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Morphological and Histological Features of Nephrectomy Materials: A Single-Center Experience and Short Review of the Literature

Nefrektomi Materyallerinin Morfolojik ve Histolojik Özellikleri: Tek Merkez Deneyimi ve Literatürün Kısa Gözden Geçirilmesi

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ABSTRACT

Objective: *To determine the demographic characteristics of patients undergoing nephrectomy at a tertiary care hospital and to analyze the spectrum of renal tumors based on histopathological findings of nephrectomy specimens by current literature.*

Material and Method: *The results of nephrectomy materials admitted to the pathology clinic between January 2019 and December 2023 were included in the study. The demographic characteristics of the included patients, presenting complaints, reasons for nephrectomy, surgical method, nephrectomy area, tumor dimension, and histopathological reports were recorded in a standard data form.*

Results: *A total of 325 nephrectomy materials were included in the study. 61.5% of the patients were male. The mean age of the patients was 54.5±20.2 years (min:3 max:91). The most common presenting complaints were flank pain (28.3%). The most commonly observed pathological malignancy was clear cell carcinoma (32%), and it was found to be significantly higher in male patients (38.5%) (p=0.001). The most frequently detected pathological TNM grade of the patients was grade 1, and the histological WHO/ISUP grade was 2. 28.9% of the patients (n:94) received a diagnosis incidentally. Among those incidentally diagnosed patients, 87.2% (n:82) were histopathologically malignant. When benign pathological diagnoses were examined, the most common diagnosis was pyelonephritis, followed by oncocytoma, benign cystic disease, and angiomyolipoma, respectively.*

Conclusion: *According to our study results, malignant tumors are more commonly observed than benign neoplasms. Despite advancements in imaging technologies, the histopathological diagnosis of renal masses cannot be determined preoperatively, and surgical intervention is required for diagnosis.*

ÖZET

Amaç: *Üçüncü basamak bir hastanede nefrektomi yapılan hastaların demografik özelliklerini belirlemek ve güncel literatür doğrultusunda nefrektomi örneklerinin histopatolojik bulgularına dayanarak böbrek tümörleri spektrumunu analiz etmek.*

Gereç ve ve Yöntem: *Çalışmaya Ocak 2019 ile Aralık 2023 tarihleri arasında patoloji kliniğine başvuran nefrektomi materyallerinin sonuçları dahil edildi. Çalışmaya dahil edilen hastaların demografik özellikleri, başvuru şikayetleri, nefrektomi nedenleri, cerrahi yöntem, nefrektomi bölgesi, tümör boyutu ve histopatolojik raporları standart bir veri formuna kaydedildi.*

Bulgular: *Çalışmaya toplam 325 nefrektomi materyali dahil edildi. Hastaların %61,5'i erkekti. Hastaların ortalama yaşı 54,5±20,2 yıl (min:3 max:91) idi. En sık başvuru yakınması yan ağrısı (%28,3) idi. En sık görülen patolojik malignite berrak hücreli karsinom (%32) olup, erkek hastalarda (%38,5) anlamlı olarak daha yüksek olduğu görüldü (p=0,001). Hastaların en sık saptanan patolojik TNM derecesi derece 1, histolojik WHO/ISUP derecesi ise 2 idi. Hastaların %28,9'una (n:94) tesadüfen tanı konuldu. Tesadüfen tanı konulan hastaların %87,2'si (n:82) histopatolojik olarak malign idi. Benign patolojik tanılar incelendiğinde en sık görülen tanı piyelonefrit olup, bunu sırasıyla onkositoma, benign kistik hastalık ve anjiyomiyolipom izlemektedir.*

Sonuç: *Çalışmamızın sonuçlarına göre malign tümörler benign neoplazmlara göre daha sık görülmektedir. Görüntüleme teknolojilerindeki ilerlemelere rağmen böbrek kitlelerinin histopatolojik tanısı ameliyat öncesi net olarak belirlenememekte ve tanı için cerrahi müdahale gerekmektedir.*

Keywords:
Nephrectomy
Tumor
Histopathology
Clear Cell Carcinoma
Oncocytoma
Pyelonephritis

Anahtar Kelimeler:
Nefrektomi
Tümör
Histopatoloji
Berrak Hücreli Karsinom
Onkositoma
Piyelonefrit

