Rev Nefrol Dial Traspl. 2024;44(2):71-79

Spectrum of biopsy-proven renal disease in geriatric patients: Clinical Presentation, Histological Diagnosis and Biopsy Indications, A Single-Centre Experience

Espectro de la enfermedad renal comprobada mediante biopsia en pacientes geriátricos: Presentación clínica, diagnóstico histológico e indicaciones de biopsia, experiencia de un solo centro

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RESUMEN

Introducción: A medida que aumenta la esperanza de vida, los pacientes geriátricos se ven afectados por la enfermedad renal; los nefrólogos se enfrentan cada vez más a una población geriátrica que requiere biopsia renal (BR). El objetivo de este estudiio fue analizar el diagnóstico histopatológico, la presentación clínica y las indicaciones de biopsia en pacientes geriátricos. **Materiales y métodos:** Se incluyeron todos los pacientes sometidos a BR nativa en nuestro centro entre 2017 y 2023. Se comparó el diagnóstico histopatológico, la presentación clínica y las indicaciones de biopsia en pacientes geriátricos con el grupo no geriátrico. **Resultados:** De los 511 pacientes incluidos, se analizaron los mayores de 65 años (n:81, 15,8%) y se compararon con los que tenían entre 18 y 64 años (n:430, 84,2%). La edad media de los pacientes fue de 68 (IQR 66-72) años, y el 56,8% eran varones. La proteinuria no nefrótica fue la indicación de biopsia más frecuente en el grupo geriátrico (27,2%, p: 0,004). La enfermedad glomerular primaria (PGD) más frecuente fue la glomerulonefritis membranosa (GNM). La GNM (33,3%) fue la principal causa de síndrome nefrótico. Los patrones histopatológicos más frecuentes de PGD en el grupo geriátrico fueron GNM, GEFS y GN pauciinmune. La frecuencia de lesión renal aguda fue significativamente mayor en el grupo geriátrico (19,8%) en comparación con el grupo no geriátrico (11,6%) (p = 0,046). Las enfermedades glomerulares secundarias (EGS) fueron más frecuentes que la PGD y la nefritis tubulointersticial. La nefropatía diabética fue la EGS más frecuente tanto en el grupo geriátrico como en el no geriátrico (24,7% y 15,6%). **Conclusiones:** El espectro de la enfermedad renal probada mediante biopsia en los pacientes geriátricos observados en nuestro estudio difiere del de la población no geriátrica. La BR aporta información útil con implicaciones diagnósticas, terapéuticas y pronósticas en estos pacientes.

Palabras Clave: Biopsia renal, pacientes geriátricos, enfermedad glomerular.

ABSTRACT

Introduction: As life expectancy increases, geriatric patients are affected

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Financiamiento:
Ninguno.

Conflicto de intereses:
Ninguno que declarar.

Recibido: 19-11- 2023
Corregido: 29-01-2024
Aceptado: 19-04-2024

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by kidney disease; nephrologists are increasingly faced with a geriatric population requiring kidney biopsy (KB). Objective: To analyze geriatric patients' histopathological diagnosis, clinical presentation, and biopsy indications. **Methods**: All patients who underwent native KB in our center between 2017 and 2023 were included. Histopathological diagnosis, clinical presentation, and biopsy indications in geriatric patients were compared with the non-geriatric group. **Results**: Among the 511 included patients, those older than 65 years (n:81, 15.8%) were analyzed and compared with those aged 18–64 years (n:430, 84.2%). The median age of the patients was 68 (IQR 66-72) years, and 56.8% were male. Non-nephrotic proteinuria was the most common biopsy indication in the geriatric group (27.2%, p: 0.004). The most frequent primer glomerular disease (PGD) was membranous glomerulonephritis (MGN). MGN (33.3%) was the leading cause of nephrotic syndrome. The geriatric group's most frequent Primary Glomerular Disease (PGD) histopathological patterns were MGN, FSGS, and pauci-immune GN. The frequency of acute kidney injury was significantly higher in the geriatric group (19.8%) compared to the non-geriatric group (11.6%) (p = 0.046). Secondary glomerular diseases (SGD) were more common than PGD and tubulointerstitial nephritis. Diabetic nephropathy was the most common SGD in both the geriatric and non-geriatric groups (24.7% and 15.6%). **Conclusions**: The spectrum of biopsy-proven kidney disease in the geriatric patients seen in our study differs from that of the non-geriatric population. KB provides valuable information with diagnostic, therapeutic, and prognostic implications in these patients.

