ORIGINAL ARTICLE

DOI: 10.4274/nkmj.galenos.2024.67689
Nam Kem Med J 2024;12(2):78-84

Clinicopathological Evaluation of Renal Biopsies Among Older Adults in Turkiye

Yaşlı Türk Toplumunda Böbrek Biyopsilerinin Klinikopatolojik Değerlendirilmesi

Mürsel KARADAVUT[1], Büşra AKPINAR[1], Murat ALTUNOK[2], Mustafa UTLU[1], Ömer KARAŞAHİN[3], Sevilay ÖZMEN[4], Pınar TOSUN TAŞAR[1]

[1]*Atatürk University Faculty of Medicine, Department of Internal Medicine, Division of Geriatrics, Erzurum, Turkey*
[2]*Atatürk University Faculty of Medicine Hospital, Department of Internal Medicine, Division of Nephrology, Erzurum, Turkey*
[3]*Erzurum Regional Training and Research Hospital, Clinic of Infectious Diseases and Clinical Microbiology, Erzurum, Turkey*
[4]*Atatürk University Faculty of Medicine Hospital, Department of Medical Pathology, Erzurum, Turkey*

ABSTRACT

Aim: Kidney disease is common in older adults due to age-related structural and functional changes in the kidneys, higher rates of chronic disease, and increased drug use. As societies age, there is a rise in the prevalence of renal disease and the number of kidney biopsies being performed in older patients. This study aimed to investigate renal biopsy indications, complications, pathology results, and subsequent treatment among older adults in Turkey.

Materials and Methods: We retrospectively analyzed data from patients aged 65 and over who underwent renal biopsy in a university nephrology department between 2004 and 2023. The patients' demographic information, chronic comorbidities, biopsy indications, pre-biopsy laboratory values, post-biopsy complications, pathology results, and post-biopsy treatments were obtained by reviewing their medical records and biopsy reports.

Results: A total of 66 patients were included in the study. The median age was 73.0 years (IQR: 68.8-79.0 years) and 66.7% of the patients were men. The most common comorbidities were hypertension (83.3%), diabetes mellitus (24.3%), coronary artery disease (22.7%), and chronic kidney disease (21.2%). The most common indication for renal biopsy was nephrotic-range proteinuria (56.1%), followed by acute kidney injury (24.2%). When the pathology results were examined, primary glomerulonephritis (62.1%) was the most common result, followed by secondary glomerulonephritis (21.2%) and tubulointerstitial nephritis (12.1%). The most common histopathological diagnoses in primary glomerulonephritis were membranous glomerulonephritis (39.4%) and focal segmental glomerulosclerosis (12.1%), while those in secondary glomerulonephritis were secondary amyloidosis (9.1%) and lupus nephritis (4.5%). After biopsy, 54.5% of the patients received immunosuppressive therapy and 34.8% received renal replacement therapy. No post-biopsy complications were observed.

Conclusion: Although the most common indication for kidney biopsy in older adults is nephrotic-range proteinuria. Kidney biopsy is the gold standard method for the diagnosis of renal parenchymal diseases and is a safe procedure in older patients, with low complication rates. Kidney biopsy should not be avoided in geriatric patients if deemed clinically necessary.

Keywords: Elderly, kidney biopsy, pathology, glomerulonephritis, complication

ÖZ

Amaç: Yaşlanmaya bağlı böbreklerde meydana gelen yapısal ve fonksiyonel değişiklikler, artmış kronik komorbid hastalıklar ve ilaç kullanım sıklığında artışa bağlı olarak yaşlılarda böbrek hastalıklarının sıklığı artmaktadır. Toplumun yaşlanmasıyla birlikte böbrek hastalıklarının prevalansı ve yaşlılarda yapılan böbrek biyopsilerinin sayısı artmaktadır. Bu çalışmada yaşlı hastalarda böbrek biyopsisi endikasyonları, komplikasyonları, patolojik sonuçları ve tedavilerinin araştırılması amaçlanmıştır.

Gereç ve Yöntem: Üniversitemiz nefroloji bilim dalında takip edilmekte olup 2004-2023 yılları arasında böbrek biyopsisi yapılan 65 yaş ve üzeri hastaların verileri retrospektif olarak incelendi. Hastaların demografik bilgileri, kronik hastalıkları, biyopsi endikasyonları, biyopsi öncesi laboratuvar

Address for Correspondence: Pınar TOSUN TAŞAR MD, Atatürk University Faculty of Medicine, Department of Internal Medicine, Division of Geriatrics, Erzurum, Turkey
Phone: +90 505 398 89 85 **E-mail:** pinar.tosun@gmail.com **ORCID ID:** orcid.org/0000-0002-2617-4610
Received: 04.03.2024 **Accepted**: 21.04.2024

değerleri, biyopsi sonrası gelişen komplikasyonlar, patoloji sonuçları ve biyopsi sonrası verilen tedaviler hastaların tıbbi kayıtları ve biyopsi raporları incelenerek kaydedildi.