INTRODUCTION

Kidney cancer accounts for 5% of malignancies in men and 3% in women. It is the 6th most common cancer in men and the 10th most common cancer in women (1). It is frequently observed in European and North American populations. According to Global Cancer Statistics, the incidence and mortality rate of kidney cancer in 2020 were 431,288 and 179,368, respectively (2). Renal cell carcinoma (RCC) constitutes over 90% of kidney cancers, with a mortality rate of approximately 2% (3). Despite being the most common urogenital malignancy, RCC is often incidentally diagnosed due to the increasing accessibility and utilization of cross-sectional abdominal imaging modalities (4). This rise in incidence is not limited

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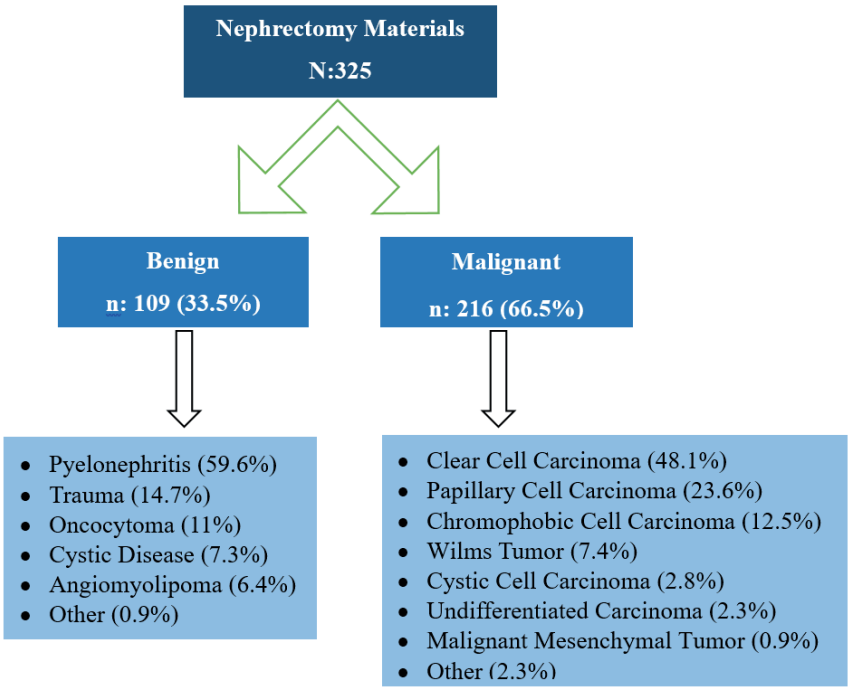

Figure 1: Histopathological Diagnosis Flow Chart of Patients.

to early-stage renal tumors; there has also been an increase in the frequency of advanced-stage tumor diagnoses (5).

Despite all technological advancements, radiological methods remain inadequate in the differential diagnosis of renal masses. The gold standard for treatment in kidney tumors is partial or total nephrectomy. Especially cases such as angiomyolipoma and oncocytoma, which are poor in fat tissue, cannot be distinguished from malignant neoplasms by radiological methods (6,7). In these situations, lesions that do not prove to be benign should be considered malignant and treated accordingly.

Advancements in molecular genetics have led to a better understanding of the molecular biology of kidney tumors, resulting in progress in their classification. The contemporary classification of renal cell carcinoma (RCC), established by the World Health Organization's Kidney Tumor Classification Panel in 2016, incorporates many new entities based on cytological, architectural, immunohistochemical, and cytogenetic features, leading to a decrease in specific RCC types (8).

The spectrum of renal tumors has limited published data and shows geographic variations. This study aims to examine the demographic characteristics of patients undergoing nephrectomy and the histopathological findings of nephrectomy materials, comparing them with the existing literature, and contributing to clinical practice.

MATERIAL AND METHODS

The study was planned as a five-year retrospective observational case series. After obtaining approval from the local ethics committee (Meeting Date: 18.01.2024, Meeting No: 144, Decision No: 3109), the research commenced. The study was conducted under the Helsinki Declaration and good clinical practices.

Patients Selection

The results of nephrectomy materials brought to the pathology clinic of a tertiary care hospital between January 1, 2019, and December 31, 2023, were included in the study. There was no age limit in the study.

Study Design

The demographic characteristics of the patients included in the study, their complaints at presentation, the area of nephrectomy, the sizes of the tumor materials, the surgical method applied, and the histopathological reports were recorded in a standard data form. The primary outcome of the study is to analyze the histopathological examinations of the materials brought to the pathology clinic after nephrectomy.