Keywords: Kidney biopsy, geriatric patients, glomerular disease

INTRODUCTION

The geriatric population is rapidly increasing due to improved survival associated with socio-economic development and advances in public health. With age, the kidney systematically loses function and undergoes anatomical changes that make the aged kidney more susceptible to disease. After age 40, the glomerular filtration rate (GFR) progressively declines at 1 mL/min per year, resulting in a decline of approximately 25 mL/min by age 65. Distinguishing between the structural and functional changes in the kidney caused by a specific preventable or treatable disease and those caused by the inevitable effects of aging can sometimes be a challenge. With the increasing prevalence of an aging population, the risk of developing acute and chronic diseases, including those of the kidney, is increasing. As a result, the number of kidney biopsies performed in this population has increased significantly. Kidney biopsy is critical in differentiating age-related changes in kidney structure from disease-specific changes and identifying lesions that may respond positively to therapeutic intervention. The available literature strongly supports the safety of kidney biopsy procedures in geriatric adults and supports the use of conventional therapies in this population. Therefore, it is recommended that kidney biopsy be considered in patients of all ages when appropriate indications and clinical contexts are met to maximize potential benefits.

This study analyzed the histopathological diagnosis, clinical presentation, and biopsy indications of geriatric patients compared with those of the non-geriatric group.

METHODS

This single-center, retrospective study included all patients (age ≥ 65 years) who underwent native kidney biopsy at Umraniye Education and Research Hospital between 2017 and 2023. Patients who underwent kidney biopsy after kidney transplantation and had inadequate biopsies (less than ten glomeruli in the specimen for light microscopy or absence of a glomerulus in immunofluorescence staining) were excluded from this study. The medical ethics committee of our hospital approved this study (2023/319, 07/09/2023).

The electronic medical records for each patient collected information on age, sex, clinical presentation, and laboratory data (including serum creatinine, serum albumin, urea, hemoglobin level, and 24-hour urine protein) at the time of biopsy and histopathological diagnoses. Comparative analysis was performed to assess the prevalence of renal pathology, clinical presentation, and indication for biopsy between geriatric and non-geriatric patient groups.

Proteinuria was defined as the presence of urinary protein excretion equal to or greater than 0.5 g per day and/or dysmorphic erythrocytes observed at a level of 10 or more red blood cells

per high-power microscopic field. The diagnosis of rapidly progressive glomerulonephritis was made on clinical grounds, particularly the presence of acute kidney injury combined with the identification of crescents on renal biopsy. The estimated glomerular filtration rate (eGFR) was calculated using the Chronic Kidney Disease Epidemiology Collaboration creatinine equation (2021) according to the guidelines of the National Kidney Foundation to assess renal function. Urinary sediment and proteinuria were assessed by 24-hour urine collection.

The clinical syndromes identified at the initial presentation were classified into the following categories:

Nephrotic syndrome (NS), characterized by proteinuria ≥ 3.5 g/day and serum albumin levels ≤ 3. 0 g/dL, typically accompanied by edema and hyperlipidemia

Acute nephritic syndrome, characterized by the presence of hematuria and proteinuria, sometimes accompanied by hypertension, edema, or a decrease in GFR

Acute or rapidly progressive renal failure (A/RPRF), characterized by a rapid or gradual decrease in GFR, often accompanied by oliguria or glomerular proteinuria/hematuria

All tissue samples were obtained by a trained nephrologist or interventional radiologist using a percutaneous, ultrasound-guided technique. The same nephropathologist at the pathology laboratory of the University of Health Sciences Umraniye Education and Research Hospital examined biopsy specimens. All patients were evaluated by renal ultrasonography four hours after biopsy for the presence of complications such as hematoma. The samples were analyzed by light microscopy (LM) and immunofluorescence microscopy (IF). For LM, paraffin sections were routinely stained with periodic acid-Schiff, hematoxylin-eosin, periodic acid-silver methenamine, and Congo red. The IF microscopy panel included staining for IgG, IgM, IgA, C3, C1q, κ, and λ light chains. Electron microscopy was not available at our center.