Bulgular: Çalışmamıza toplam 66 hasta dahil edildi. Hastaların yaş ortancası 73,0 (IQR: 68,8-79,0) yıl olup, %66,7'si erkekti. En sık görülen kronik sistemik hastalıklar hipertansiyon (%83,3), diabetes mellitus (%24,3), koroner arter hastalığı (%22,7) ve kronik böbrek yetmezliği (%21,2) idi. Nefrotik düzeyde proteinüri (%56,1) en sık böbrek biyopsi endikasyonuydu. İkinci en sık biyopsi endikasyonunun akut böbrek hasarı (%24,2) olduğu görüldü. Patoloji sonuçları incelendiğinde primer glomerülonefrit (%62,1) en sık saptanan biyopsi sonucu iken, bunu sırasıyla sekonder glomerülonefritin (%21,2) ve tübülointerstisyel nefritin (%12,1) izlediği görüldü. Primer glomerülonefritte en sık görülen histopatolojik tanılar membranöz glomerülonefrit (%39,4) ve fokal segmental glomerüloskleroz (%12,1) iken, sekonder glomerülonefritte sekonder amiloidoz (%9,1) ve lupus nefriti (%4,5) idi. Biyopsi sonrasında hastalara en sık immünosupresif tedaviler (%54,5) uygulanırken, %34,8 hastaya ise renal replasman tedavisinin uygulandığı görüldü. Yapılan biyopsiler sonrasında komplikasyon görülmedi.

Sonuç: Yaşlılarda en sık böbrek biyopsi endikasyonu nefrotik düzeyde proteinüridir. Böbrek biyopsisi renal parankimal hastalıkların tanısında altın standart yöntemdir ve yaşlılarda düşük komplikasyon oranları ile güvenilir bir işlemdir. Klinik gereklilik halinde yaşlılarda böbrek biyopsisinden kaçınılmamalıdır.

Anahtar Kelimeler: Yaşlı, böbrek biyopsisi, patoloji, glomerülonefrit, komplikasyon

INTRODUCTION

Kidney disease is a common clinical problem in the elderly and is associated with increased mortality and morbidity. The prevalence of many kidney diseases, especially chronic kidney disease (CKD), increases in the elderly. This is mainly attributed to the increasing prevalence of traditional risk factors for kidney diseases, such as diabetes mellitus (DM), hypertension (HT) and cardiovascular diseases, and changes in the genitourinary system with aging[1,2]. Various anatomical and functional changes occur in the kidney with aging. Cortical parenchyma, functional nephron number, renal blood flow and glomerular filtration rate (GFR) decrease. Due to these aging-related changes in the kidney and increased comorbid diseases, the physiological reserves of the kidney decrease and the adaptation response to stressors deteriorates; many renal diseases, especially acute kidney injury, are observed more easily and frequently[3-5].

Renal biopsy is the sampling of renal tissue by methods such as percutaneous renal biopsy or fine needle aspiration. Renal biopsy is the gold standard in the diagnosis, treatment and prognosis of renal parenchymal diseases[6]. In the elderly population, indications for renal biopsy in nephrology practice are similar to that in all age groups. Kidney biopsy indications include nephrotic syndrome and non-nephrotic proteinuria, acute kidney injury, isolated microscopic/macroscopic hematuria, coexistence of proteinuria-hematuria, systemic diseases with loss of renal function, and renal allograft dysfunction[7].

There are special considerations when making the decision to perform renal biopsy in elderly patients. As with many invasive procedures in the elderly population, renal biopsy may have a high complication rate due to factors such as physiologic changes related to aging, accompanying comorbid diseases, polypharmacy and contrast exposure[8].

The number and proportion of the elderly population in Turkey and the world is increasing rapidly. It is estimated that there were 783 million elderly people worldwide in 2022 and that this number will increase to 1.3 billion in 2040. In Turkey, the elderly population, which was 7.18 million in 2018, increased by 21.4% in the last five years and reached 8.7 million in 2023, and this figure is expected to increase to approximately 16 million in 2040[9]. In parallel with the increasing elderly population, the number of renal biopsies in the elderly is gradually increasing[10,11]. In our country, studies evaluating the results of renal biopsy in the elderly are limited in number. In this study, we aimed to investigate the indications, complications, pathologic results and treatments of renal biopsy in elderly patients.

MATERIALS AND METHODS

Our study is a retrospective descriptive cross-sectional study among patients aged 65 years and older, who underwent ultrasonography-guided renal biopsy using a 16-18 G automatic biopsy needle between January 01, 2004 and January 01, 2023 in the department of nephrology of our hospital, a tertiary care university hospital.

Inclusion criteria were determined as;

- Having kidney biopsy performed,

- Being 65 years of age or older and being followed up in the nephrology clinic of our university.