Statistical Analysis

Continuous data were summarized as mean and standard deviation, while categorical data were summarized as numbers and percentages. Categorical data were compared using the Chi-square test. The Kolmogorov-Smirnov test and assessments with histograms were used to compare the means of the parameters examined. In cases where the variables were normally distributed, the Student's t-test was used for comparisons between two groups; when not normally distributed, the Mann-Whitney U test was employed. The statistical analysis of the data obtained in the study was performed using the SPSS 25 software package (SPSS Inc, Chicago, Illinois, USA). The level of statistical significance was set at $p<0.05$.

RESULTS

The study included 325 cases. The flowchart of the histopathological diagnoses of the patients included in the study is presented in Figure 1.

Among the patients included in the study, 61.5% (n=200) were male, and 38.5% (n=125) were female. The age range of the patients was between 3 and 91 years, with an average age of 54.5±20.2 years. No statistically significant difference was found between age and gender (p=0.935). Incidental diagnoses were found in 28.9% (n=94) of the patients. The average age of patients diagnosed incidentally

Table 1: Distribution of patients' demographic characteristics by gender.

	Total	Male	Female	p
	n: 325 (100%)	n: 200 (61.5%)	n: 125 (38.5%)	
Mean Age (years) mean±SD	54.5±20.2	54.5±19,9	54.7±20.7	0,935
(min-max)	(3-91)	(3-91)	(4-98)	
Application Complaint n (%)				
Incidental	94 (28.9%)	60 (30%)	34 (27.2%)	0,447
Flank pain	92 (28.3%)	52 (26%)	40 (32%)	
Haematuria	36 (11.1%)	24 (12%)	12 (9.6%)	
Abdominal Pain	32 (9.8%)	18 (9%)	14 (11.2%)	
Dysuria	26 (8%)	21 (10.5%)	5 (4%)	
Lower back pain	17 (5.2%)	10 (5%)	7 (5.6%)	
Trauma	15 (4.6%)	8 (4%)	7 (5.6%)	
Abdominal Swelling	13 (4%)	7 (3.5%)	6 (4.8%)	
Applied Surgical Method n (%)				
Radical	280 (86.2%)	174 (87%)	106 (84.8%)	0,280
Laparoscopic	133 (40.9%)	90 (45%)	43 (34.4%)	
Open	101 (31.1%)	61 (30.5%)	40 (32%)	
Robotics	46 (14.2%)	23 (11.5%)	23 (18.4%)	
Partial	45 (13.8%)	31 (15.5%)	19 (15.2%)	
Laparoscopic	30 (9.2%)	16 (8%)	14 (11.2%)	
Open	7 (2.2%)	7 (3.5%)	3 (2.4%)	
Robotics	8 (2.5%)	8 (4%)	2 (1.6%)	
Nephrectomy n (%)				
Right	136 (41.8%)	85 (42.5%)	51 (40.8%)	0,762
Left	189 (58.2%)	115 (57.5%)	74 (59.2%)	
Dimension of tumor material n (%)				
<4cm	23 (7.1%)	11 (5.5%)	12 (9.6%)	0,167
4-5cm	50 (15.4%)	32 (16%)	18 (14.4%)	
5-7cm	97 (29.8%)	67 (33.5%)	30 (24%)	
>7cm	155 (47.7%)	90 (45%)	65 (52%)	

(58.5±19.4 years) was statistically significantly higher than that of patients diagnosed after presenting with symptoms (52.9±20.3 years) (p=0.023). Of the patients diagnosed incidentally, 87.2% (n=82) received a histopathological diagnosis of malignancy. Among the malignant patients, 65.9% (n=54) were in pathologic TNM grade 1, while 23.2% (n=19) were in grade 2. A total of 71.1% of the patients were diagnosed after presenting with a complaint. The most common presenting complaints were flank pain (28.3%) and hematuria (11.1%). There was no statistically significant difference between presenting complaints and gender (p=0.447). Radical nephrectomy was performed in 86.2% of the patients while nephron-sparing (partial nephrectomy) surgery was performed in 13.8%. In the patient group, 50.2% (n=163) underwent laparoscopic surgery, 33.2% (n=108) had open surgery, and 16.6% (n=54) received robotic surgery. Of the 58.2% (n=189) were left nephrectomies, and 41.8% (n=136) were right nephrectomies. There was no statistically significant difference between nephrectomy location and gender (p=0.762). When examining the size of the nephrectomy material; it was found that 47.7% were >7 cm, 29.8% were 5-7 cm, 15.4% were 4-5 cm, and 7.1% were <4 cm. There was no statistically significant difference between nephrectomy material size and gender (p=0.167) (Table 1).