Histopathological findings were classified into the following four categories:

Primary glomerular disease (PGD): This included focal segmental glomerulosclerosis (FSGS), membranous glomerulonephritis (MGN), minimal change disease (MCD), membranoproliferative glomerulonephritis (MPGN), IgA nephropathy (IgAN), immunoglobulin M nephropathy (IgMN) and pauci-immune glomerulonephritis. While primary membranous glomerulopathy was diagnosed, positive staining for anti-phospholipase A2 receptor antigen was found in the pathology specimens. The ELISA analysis of anti-phospholipase A2 receptor antibody levels could not be done because the health insurance system did not reimburse it. We investigated secondary causes and ruled out a diagnosis of secondary membranous nephropathy.

Secondary glomerular disease (SGD): This category included lupus nephritis (LN), diabetic nephropathy (DN), hypertensive nephrosclerosis (HN), amyloidosis (AA = amyloid A; AL = amyloid light chain), thrombotic microangiopathy and cast nephropathy.

Tubulo-interstitial nephropathies: included tubulointerstitial nephritis (TIN), which could be acute or chronic, and acute tubular necrosis (ATN).

Unclassified: This category included conditions such as oxalate nephropathy and phosphate nephropathy.

Statistical analysis

The Statistical Package for Social Science (IBM SPSS Statistics New York, USA) version 23.0 was used for statistical analysis. Continuous variables were expressed as median with interquartile range, and categorical variables were expressed as percentages. The data showed an abnormal distribution according to the Kolmogorov-Smirnov and Shapiro-Wilk tests. The significance of differences for non-normally distributed variables was determined using the Mann-Whitney U test. The statistical significance level was set at $p<0.05$.

RESULTS

Five hundred ninety-seven native kidney biopsies were performed in patients over 18 years of age during the study period. Eighty-six were excluded from the analysis due to inadequate sampling. Out of 511 biopsies, 81 were performed in geriatric patients with a median age of 68 (IQR 66 - 72, mean:65, max:92) years. The geriatric group consisted of 81 patients (46 (56.8%) men and 35 (43.2%) women). The clinical characteristics of the included patients are shown in Table 1. In the geriatric group, the median serum urea level at the time of renal biopsy was

56 mg/dL (IQR: 43-89) and was significantly higher than the non-geriatric group (p <0.001). The median serum creatinine level was 1.48 mg/dL (IQR: 0.93-2.28), significantly higher than the non-geriatric group (p:0.003). The median eGFR was 51 mL/min/1.73m2 (IQR: 24-75), which was significantly higher than the non-geriatric group (p<0.001). The median serum albumin level was 37 mg/dL (IQR: 24-41), significantly higher than the non-geriatric group (p:0.043). The median 24-hour urine protein level was 1265 mg/day (IQR: 314.5-4118), which was similar between the two age groups (p > 0.05) (**Table 1**).

Table 2 shows the comparison of biopsy indications at presentation between the geriatric and non-geriatric patient groups.

Table 1: The socio-demographic and clinical characteristics of the patients based on age group.