Exclusion crtiteria were as follows;

- Having transplanted kidney biopsies,

- Undergoing biopsy for malignancy,

- Having kidney biopsy procedure that was performed in our hospital, but being followed up and treated in another hospital,

- Having unmeasured proteinuria in 24-hour urine (followed up with spot urine protein/creatinine ratio),

- Having insufficiently recorded available data,

- Being younger than 65 years of age.

Demographic information, biopsy date, chronic diseases, indications for biopsy, pre-biopsy laboratory data, complications after biopsy, pathology results, post-biopsy treatments and complications after treatment were recorded from patient files and hospital information system. Indications for biopsy were grouped as nephrotic proteinuria, acute kidney injury, non-nephrotic proteinuria and micro/macrohematuria. Nephrotic proteinuria was defined as protein excretion above 3.5 g/day in 24-hour urine, acute kidney injury as serum creatinine level ≥0.3 mg/dL or ≥0.5-fold increase from baseline in the last 48 hours or ≥1.5-fold increase from baseline in the last 7 days or urine output less than 0.5 mL/kg/hour in the last 6 hours, non-nephrotic proteinuria as the presence of proteinuria below 3.5 g/day without accompanying hematuria, and micro/macrohematuria as the presence of hematuria without accompanying proteinuria. Proteinuria was considered as the presence of more than 500 mg of protein in the 24-hour urine, microscopic hematuria was defined as the presence of ≥3 erythrocytes in each large magnification field on microscopic examination of urine sediment, and macroscopic hematuria was defined as hematuria that caused discoloration in the urine that was visible to the naked eye. Serum creatinine, albumin, uric acid, estimated GFR, 24-hour urine proteinuria and hematuria were recorded before biopsy. Creatinine clearance was calculated according to the Cockcroft and Gault[12] and MDRD-4 (Modification of Diet in Renal Disease-4)[13] formulas. Pathologic classification was made into 5 groups as primary glomerulonephritis (PGN), secondary glomerulonephritis (SGN), tubulointerstitial nephritis (TIN), vascular diseases and unclassified cases.

For all patients, renal biopsy specimens examined by light microscopy and immunofluorescence microscopy were considered adequate if there were at least 10 glomeruli in the sample[14]. Immunosuppressive treatments given to the patients after biopsy were recorded. Immunosuppressive treatments were grouped as glucocorticoids, cyclophosphamide, mycophenolate mofetil.

Complications developing after biopsy were grouped as major and minor. Complications such as bleeding requiring transfusion, macroscopic hematuria, penetration to liver, spleen, pancreas, intestine and gallbladder, pneumothorax, hemothorax, development of arteriovenous fistula and death were considered major complications and complications such as pain and perirenal hematoma were considered minor complications.

The study was conducted after obtaining the necessary permissions from Atatürk University Faculty of Medicine Clinical Research Ethics Committee (decision no: B.30.2.ATA.0.01.00/862, date: 26.10.2023).

Statistical Analysis

Data were recorded into the Statistical Package for the Social Sciences 23.0 package program and analyses were performed using the same program. Data were presented as number (n), percentage (%) and median (minimum-maximum). Descriptive statistics were given as median and minimum-maximum median for nonparametric continuous data. Categorical data were presented as frequencies with percentages in parentheses and compared using the chi-square test. The Mann-Whitney U test was used to determine the differences in the rating scores, which were considered as continuous data. A probability value less than 0.05 was considered to be statistically significant.

RESULTS

In our study, 66 geriatric patients who underwent renal biopsy were retrospectively evaluated. The median age of the patients was 73.0 (IQR; 68.8-79.0) years and 44 (66.7%) were male. When the patients were evaluated in terms of chronic systemic diseases, HT (83.3%), DM (24.3%), coronary artery disease (22.7%) and CKD (21.2%) were detected to be the most common diseases. Demographic characteristics and underlying diseases of the patients are shown in Table 1.

When the patients were evaluated in terms of indications for renal biopsy, nephrotic proteinuria (n=37, 56.1%) was found to be the most common indication for renal biopsy. The second most common indication for biopsy was acute kidney injury (n=16, 24.2%). The median pre-biopsy serum creatinine, albumin and proteinuria levels were 2.14 (0.99-4.63) mg/dL, 2.51 (2.10-2.95) g/dl, and 4770 (1156-7644) mg/day, respectively. Indications for renal biopsy and pre-biopsy laboratory data are presented in Table 2. None of the patients developed major or minor complications after biopsy.

PGN (62.1%) was the most common biopsy result, followed by SGN (21.2%) and TIN (12.1%). Membranous glomerulonephritis (MGN) was the most common primary glomerular disease

Table 1. Demographic characteristics and underlying diseases of the patients

Age, median (IQR)	73.0 (68.8-79.0)
Sex, n (%), male	44 (66.7)
Underlying diseases, n (%)	
HT	55 (83.3)
DM	16 (24.3)
CAD	15 (22.7)
CHF	6 (9.1)
Malignancy	5 (7.6)
COPD	5 (7.6)
CVD	2 (3.0)
Chronic liver disease	1 (1.5)
Number of disease, median (IQR)	3 (2-4)

IQR: Interquartile range, HT: Hypertension, DM: Diabetes mellitus, CAD: Coronary artery disease, CHF: Congestive heart failure, COPD: Chronic obstructive pulmonary disease, CVD: Cerebrovascular disease

(39.4%), while secondary amyloidosis was the most common secondary glomerular disease (9.1%). When pathology results were evaluated without differentiating between primary and secondary GN, the most common diagnoses were revealed to be MGN (39.4%), focal segmental glomerulosclerosis (FSGS) (12.1%), secondary amyloidosis (9.1%), and chronic TIN (9.1%) (Table 3).