7.69% (n:25) of the nephrectomy materials included in the study belonged to patients under the age of 18. 64% of the pediatric patients were male and the average age was 8.28±3.98 years. It was determined that 24% of pediatric patients were diagnosed incidentally. When the histopathology of the nephrectomy materials of this group was examined, 68% were found to be malignant. 64% of pediatric patients had Wilms tumor, 28% had pyelonephritis, 4% had blunt trauma and 4% had undifferentiated carcinoma.

Upon examining the histopathological diagnoses of the nephrectomy materials, it was obtained that 66.5% (n=216) were malignant pathologies, while 33.5% (n=109) were benign pathologies. The most frequently

Table 2: Distribution of patients' histopathological diagnoses by gender.

	Total n: 325 (100%)	Male n: 200 (61.5%)	Female n: 125 (38.5%)	p
Pathology n (%)				
Benign	109 (33.5%)	61 (30.5%)	49 (38.4%)	0,142
Malignant	216 (66.5%)	139 (69.5%)	77 (61.6%)	
Histopathological Benign Diagnoses n (%)				
Pyelonephritis	65 (20%)	37 (18.5%)	28 (22.4%)	0.392
Chronic Pyelonephritis	35 (10.8%)	20 (10%)	15 (12%)	0.635
Nephrolithiasis + Chronic Pyelonephritis	22 (6.8%)	14 (7%)	8 (6.4%)	0.738
Xanthogranulomatous pyelonephritis	8 (2.4%)	3 (1.5%)	5 (4%)	0.236
Trauma	16 (4.9%)	8 (4%)	8 (6.4%)	0.313
Blunt trauma	9 (2.8%)	5 (2.5%)	4 (3.2%)	0.708
Gunshot Wound	7 (2.2%)	3 (1.5%)	4 (3.2%)	0.304
Oncocytoma	12 (3.7%)	8 (4%)	4 (3.2%)	0.710
Benign Cystic Disease	8 (2.5%)	5 (2.5%)	3 (2.4%)	0.955
Angiomyolipoma	7 (2.2%)	2 (1%)	5 (4%)	0.070
Other*	1 (0.3%)	1 (0,5%)	0	0.428
Histopathological Malignant Diagnoses n (%)				
Clear Cell Carcinoma	104 (32%)	77 (38.5%)	27 (21.6%)	0,001
Papillary Cell Carcinoma	51 (15.7%)	35 (17.5%)	16 (12.8%)	0,257
Chromophobic Cell Carcinoma	27 (8.3%)	11 (5.5%)	16 (12.8%)	0.020
Wilms Tumor	16 (4.9%)	9 (4.5%)	7 (5.6%)	0.656
Cystic Cell Carcinoma	6 (1.8%)	5 (2.5%)	1 (0.8%)	0.268
Undifferentiated Carcinoma	5 (1.5%)	1 (0.5%)	4 (3.2%)	0.054
Malignant Mesenchymal Tumor	2 (0.6%)	0	2 (1.6%)	0.073
Other**	5 (1.5%)	1 (0.5%)	4 (3.2%)	0.054

Other: 1 patient each diagnosed with Hyperacute Rejection*
*Other**: 1 patient each diagnosed with B Cell Lymphoma, Well Differentiated Neuroendocrine Tumor, Lipomatous Hemangiopericytoma, Squamous Cell Carcinoma, Malignant Fibrous Histiocytoma*

detected malignant pathology was clear cell carcinoma. Nephrectomy performed due to pyelonephritis was the most commonly diagnosed benign pathology (Table 2).

When examining the diagnoses of benign pathologies, 59.6% were due to pyelonephritis, 14.7% to trauma, 11% to oncocytoma, 7.3% to cystic disease, 6.4% to angiomyolipoma, and 0.9% to other causes (hyperacute rejection in one patient). The average age of patients with benign diseases (45.6±18.4 years) was significantly lower than that of patients with malignant diseases (59.1±19.5 years) ($p<0.001$). Among benign diseases, the lowest average age was observed in trauma patients (34.9±16.3 years), while the highest average age was in patients diagnosed with oncocytoma (60.6±10.9 years).