Characteristics	**Nongeriatric (n=430)**	**Geriatric (n=81)**	***p*-value**
Age (years) (median, IQR 25-75, mean,max)	46 (IQR 35 – 54, mean:18, max:64)	68 (IQR 66 – 72, mean:65, max:92)	**<0,001**
Gender Female (n, %) Male (n, %)	194(%45.1) 236(%54.9)	35(%43.2) 46(%56.8)	0.752(NS)
Comorbidities DM (n, %) HT (n, %)	115(%26.7) 189(%44)	43(%53.1) 63(%77,8)	**<0,001*** **<0,001***
Hematuria (n, %)	190(%44,2)	25(%30.9)	**0,026***
Urea (mg/dL), (median, IQR 25-75)	37.5(IQR: 26-55.2)	56(IQR: 43-89)	**<0,001***
Creatinine (mg/dL), (median, IQR 25-75)	1.19(IQR: 0.76-1.70)	1.48(IQR: 0.93-2.28)	**0.003***
Hemoglobin (gr/dL), (median, IQR 25-75)	12.8(IQR: 11.2-14.3)	11.50(IQR: 9.6-13.1)	**<0,001***
Thrombocyte (cell/ml) (median, IQR 25-75)	262500(IQR: 211000-311000)	237000(IQR: 194500-295500)	**0,017***
eGFR (mL/min/1.73m²) (median, IQR 25-75)	66(IQR: 43.75-104.25)	51(IQR: 24-75)	**<0,001***
Albumin (gr/dL), (median, IQR 25-75)	39(IQR: 32-42)	37(IQR: 24-41)	**0,043***
Proteinuria (mg/day), (median, IQR 25-75)	1750(IQR: 642.5-3896)	1265(IQR: 314.5-4118)	0,277(NS)

Abbreviations: **: indicates statistical significance.* ***A:*** *Mann Whitney U Test,* ***DM:*** *Diabetes Mellitus,* ***eGFR:*** *Estimated glomerular filtration rate* ***HT:*** *Hypertension,* ***NS:*** *non-significant*

Table 2: Details on the group differences in terms of indications for biopsy.

Indications	**Nongeriatric (n=430)**	**Geriatric (n=81)**	***p*-value**
Non-Nephrotic Proteinuria (n,%)	191(44.4%)	22(27.2%)	**0.004***
Nephrotic Proteinuria (n,%)	33(7.7%)	4(4.9%)	0.384(NS)
Microscopic Hematuria (n,%)	7(1,6%)	1(1,2%)	0.794(NS)
Nephritic Syndrome (n,%)	14(3.3%)	3(3.7%)	0.837(NS)
Nephrotic Syndrome (n,%)	66(15.3%)	15(18.5%)	0.449(NS)
Macroscopic Hematuria (n,%)	2(0,5%)	-	0.539(NS)
Chronic Renal Failure (n,%)	67(15.6%)	20(24.7%)	**0.046***
Acute Kidney Injury (n,%)	50(11.6%)	16(19.8%)	**0.046***

Abbreviations: ****:*** *indicates statistical significance,* ***a:*** *Mann-Whitney U test,* ***NS:*** *non significant.*

ISSN 0326-3428

The indications for renal biopsy in the geriatric group by prevalence rate were as follows: non-nephrotic proteinuria (27.2%), acute renal failure (19.8%), chronic kidney disease (24.7%), nephrotic syndrome (18.5%), nephritic syndrome (3.7%), nephrotic proteinuria (4.9%) and microscopic hematuria (1.2%). Non-nephrotic proteinuria was more common in the non-geriatric group (p: 0.004) than in the geriatric group. The frequency of nephritic syndrome in the geriatric group (3.7%) was similar to that in the non-geriatric group (3.3%) (p = 0.937). The frequency of NS in the geriatric group (18.5%) was similar to that in the non-geriatric group (15.3%) (p = 0.449). The frequency of acute kidney injury (AKI) was significantly higher in the geriatric group (19.8%) compared to the non-geriatric group (11.6%) (p = 0.046). The frequency of chronic kidney disease (CKD) was significantly higher in the geriatric group (24.7%) compared to the non-geriatric group (15.6%) (p = 0.046).

In **Table 3**, the spectrum of the renal pathologies is compared between the geriatric and non-geriatric groups.