Immunosuppressive treatment was administered to the patients most frequently (54.5%) after biopsy. Glucocorticoids (48.5%) and cyclophosphamide (22.7%) were the most common immunosuppressive treatments. The treatments given to the patients after biopsy are presented in Table 4.

Table 2. Renal biopsy indications of the patients and laboratory data before biopsy

Indication for biopsy, n (%)	
Nephrotic proteinuria	37 (56.1)
Acute kidney disease	16 (24.2)
Non-nephrotic proteinuria	9 (13.6)
Abnormal urinary system findings	3 (4.5)
Micro-macro hematuria	1 (1.5)
Laboratory, median (IQR)	
Proteinuria level (mg/day)	4770 (1156-7644)
Hematuria level (≥3 erythrocytes/hpf)	4 (2-25)
Serum uric acid (mg/dL)	6.0 (5.3-7.4)
Serum creatine (mg/dL)	2.14 (0.99-4.63)
Serum albumin (g/dL)	2.51 (2.10-2.95)
eGFR Cockcroft and Gault[12] (mL/min/1.73 m^2)	34.2 (15.2-78.5)
eGFR MDRD (mL/min/1.73 m^2)	27.3 (11.2-72.2)

IQR: Interquartile range, eGFR: Estimated glomerular filtration rate, MDRD: Modification of Diet in Renal Disease-4

Table 3. Pathology results of renal biopsy, n (%)

PGN	**41 (62.1)**
MGN	26 (39.4)
FSGS	8 (12.1)
MPGN	3 (4.5)
Crecentric glomerulonephritis	1 (1.5)
Other	3 (4.5)
SGN	**14 (21.2)**
Secondary amyloidosis	6 (9.1)
Lupus nephritis	3 (4.5)
ANCA-associated vasculitis	2 (3.0)
DM	2 (3.0)
Primary amyloidosis	1 (1.5)
TIN	**8 (12.1)**
Chronic TIN	6 (9.1)
Acute TIN	2 (3.0)

PGN: Primary glomerulonephrite, FSGS: Focal segmental glomerulosclerosis, MPGN: Membranoproliferative glomerulonephrite, SGN: Secondary glomerulonephrite, DM: Diabetes mellitus, TIN: Tubulointerstitial nephritis

Table 4. Treatments given to patients after biopsy, n (%)

Immunosuppressive therapy	36 (54.5)
Glucocorticoid	32 (48.5)
Cyclophosphamide	15 (22.7)
Mycophenolate mofetil	4 (6.1)
Immunoglobulin modulator	3 (4.5)

DISCUSSION

Renal biopsy is the gold standard for determining whether glomerular lesions are acute or chronic, reversible or treatable, regardless of age[14]. Identification of renal lesions by biopsy enables more accurate identification of renal pathologies without being dependent on diagnostic methods such as creatinine-based GFR (eGFR) calculations, which can be affected by many age-related factors. Thus, it allows the selection of the right treatment modalities. It helps to avoid inappropriate treatments, especially immunosuppression, and related complications. Early diagnosis and correct treatment may be of vital importance in the elderly, especially in the frail elderly population. In the literature, it has been shown that renal damage tends to become chronic faster in the elderly compared to young people due to low renal reserve and decreased renal mass and function[15].

In our study, which included a total of 66 geriatric patients who underwent kidney biopsy, it was observed that kidney biopsy was performed more frequently in male patients (66.7%), in line with the literature[16,17]. It is known that, starting from the fourth decade of aging, there is a decrease in kidney size due to a decrease in the renal cortical parenchyma and the number of functional nephrons. It has been shown that the decrease in kidney size is greater in the male gender[3]. It has also been shown that gender is one of the determinants of age-related decline in renal functions, that most of the damage that occurs in the kidney with age is related to androgen production, and that medical castration can slow the progression of these changes[18,19]. Kidney biopsy is performed more frequently in men, which may be due to the fact that renal functions and renal parenchyma loss are greater in men and the number of cases is lower. In our study, the most common chronic systemic diseases in patients who underwent kidney biopsy were found to be HT (83.3%), DM (24.3%), CAD (22.7%) and CKD (21.2%). Studies have reported that HT is the most common chronic disease in elderly patients who underwent biopsy, with rates ranging from 24.1% to 78%[20-24]. The rate of DM was reported to be 15.3% by Ozturk et al.[20] and 29.4% by Tuğcu et al.[23], similar to that in our study. As renal reserves decrease with aging, additional diseases that may cause kidney disease, especially DM, atherosclerotic vascular diseases and HT, facilitate the development of new kidney pathologies. Studies have shown that approximately 5-10% of the elderly have a decrease in kidney function with age, despite the absence of any accelerating factors, while no measurable decrease is detected in 30% of them[25]. eGFR can be expected

to decrease with aging. However, normal eGFR values have also been detected, especially in normotensive elderly people[5]. This shows us the contribution of chronic comorbid diseases to the progression of renal dysfunction.