Patients diagnosed with pyelonephritis most commonly presented with flank pain (52.3%) and dysuria (23.1%). Among patients diagnosed with oncocytoma, 41.7% received an incidental diagnosis. When examining the size of the nephrectomy material, it was found that 70.8% of pyelonephritis patients had a size of >7 cm, while 41.7% of oncocytoma patients had a size of <4 cm. While 96.9% of pyelonephritis patients, 100% of trauma patients, and 87.5% of cystic disease patients underwent radical nephrectomy, nephron-sparing (partial nephrectomy) surgery was performed in 41.7% of oncocytoma patients and 42.9% of angiomyolipoma patients (Table 3).

When examining the diagnoses of malignant pathologies, 48.1% were clear cell carcinoma, 23.6% were papillary cell carcinoma, 12.5% were chromophobe cell carcinoma, 7.4% were Wilms tumor, 2.8% were cystic cell carcinoma, 2.3% were undifferentiated carcinoma, 0.9% were malignant mesenchymal tumor, and 2.3% were other reasons (well-differentiated neuroendocrine tumor, hemangiopericytoma, malignant fibrous histiocytoma, B-cell lymphoma, and squamous cell carcinoma, each one patient). The average age of patients with malignant diseases was 59.1±19.5 years. Among malignant diseases, the lowest average age was observed in patients with Wilms tumor (7.4±2.7 years), while the highest average age was in patients diagnosed with papillary cell carcinoma (66.4±13.3 years). Patients with clear cell carcinoma are most commonly diagnosed incidentally (43.3%). The most common presenting complaints were flank pain (22.1%) and hematuria (13.7%). Among patients with Wilms tumor, 62.5% presented to the hospital due to abdominal swelling. When examining the tumor size in

Table 3: Demographic Characteristics of Benign Pathologies.

	Pyelonephritis	Trauma	Oncocytoma	Cystic Disease	Angiomyolipoma
	n:6 (59.6%)	n:16 (14.7%)	n:12 (11%)	n:8 (7.3%)	n:7 (6.4%)
Mean Age (years) mean±SD	44.6±18.9	34.9±16.3	60.6±10.9	51.4±10.6	45.3±20.9
Application Complaint n (%)					
Incidental	34 (52.3%)	0	3 (25%)	3 (37.5%)	4 (57.1%)
Flank pain	15 (23.1%)	0	1 (8.3%)	1 (12.5%)	0
Haematuria	0	15 (93.8%)	0	0	0
Abdominal Pain	4 (6.2%)	0	5 (41.7%)	2 (25%)	1 (14.3%)
Dysuria	8 (12.3%)	0	1 (8.3%)	0	1 (14.3%)
Lower back pain	2 (3.1%)	1 (6.3%)	1 (8.3%)	0	1 (14.3%)
Trauma	2 (3.1%)	0	1 (8.3%)	1 (12.5%)	0
Abdominal Swelling	0	0	0	1 (12.5%)	0
Dimension of tumor material n (%)					
<4cm			5 (41.7%)	0	1 (14.3%)
4-5cm			1 (8.3%)	1 (12.5%)	1 (14.3%)
5-7cm			2 (16.7%)	2 (25%)	1 (14.3%)
>7cm			4 (33.3%)	5 (62.5%)	4 (57.1%)
Applied Surgical Method n (%)					
Radical	63 (96.9%)	16 (100%)	7 (58.3%)	7 (87.5%)	4 (57.1%)
Laparoscopic	44 (67.7%)	2 (12.5%)	3 (25%)	5 (62.5%)	3 (42.9%)
Open	11 (16.9%)	14 (87.5%)	3 (25%)	1 (12.5%)	0
Robotics	8 (12.3%)	0	1 (8.3%)	1 (12.5%)	1 (14.3%)
Partial	2 (3.1%)	0	5 (41.7%)	1 (12.5%)	3 (42.9%)
Laparoscopic	1 (1.5%)	0	4 (33.3%)	1 (12.5%)	2 (28.6%)
Open	1 (1.5%)	0	0	0	0
Robotics	0	0	1 (8.3%)	0	1 (14.3%)

Other (0.9%): 1 patient diagnosed with hyperacute rejection.