Table 3: Distribution of kidney-based renal disease based on age

Characteristics	Nongeriatric (n=430)	Geriatric (n=81)	*p*-value
Primary Glomerular Disease (n,%)	208(48,4%)	31(38.3%)	0.095(NS)
FSGS	73(17%)	9(11.1%)	0.187(NS)
MGN	34(7.9%)	11(13.6%)	0.099(NS)
MCD	10(2.3%)	-	0.166(NS)
MPGN	3(0.70%)	-	0.451(NS)
IgAN	72(16.7%)	5(6.2%)	**0,015***
IgMN	3(0.7%)	-	0.451(NS)
Pauci-Immune GN	9(2,10%)	6(7.4%)	**0,009***
c3	2(0.50%)	-	0.539(NS)
DDD	1(0.2%)	-	0.664(NS)
FG	1(0.2%)	-	0.664(NS)
Secondary Glomerular Disease (n,%)	139(32.3%)	36(44.4%)	**0.034***
DN	67(15.6%)	20(24.7%)	**0.046***
AA-Amiloidozis	16(3.7%)	4(4.9%)	0.605(NS)
LN	14(3.3%)	-	0.10(NS)
HT-Nephrosclerosis	26(6%)	8(9.9%)	0.205(NS)
Al-amyloidosis	2(0.5%)	2(2.5%)	0.061(NS)
Cryo GN	1(0.2%)	1(1.2%)	0.186(NS)
Pyelonefrit	-	1(1.2%)	**0.021***
Apsgn	3(0.7%)	-	0.451(NS)
Hıvan	1(0.2%)	-	0.664(NS)
Myeloma cast nephropathy	3(0.7%)	-	0.451(NS)
Tma	7(1.6%)	-	0.248(NS)
Tubulo-interstitial nephropathies (n,%)	34(7.9%)	13(16%)	0.20(NS)
Acute TIN	18(4.20%)	5(6.2%)	0.429(NS)
Chronic TIN	9(2.1%)	7(8.6%)	**0.002***
ATN	7(1.60%)	1(1.2%)	0.749(NS)
Unclassifiable	5(1.2%)	1(1.2%)	0.956(NS)
Oxalate nephropathy	2(0.4%)	-	0.564(NS)
Alport sydrome	1(0.2%)	-	0.664(NS)
Phosphate nephropathy	2(0.4%)	-	0.564(NS)
NonDiagnostic	44(10%)	1(1.2%)	**0.003***

Abbreviations: ****:*** *indicates statistical significance,* ***a:*** *Mann-Whitney U test.* ***Apsgn:*** *acute poststreptococcal glomerulonephritis,* ***ATN:*** *acute tubular necrosis,* ***Cryo GN:*** *cryoglobulinemic glomerulonephritis,* ***C3G:*** *C3 glomerulopathy,* ***DDD:*** *dense deposit disease,* ***DN:*** *diabetic nephropathy,* ***FG:*** *Fibrillar Glomerulopathy,* ***FSGS:*** *focal segmental glomerulosclerosis,* ***HIVAN:*** *HIV-associated nephropathy,* ***HT-Nephrosclerosis:*** *hypertensive nephrosclerosis,* ***IgAN:*** *immunoglobulin A nephropathy,* ***IgMN:*** *Immunoglobulin M nephropathy,* ***LN:*** *Lupus nephritis,* ***MCD:*** *minimal change disease,* ***MGN:*** *membranous glomerulonephritis,* ***MPGN:*** *membranoproliferative glomerulonephritis,* ***NS:*** *non-significant,* ***Pauci-immune GN:*** *Pauci-immune glomerulonephritis,* ***TIN:*** *tubulointerstitial nephritis,* ***TMA:*** *thrombotic microangiopathy.*

SGD was more common in the geriatric group (p: 0.034) than in the non-geriatric group. SGD was the most common category, accounting for 44.4% (n = 36), followed by PGD (n = 31, 38.3%) and TIN (n = 13, 16%). The frequency of PGD and TIN was similar between the two groups. Non-diagnostic biopsy results were statistically higher in the non-geriatric patients' group (p:0.003). IgAN (p=0.015) was significantly lower in the geriatric group, whereas Pauci-Immune GN (p=0.009) was significantly lower in the non-geriatric group. The most common renal biopsy results were pauci-immune GN (27.27%), AA-Amyloidosis (18.18%), DN (18.18%), and A-TIN (18.18%) among the 11 patients requiring dialysis at the time of biopsy.