Although biopsy indications vary on a national or center basis in the literature, it has been reported in many biopsy series that the most common indication in the elderly is nephrotic proteinuria[11,23,24,26,27]. In our study, nephrotic proteinuria (56.1%) was found to be the most common biopsy indication in the elderly. Studies conducted in our country have reported that the rate of kidney biopsy performed with the indication of nephrotic proteinuria in the elderly is between 41.38% and 60%[11,21-24,26,28]. The fact that nephrotic proteinuria is the most common biopsy indication may be due to the fact that the elderly see the symptoms as a part of the natural process of aging and apply to the hospital late. Similar to our study, studies have shown that acute kidney disease (AKD) is the second most common biopsy indication in the elderly and that biopsy due to AKD is performed more frequently in the elderly than in young people[21,23,24,29]. Additionally, in two studies conducted in elderly patients, AKD was reported to be the most common indication[30,31]. Studies have proven that the incidence of AKD increases with age[32]. Among the elderly, the frequency of AKD increases significantly as age increases[33]. The elderly are prone to kidney damage due to structural and functional changes in the kidney with aging, increased comorbid diseases and polypharmacy[4]. Increased biopsy rates due to AKD in the elderly may be related to the fact that the elderly are more prone to AKD and have a higher probability of prolonging the duration of AKD and becoming chronic due to their low renal reserves.

In our study, similar to studies conducted in our country[21,22,24,34], PGN (62.1%) was the most frequently detected biopsy result, followed by SGN (21.2%) and TIN (12.1%), respectively. In studies conducted abroad and involving large patient groups, it has been shown that PGN is the most common disease in the elderly, followed by SGN and TIN[35]. In the study by Harmankaya et al.[24] in 2015, in which they evaluated 98 elderly patients, the most frequently detected PGN type was stated as MGN (14.3%). This was followed by FSGS (12.2%) and crescentic GN (6.1%)[24]. In the study by Tuğcu et al.[23] in which kidney biopsies of 109 elderly patients were evaluated, the most common causes of PGN were found to be FSGS (13.8%), MGN (10.1%) and pauci-immune glomerulonephritis (PIGN) (5.5%), respectively. In the study of Hur et al.[34], in which 121 elderly patients who underwent kidney biopsy were included, it was reported that the most common PGNs were MGN (14.8%), crescentic GN (9.92%) and FSGS (9.92%). In another study conducted by Ozdemir et al.[26] on 93 elderly patients and presented in 2022, MGN (42.8%) was found to be the most common pathology among PGNs. In the study conducted by the Turkish Nephrology Association 'Glomerulonephritis Study Group', in which 47 centers participated and which included the largest number of biopsy series regarding PGNs in our country, only primary glomerular diseases were included and 3,858 patients, 262 of whom were elderly, were evaluated. In this study, MGN (40.2%), FSGS (17.4%) and crescentic GN (15.1%) were most commonly observed in the elderly. In addition, in the period covering 2017 and before, crescentic GN (23%) was the second most common type of GN and FSGS (15.2%) was the third most common type of GN. It has been stated that as of 2017, FSGS has become the second most common GN and the frequency of FSGS in the elderly is gradually increasing[11]. Studies have shown that the incidence of FSGS in the elderly is increasing worldwide[23,36]. This increase has been attributed to increased awareness of FSGS and an increase in the incidence of FSGS in the elderly secondary to diseases such as HT and age-related nephropathy[30]. In studies conducted abroad, while MGN stands out as the most frequently detected PGN in Spain[37], Czech Republic[38], Italy[39] and England[40] in Europe, the second one changes FSGS, minimal change disease and IgA nephropathy (IgAN). In studies conducted outside Europe, PGN and MGN were most frequently detected as in all other studies in Brazil[41], South Africa[42], Ireland[43], China[44], Japan[35] and the United States[30]. It has been reported that FSGS and IgAN are the second most common. The distribution of glomerulonephritis types varies from country to country and in different regions of the same country, depending on age, gender, ethnicity, geographical region, clinicians' attitudes towards indications and years. As in recent studies conducted in our country[11,24], in our study, MGN (39.4%) was found to be the most common and FSGS (12.1%) was the second most common glomerular pathology, both among PGNs and among all patients who underwent biopsy. In terms of the frequency of PGN, the results of our study are similar to those reported by recent large-scale studies conducted in our country[11,26].

