRD) or a combination of both, which has important implications for prognosis and management. Accurate histological characterization therefore plays a pivotal role in guiding appropriate therapeutic strategies.

This study aims to analyze the Renal biopsy findings in patients with Diabetes Mellitus to delineate the spectrum of Glomerular lesions associated with DN and to highlight the occurrence of concurrent Non-Diabetic Renal diseases. By providing histopathological insights, this work emphasizes the importance of biopsy in refining diagnosis, improving patient outcomes, and enhancing our understanding of the Renal manifestations of Diabetes.

MATERIALS AND METHODS

This was a Retrospective, observational study conducted in the Department of Pathology at Karnataka Medical College & Research Institute (KMC&RI), Hubballi from Jan 2023 to Jan 2025 for a period of two years. A total of 64 cases were included. Renal biopsy specimens of patients with Diabetes Mellitus who presented with renal involvement were included and analyzed. Relevant Demographic, clinical, and biochemical data were collected from medical records. Histopathological examination of Renal biopsy tissues was performed using Light microscopy, special stains wherever required. The biopsy findings were categorized into Diabetic Nephropathy (DN) based on standard morphological criteria and Non-Diabetic Renal diseases (NDRD) or mixed lesions, depending on the spectrum observed.

Inclusion Criteria

1. Patients with a known diagnosis of Type 1 or Type 2 Diabetes Mellitus.
2. Patients who underwent Renal biopsy for clinical indications such as proteinuria, hematuria, or unexplained renal dysfunction.
3. Adequate Renal biopsy tissue containing at least 10 glomeruli for histological evaluation.

Exclusion Criteria

1. Patients with inadequate or non-diagnostic biopsy material.
2. Patients with Advanced Chronic Kidney Disease (CKD) where biopsy interpretation was limited due to extensive sclerosis.
3. Patients with incomplete clinical or laboratory records.

All biopsy samples were systematically evaluated for glomerular, tubular, interstitial, and vascular changes. The classification of DN was carried out according to the Renal Pathology Society (RPS) criteria, while NDRD lesions were diagnosed based on established histopathological features. Data were analyzed to determine the frequency and distribution of DN and other glomerular lesions. Statistical analysis was done using SPSS version 16.

RESULTS

A total of 64 Renal biopsies were analyzed for the spectrum of Glomerular lesions in Diabetic patients. Diabetic Nephropathy (DN) was the most frequent finding, observed in 30 cases (46.9%). Among these, class IV DN was the predominant pattern, accounting for 22 cases (34.4%), followed by class III DN in 6 cases (9.4%), and class IIa and IIb DN in 1 case each (1.6%). [Table 1]

Non-Diabetic Renal diseases (NDRD) were identified in 34 cases (53.1%). The most common lesion was Acute Interstitial Nephritis/Acute Tubulointerstitial Nephritis (AIN/ATIN), present in 7 cases (10.9%). Acute Tubular injury/necrosis (ATI/ATN) was seen in 6 cases (9.4%). Chronic Tubulointerstitial Nephritis (CTIN) in 3 cases (4.7%) and Hypertension-related changes were observed in 4 cases (6.2%). Other Glomerular lesions included Membranoproliferative Glomerulonephritis (MPGN) in 4 cases (6.2%), IgA Nephropathy in 3 cases (4.7%), Membranous Nephropathy (MGN) in 1 case (1.6%), Infection-related Glomerulonephritis (IRGN) in 2 cases (3.1%), Minimal Change disease (MCD) in 1 case (1.6%), Focal Segmental Glomerulosclerosis (FSGS) in 2 cases (3.1%), and Pyelonephritis in 1 case (1.6%). [Figure 1]

Table 1: Distribution of Glomerular Lesions

Histopathological diagnosis	No. of cases (n=64)
AIN / ATIN (Acute Interstitial Nephritis/Acute Tubulointerstitial nephritis)	7
ATI / ATN (Acute Tubular injury/Acute Tubular necrosis)	6
MPGN (Membranoproliferative Glomerulonephritis)	4
MGN (Membranous Nephropathy)	1
IgA Nephropathy	3
IRGN (Infection-related Glomerulonephritis)	2