In that order, the most frequent histopathological patterns of PGD in the geriatric group were MGN, FSGS, and pauci-immune GN. In contrast, in the non-geriatric group, the biopsies showed FSGS, IgAN, and MGN in decreasing order. Among the patients with SGD, the most frequent diagnosis was DN in both the geriatric and the non-geriatric groups (24.7% and 15.6%, respectively). Hypertensive nephrosclerosis (n = 8, 9.9%) was an uncommon histological pattern, and none of the geriatric patients were diagnosed with LN.

Forty-three geriatric patients had diabetes. 53.4% of these patients had non-diabetic kidney disease (NDKD), and the most common PGD was FSGS (13.04%) among NDKD. Hypertension and age-related lesions (n:8; 9.9%) were rare findings in renal biopsies performed in individuals aged ≥ 65.

There was no significant difference in hematoma occurrence between the two groups (n=65 (15.3%) vs. n=15 (18.5%), p=0.457). One patient in the geriatric group underwent arterial embolization due to bleeding (1.2%). The need for transfusion was also similar between the groups (n:9, 2.09% and n:2, 2.4% for non-geriatric and geriatric groups, respectively) (p=0.150).

DISCUSSION

As life expectancy increases, more elderly patients are affected by acute and chronic diseases; nephrologists are increasingly faced with the geriatric population with many comorbidities [1]. The renal parenchymal biopsy is a valuable tool for diagnosing and managing patients with kidney disease. This study evaluated the demographic characteristics, clinical presentation, and histopathological spectrum of biopsy-proven kidney disease in the geriatric patient population. In our study, 15.8% of renal biopsies were performed in the geriatric population, which is lower than in developed countries such as Japan, the USA, and Europe [2-6]. This rate is higher than the reported in other studies from Brazil and China [7,8]. There is a high variability in the rate of renal biopsies performed in geriatric patients in the literature. This variability can be explained by the relatively larger geriatric population and better access to healthcare in developed countries. In addition, patient preference and the clinician's decision whether or not to perform a kidney biopsy in this geriatric age group can significantly impact the biopsy rate.

Although the incidence of end-stage renal disease is 50% higher in adult men than in women, the prevalence of CKD is higher in women [9,10]. In our study, 56.8% of our cases are male, similar to reports from Spain, India, and Turkiye [6,11,12]. This fact may be explained because more severe kidney disease requiring a kidney biopsy is more common in men.

We found a statistically significant difference in serum creatinine, urea, and eGFR levels between the geriatric and non-geriatric groups. It may be related to the known decline in renal function associated with aging and loss of functional renal reserve.

The study's most frequent clinical presentation of geriatric and non-geriatric patients was non-nephrotic proteinuria (27.2% and 44.4%, respectively). CKD and A/RPRF followed non-nephrotic proteinuria in the geriatric patient group. This finding was not consistent with the literature [1,13]. Moutzouris et al. reported that in geriatric patients, the most common reasons for biopsy were AKI (46.4%), CKD (23.8%), and NS (13.2%), in descending order of frequency. In the study by Chanaka Muthukuda et al., the indications for biopsy in geriatric patients were nephrotic proteinuria (54.3%), non-nephrotic proteinuria (14.3%), AKI (4.3%), and CKD (3.6%). These facts may be due to differences in biopsy preference between clinicians or different socio-economic and ethnic backgrounds of the patients in different parts of the world.

In our geriatric patients, SGD was more

common than PGD and TIN. This finding was inconsistent with renal biopsy results in the geriatric patient population in the literature. Josephine S et al. and Yue Chen et al. found that PGD was more common than SGD and TIN in their studies [14,15]. The epidemiology of primary and secondary glomerular diseases may differ worldwide due to different socio-economic and ethnic backgrounds in different parts of the world. MGN was present in 35.4% of the PGD cases and 13.6% of the total elderly patients in our study. Soumita Bagchi et al. found that MGN (22.6%) was the most common cause of PGD in their study [11].