In the study conducted by Tuğcu et al.[23], while the most common cause of SGN was found to be secondary amyloidosis (22.9%), diabetic nephropathy (DN) was reported to be the second most common and lupus nephritis (LN) was reported to be at the rate of 3.6%. In the study conducted by Harmankaya et al.[24], amyloidosis was found to be the most common SGN with the rate of 15.3%, followed by PIGN (8.2%) and DN (5.1%). Hur et al.[34] found that amyloidosis (19.1%) was the most common cause of SGN, followed by GNs due to vasculitis (4.96%) and LN (1.65%). In European, American and Asian countries, it has been reported that SGN due to LN is more common than secondary amyloidosis and vasculitis[30,37,39,42]. The frequent occurrence of secondary amyloidosis in our study and in our country is due to the fact that Familial Mediterranean Fever is an endemic disease in Turkey and the most common cause of secondary amyloidosis[45]. In our study, the frequency of DN is low and the rates are consistent with the literature[23,24,34]. Although DN is the most important cause of ESRD, it is rarely

observed in biopsy results. The reason for this is that the diagnosis of DN is made clinically and biopsy is not preferred unless there is additional evidence suggesting PGN[46]. In our study, although 24.3% of the patients who underwent biopsy were diagnosed with DM, the rate of patients diagnosed with DN as a result of biopsy was 3%.

Complications seen after kidney biopsy include pain, hematoma, macroscopic hematuria, major hemorrhage (bleeding requiring transfusion or radiological/surgical intervention), septicemia, and arteriovenous fistula formation[47]. Although theoretically there is no difference in the indications for biopsy between young and old patients, biopsy can be avoided in the elderly due to concomitant systemic diseases, low life expectancy, clinicians' avoiding biopsy and immunosuppressive treatment complications, and the thought that biopsy will show findings of chronic changes such as interstitial fibrosis and atrophy rather than a treatable lesion[27,30]. The frequency of complications after kidney biopsy varies due to patient selection, procedural techniques, variability in complication definitions, and differences in post-procedure monitoring time, but is on average 5-10%[47]. Serious side effects requiring surgical intervention occur at a rate of <1% and the mortality rate is <0.1%[27]. Kajawo et al.[48] performed a meta-analysis and they stated that complication rates decreased after biopsy procedures performed under ultrasound guidance and automatic needles. In the literature, it has been reported in series including large patient groups that age is not a risk factor for biopsy complications and that there is no increase in the risk of complications in the elderly[48,49]. It was observed that there were no complications after the kidney biopsies performed in our study. It is thought that the reason why no complications were observed in our study may be related to the fact that biopsies were performed with automatic biopsy needles under ultrasound guidance, bleeding control was routinely performed with ultrasound during follow-up, protective measures were taken more frequently as the risk of complications was higher in the elderly, and the number of cases was low. Inadequate diagnosis and treatment of renal parenchymal diseases is strongly associated with the risk of ESRD and increased morbidity and mortality in the elderly[50]. Pathological diagnoses made by kidney biopsy in elderly patients can be controlled with appropriate treatment. In this way, negative health consequences and unnecessary treatment burden in elderly patients can be avoided. Kidney biopsy, which is a reliable procedure with low complication rates, should not be avoided in the elderly.

Study Limitations

The strength of our study is that it is the first study examining elderly kidney biopsies in our region. The limitations of our study are that it was retrospective and conducted in a single center.

CONCLUSION

As a result, the most common indications for kidney biopsy in the elderly are nephrotic proteinuria and AKD, and it is the most common reason for biopsy in the elderly. PGN is most commonly seen in the elderly, and MGN and FSGS are observed more frequently. Among SGN, amyloidosis and LN are the most common. Kidney biopsy is the gold standard method in the diagnosis of renal parenchymal diseases and is a reliable procedure with low complication rates in the elderly. Kidney biopsy should not be avoided in the elderly if clinically necessary.

Ethics

Ethics Committee Approval: The study was conducted after obtaining the necessary permissions from Atatürk University Faculty of Medicine Clinical Research Ethics Committee (decision no: B.30.2.ATA.0.01.00/862, date: 26.10.2023).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: M.A., S.Ö., Concept: M.K., S.Ö., P.T.T., Design: M.K., Data Collection or Processing: M.K., B.A., M.A., M.U., Analysis or Interpretation: Ö.K., P.T.T., Literature Search: M.K., B.A., M.U., Ö.K., P.T.T., Writing: M.K., B.A., Ö.K., P.T.T.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