Hypertension	4
MCD (Minimal Change Disease)	1
FSGS (Focal Segmental Glomerular Sclerosis)	2
CTIN (Chronic Tubulointerstitial Nephritis)	3
Pyelonephritis	1
Class 2A DN (Diabetes Nephropathy)	1
Class 2B DN	1
Class 3 DN	6
Class 4 DN	22

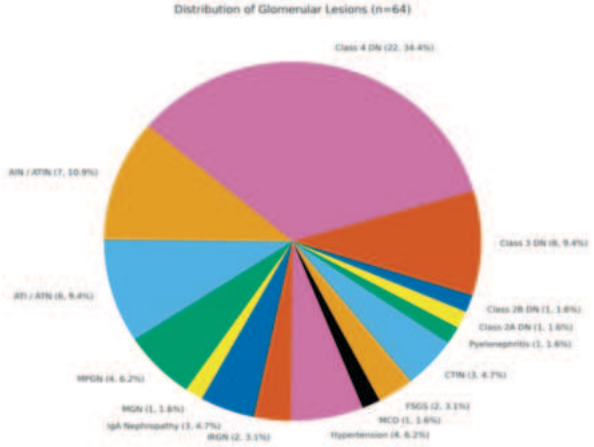

Figure 1: Pie Chart Showing the Distribution of Glomerular Lesions Among 64 Cases.

Overall, DN constituted the single most common category, particularly class IV DN, while collectively NDRD formed a slightly larger proportion of cases. This emphasizes the histological diversity of Renal lesions in Diabetic patients and underlines the diagnostic utility of Renal biopsy.

DISCUSSION

In the present study of 64 renal biopsies from Diabetic patients, class IV Diabetic Nephropathy (DN) was the most frequent lesion, observed in 22 cases (34.4%), followed by class III DN in 6 cases (9.4%). Early stages were less common, with class IIa and IIb each accounting for 1 case (1.6%). These findings are consistent with the natural history of DN, where advanced classes are often detected at the time of biopsy. Sharma et al. (2013) similarly reported that class III and IV DN were the predominant lesions in their cohort.

Interestingly, a considerable proportion of our cases showed Non-Diabetic Renal Diseases (NDRD). Acute Interstitial Nephritis (AIN/ATIN) was noted in 7 cases (10.9%), Acute Tubular Injury/ Necrosis in 6 cases (9.4%), Chronic Tubulointerstitial Nephritis in 3 cases (4.7%), and Pyelonephritis in 1 case (1.6%). Among Glomerular NDRDs, Membranoproliferative GN was found in 4 cases (6.2%), IgA nephropathy in 3 cases (4.7%), Infection-Related GN in 2 cases (3.1%), Membranous Nephropathy in 1 case (1.6%), Minimal Change Disease in 1 case (1.6%), and Focal Segmental Glomeru-losclerosis in 2 cases (3.1%). Overall, NDRDs accounted for nearly more than half of the biopsies (≈53.1%), highlighting their clinical significance.

This frequency is comparable to Chandragiri et al. (2020), who reported that around 25–30% of Diabetic patients undergoing biopsy harbored NDRD, either alone or superimposed on DN. Likewise, Mittal et al. (2024) from India emphasized that Renal biopsy plays a pivotal role in identifying NDRD, as many patients with atypical features such as hematuria, rapid decline in Renal function, or short duration of Diabetes are more likely to have treatable lesions.

International studies also reflect similar observations. Bermejo et al. (2015) from Spain demonstrated that a significant fraction of Diabetics had NDRDs, and early diagnosis impacted management. Artan et al. (2021) from Turkey also noted that differentiating DN from NDRD solely on clinical grounds is unreliable, reiterating the importance of biopsy.

Our study thus reinforces the dual message: while advanced DN remains the most common pathology in Diabetic patients, a substantial number harbor NDRD, many of which have better prognosis and may respond to specific therapy. Identifying these cases is crucial to improve Renal survival and tailor patient management.

CONCLUSION

Renal biopsy reveals that while Diabetic Nephropathy is the predominant lesion, a significant proportion of Diabetic patients also have Non-Diabetic Renal Diseases. Recognizing these atypical lesions is essential, as many are treatable and influence prognosis. Careful patient selection for biopsy ensures accurate diagnosis and guides optimal management.

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