Ozdemır A. et al. found that MGN (21.5%) was the most common cause of PGD in their study [12], which similar to ours.

FSGS is the second most common histological diagnosis in the geriatric group, and there is no difference in FSGS frequency between the groups (p = 0.187). In most cases, the underlying cause of FSGS remained unclear, as it was difficult to distinguish the role of aging, hypertension, and arteriosclerosis in the development of FSGS in many geriatric patients. Pauci-immune GN was the third most common PGD in geriatric patients (19.3%). This higher rate in geriatric patients may be explained by the peak incidence of the disease after 65 years of age and the relatively higher frequency of renal involvement in geriatric vasculitis, unlike non-geriatric patients, in whom upper respiratory tract involvement predominates. The incidence of tubulointerstitial disease was lower because its diagnosis is mainly based on clinical signs and other non-invasive methods other than kidney biopsy.

There was a significant difference in the frequency of some nephropathies between the two age groups. While the prevalence of pauci-immune GN and DN was higher in the geriatric group than in the non-geriatric group (p = 0.009 and p = 0.046, respectively), IgAN and LN were more frequent in the non-geriatric group than in the geriatric group (p = 0.015 and p = 0.10 respectively). This finding was consistent with the literature 16-18. We diagnosed no cases of LN in geriatric patients, whereas n:14 (10%) of non-geriatric patients with SGD had LN. The main reason for this discrepancy may be the rare occurrence of lupus after the age of 65 years.

MGN (n:5, 33.3%) was the leading cause of NS in our geriatric patient group. Similar results were found in the study by Ozdemir A. et al. [12]. On the other hand, other studies from Turkiye reported that AA-amyloidosis was the leading cause of NS in the geriatric group [19,20]. Amyloidosis (n:4, 26.6%) was the second most common diagnosis in our geriatric patients presenting with NS, of which 2 were secondary amyloidosis and 2 were primary amyloidosis. DN (n:3, 20%) was the third most common diagnosis in our geriatric patients presenting with NS. In our geriatric patients with A/PPRF who underwent kidney biopsy, pauci-immune GN and interstitial nephritis were the most common histological patterns, accounting for 31.2% and 25%, respectively. Similar results were found in the study by Ozdemir A. et al. [12].

Although patients with diabetes mellitus often have DN, they can also develop other kidney diseases unrelated to diabetes, known as NDKD. While the prevalence of DN ranges from 2.2% to 15% in renal biopsy registries, NDKD can occur in up to 43.7% of people with type 2 diabetes, either alone or superimposed on DN21- [23]. Therefore, kidney biopsy in these patients is crucial in differentiating between diabetic and non-diabetic kidney disease. Among the geriatric patients, 43 individuals had diabetes. 53.4% of these patients had non-diabetic kidney disease (NDKD), and the most common PGD was FSGS (13.04%) among NDKD. Similar results were found in the study by Sharma SG et al. [24].

There were several limitations to this study. Firstly, as a retrospective study, there may have been a selection bias, as some older patients may have refused to undergo biopsies for various reasons, particularly those with mild clinical symptoms. Secondly, the study had a relatively small sample size, probably due to the reluctance of elderly patients with kidney disease to undergo kidney biopsies. This reluctance limited the number of older patients who underwent kidney biopsies. This study only reflects the clinical presentation and incidence of kidney disease in those who underwent kidney biopsy.

CONCLUSION

The spectrum of biopsy-proven kidney disease in the geriatric patients seen in our study differs from that of the non-geriatric population. Kidney biopsy provides helpful information with diagnostic, therapeutic, and prognostic implications in these patients. The percentage of

geriatric patients in the total biopsied population is low in Turkiye. Prospective studies are needed to assess the outcome of common renal diseases in the geriatric population.

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