REFERENCES

1. Modesto-Segonds A, Ah-Soune MF, Durand D, Suc JM. Renal biopsy in the elderly. Am J Nephrol. 1993;13:27-34.
2. Hansberry MR, Whittier WL, Krause MW. The elderly patient with chronic kidney disease. Adv Chronic Kidney Dis. 2005;12:71-7.
3. Denic A, Lieske JC, Chakkera HA, Poggio ED, Alexander MP, Singh P, et al. Substantial Loss of Nephrons in Healthy Human Kidneys with Aging. J Am Soc Nephrol. 2017;28:313-20.
4. Glassock RJ, Rule AD. Aging and the Kidneys: Anatomy, Physiology and Consequences for Defining Chronic Kidney Disease. Nephron. 2016;134:25-9.
5. Lindeman RD, Goldman R. Anatomic and physiologic age changes in the kidney. Exp Gerontol. 1986;21:379-406.
6. Korbet SM. Percutaneous renal biopsy. Semin Nephrol. 2002;22:254-67.
7. Feehally J, Joseph Johnson R, Floege J, Tonelli M. Comprehensive clinical nephrology: Elsevier; 2019.
8. Kasapoğlu U, Dikeç M. Yaşlı hastalarda böbrek biyopsisi. Yılmaz M, editör. Böbrek Biyopsisi. 1. Baskı. Ankara: Türkiye Klinikleri. 2023:41-6.
9. Türkiye İstatistik Kurumu. İstatistiklerle Yaşlılar, 2022. Erişim tarihi: 16.02.2024. Erişim adresi: https://data.tuik.gov.tr/Bulten/Index?p=Istatistiklerle-Yaslilar-2022-49667
10. Davison AM, Johnston PA. Glomerulonephritis in the elderly. Nephrol Dial Transplant. 1996;11(Suppl 9):34-7.
11. Gül CB, Küçük M, Öztürk S, Demir E, Eren N, Şumnu A, et al. Trends of primary glomerular disease in Turkey: TSN-GOLD registry report. Int Urol Nephrol. 2022;54:2285-94.

12. Cockcroft DW, Gault MH. Prediction of creatinine clearance from serum creatinine. Nephron. 1976;16:31-41.

13. Levey AS, Bosch JP, Lewis JB, Greene T, Rogers N, Roth D. A more accurate method to estimate glomerular filtration rate from serum creatinine: a new prediction equation. Modification of Diet in Renal Disease Study Group. Ann Intern Med. 1999;130:461-70.

14. Kidney Disease: Improving Global Outcomes (KDIGO) Glomerular Diseases Work Group. KDIGO 2021 Clinical Practice Guideline for the Management of Glomerular Diseases. Kidney Int. 2021;100:S1-S276.

15. Schmitt R, Coca S, Kanbay M, Tinetti ME, Cantley LG, Parikh CR. Recovery of kidney function after acute kidney injury in the elderly: a systematic review and meta-analysis. Am J Kidney Dis. 2008;52:262-71.

16. Tekin E, Diniz G, Karadeniz T, Akar H, Yavaşçan Ö. Histopathological profile of kidney biopsies: Single center, four years experience. Tepecik Eğit ve Araş Hast Dergisi. 2018;28:181-6.

17. Piskinpasa S, Dede F, Akoglu H, Dogru F, Yenigun E, Ozturk R, et al. Clinicopathological Evaluation of the Kidney Biopsies: Our Center's Experience. Turk Neph Dial Transpl. 2012;21:167-72.

18. Baylis C, Wilson CB. Sex and the single kidney. Am J Kidney Dis. 1989;13:290-8.

19. Tanaka A, Kyokuwa M, Mori T, Kawashima S. Acceleration of renal dysfunction with ageing by the use of androgen in Wistar/Tw rats. In Vivo. 1995;9:495-502.

20. Ozturk İ, Duzman S, Patlak Ş, Guzel F, Kılınç E, Erken E, ve ark. Analysis of our renal biopsy cases: a single center experience. Ankara Eğt Arş Hast Derg. 2023;56:29-34.

21. Yılmaz O. 2010–2017 Yılları Arasında Böbrek Biyopsisi Yapılan Hastalarımızn Retrospektif İncelemesi. Uzmanlık Tezi. 2019; Edirne.

22. Kayta Y. 2008-2017 yılları arasında böbrek biyopsisi yapılan hastaların retrospektif incelenmesi. 2018; Denizli.

23. Tuğcu M, Kasapoğlu U, Şahin G, Apaydın S, Gümrükçü G. Evaluation of kidney biopsies in elderly patients. Int Urol Nephrol. 2019;51:869-74.

24. Harmankaya O, Okuturlar Y, Kocoglu H, Kaptanogullari H, Yucel SK, Ozkan H, et al. Renal biopsy in the elderly: a single-center experience. Int Urol Nephrol. 2015;47:1397-401.

25. Lindeman RD, Tobin J, Shock NW. Longitudinal studies on the rate of decline in renal function with age. J Am Geriatr Soc. 1985;33:278-85.

26. Ozdemir A, Yucel Kocak S, Ozagari AA, Yılmaz M. Spectrum of biopsy-based renal disease in an elderly Turkish population. Clin Nephrol. 2022;97:46-52.

27. Mohamed N, John R. Use of renal biopsy in the elderly. International urology and nephrology. 2011;43:593-600.

28. Oğuz Y, Dede F, Ay A, Karaman M, Eyileten T, Kırkpantur A, et al. Renal biopsy in patients aged 65 years and older: A clinicopathological analysis. Turkish Nephrology, Dialysis and Transplantation Journal. 2010;19:174-9.

29. Özdemir A, Yücel FSK, Eken KG, Yılmaz M. Do Histopathological Findings of Kidney Biopsies Performed in Patients with Acute Kidney Injury Differ with Age? Med J Bakirkoy. 2021;17:243-7.

30. Moutzouris DA, Herlitz L, Appel GB, Markowitz GS, Freudenthal B, Radhakrishnan J, et al. Renal biopsy in the very elderly. Clin J Am Soc Nephrol. 2009;4:1073-82.

31. Verde E, Quiroga B, Rivera F, López-Gómez JM. Renal biopsy in very elderly patients: data from the Spanish Registry of Glomerulonephritis. Am J Nephrol. 2012;35:230-7.

32. Hsu CY, Chertow GM, McCulloch CE, Fan D, Ordoñez JD, Go AS. Nonrecovery of kidney function and death after acute on chronic renal failure. Clin J Am Soc Nephrol. 2009;4:891-8.

33. Bellomo R, Kellum JA, Ronco C. Acute kidney injury. Lancet. 2012;380:756-66.

34. Hur E, Bozkurt D, Taskın H, Sarsık B, Sen S, Akcicek F, et al. Native Renal Biopsies Performed in Older Adults Are Increasing: Twelve Yeas Experience of Ege University. Turkish Journal of Geriatrics. 2011;14:289-94.

35. Yokoyama H, Sugiyama H, Sato H, Taguchi T, Nagata M, Matsuo S, et al. Renal disease in the elderly and the very elderly Japanese: analysis of the Japan Renal Biopsy Registry (J-RBR). Clin Exp Nephrol. 2012;16:903-20.

36. Kitiyakara C, Eggers P, Kopp JB. Twenty-one-year trend in ESRD due to focal segmental glomerulosclerosis in the United States. Am J Kidney Dis. 2004;44:815-25.

37. Rivera F, López-Gómez JM, Pérez-García R; Spsnish Registry of Glomerulonephritis. Frequency of renal pathology in Spain 1994-1999. Nephrol Dial Transplant. 2002;17:1594-602.

38. Rychlík I, Jančová E, Tesař V, Kolský A, Lácha J, Stejskal J, et al. Occurrence of renal diseases in the years 1994-2000. Nephrol Dial Transplant. 2004;19:3040-9.

39. Gesualdo L, Di Palma AM, Morrone LF, Strippoli GF, Schena FP; Italian Immunopathology Group, Italian Society of Nephrology. The Italian experience of the national registry of renal biopsies. Kidney Int. 2004;66:890-4.

40. Davison AM. The United Kingdom Medical Research Council's glomerulonephritis registry. Contrib Nephrol. 1985;48:24-35.

41. Carmo PA, Kirsztajn GM, Carmo WB, Franco MF, Bastos MG. Histopathological findings in elderly patients. J Bras Nefrol. 2010;32:286-91.

42. Okpechi IG, Ayodele OE, Rayner BL, Swanepoel CR. Kidney disease in elderly South Africans. Clin Nephrol. 2013;79:269-76.

43. Brown CM, Scheven L, O'Kelly P, Dorman AM, Walshe JJ. Renal histology in the elderly: indications and outcomes. J Nephrol. 2012;25:240-4.

44. Jin B, Zeng C, Ge Y, Le W, Xie H, Chen H, et al. The spectrum of biopsy-proven kidney diseases in elderly Chinese patients. Nephrol Dial Transplant. 2014;29:2251-9.

45. Familial Mediterranean fever (FMF) in Turkey: results of a nationwide multicenter study. Medicine (Baltimore). 2005;84:1-11.

46. Yeter HH, Gecegelen E, Bastug V, Korucu B, Fettahoglu FC, Gonul I, et al. Changing Aspect in Adult Kidney Biopsies: Ten Years Single Center Experience. GMJ. 2020;31:563-8.

47. Whittier WL, Korbet SM. Timing of complications in percutaneous renal biopsy. J Am Soc Nephrol. 2004;15:142-7.

48. Kajawo S, Ekrikpo U, Moloi MW, Noubiap JJ, Osman MA, Okpechi-Samuel US, et al. A Systematic Review of Complications Associated With Percutaneous Native Kidney Biopsies in Adults in Low- and Middle-Income Countries. Kidney Int Rep. 2020;6:78-90.

49. Corapi KM, Chen JL, Balk EM, Gordon CE. Bleeding complications of native kidney biopsy: a systematic review and meta-analysis. Am J Kidney Dis. 2012;60:62-73.

50. DuBose Jr TD, Warnock DG, Mehta RL, Bonventre JV, Hammerman MR, Molitoris BA, et al. Acute renal failure in the 21st century: recommendations for management and outcomes assessment. Am J Kidney Dis. 1997;29:793-9.