nephrectomy materials, it was found that 34.6% of clear cell carcinoma cases had a size of >7 cm. Among patients with cystic cell carcinoma, 50% had a tumor size of 4-5 cm. Regarding pathologic TNM classification, 64.4% of patients with clear cell carcinoma, 58.8% of patients with papillary cell carcinoma, 48.1% of patients with chromophobe cell carcinoma, and 100% of patients with cystic cell carcinoma were classified as grade 1. Among patients with undifferentiated carcinoma, 60% were in Stage 3. Regarding Histological grade (WHO/ISUP), 43.3% of patients with clear cell carcinoma and 45.1% of patients with papillary cell carcinoma were grade 2. Radical nephrectomy was performed in 79.8% of patients with clear cell carcinoma, 90.2% of patients with papillary cell carcinoma, 81.5% of patients with chromophobe cell carcinoma, and in all patients with Wilms tumor, undifferentiated carcinoma, and malignant mesenchymal tumor, whereas nephron-sparing (partial nephrectomy) surgery was performed in 50% of patients with cystic cell carcinoma (Table 4).

DISCUSSION

In the study, histopathological examination of nephrectomy specimens from cases undergoing nephrectomy was performed. According to the study data, 28.9% of the cases were diagnosed coincidentally and underwent surgical treatment. The most common malignant pathological diagnosis in the study was clear cell carcinoma, while the most frequently detected benign pathologies were pyelonephritis and oncocytoma. In cases with RCC, the female-to-male ratio was approximately 1/2. Additionally, 4.9% of the cases underwent nephrectomy due to trauma.

RCC is a heterogeneous disease with varying clinical features. It accounts for 2-3% of all cancers and is the seventh leading cause of cancer-related deaths according to studies. It is also the most common cause of death among urogenital cancers, accounting for 30-40% of cases (9). The incidence of RCC varies by country but is more common in developed countries. Its incidence is higher in men compared to women. RCC is mostly seen in the 60-70 age group and is less common after the age of 70 (10). Our study included all nephrectomy specimens regardless of age range. Wilms tumors, which are seen in the early age period, were also among the malignant pathological diagnoses we detected. Therefore, the age range of the patients included in the study was 3-91, but the average age was consistent with the literature. Moreover, the female-to-male ratio also paralleled the current literature.

Table 4: Demographic Characteristics of Malignant Pathologies

	Clear Cell Carcinoma	Papillary Cell Carcinoma	Chromophobic Cell Carcinoma	Wilms Tumor	Cystic Cell Carcinoma	Undifferentiated Carcinoma	Malignant Mesenchymal Tumor
	n:104 (48.1%)	n:51 (23.6%)	n:27 (12.5%)	n:16 (7.4%)	n:6 (2.8%)	n: 5 (2.3%)	n: 2 (0.9%)
Mean Age (years) mean±SD	63.2±11.9	66.4±13.3	62.7±12.2	7.4±2.7	45±8.9	55.8±32.2	47±4.2
Application Complaint							
Incidental	45 (43.3%)	14 (27.5%)	14 (51.9%)	5 (31.3%)	2 (33.3%)	0	2 (100%)
Flank pain	23 (22.1%)	15 (29.4%)	5 (18.5%)	0	1 (16.7%)	2 (40%)	0
Haematuria	14 (13.7%)	15 (29.4%)	3 (11.1%)	0	0	0	0
Abdominal Pain	10 (9.6%)	4 (7.8%)	1 (3.7%)	1 (6.3%)	0	2 (40%)	0
Lower back pain	6 (8.8%)	1 (2%)	3 (11.1%)	0	2 (33.3%)	0	0
Abdominal Swelling	1 (1%)	0	0	10 (62.5%)	0	1 (20%)	0
Dysuria	5 (4.8%)	2 (3.9%)	1 (3.7%)	0	1 (16.7%)	0	0
Dimension of tumor material							
<4cm	12 (11.5%)	1 (2%)	1 (3.7%)	0	1 (16.7%)	0	0
4-5cm	23 (22.1%)	9 (17.6%)	6 (22.2%)	1 (6.3%)	3 (50%)	1 (20%)	0
5-7cm	33 (31.7%)	26 (51%)	5 (18.5%)	3 (18.8%)	2 (33.3%)	1 (20%)	0
>7cm	36 (34.6%)	15 (29.4%)	15 (55.6%)	12 (75%)	0	3 (60%)	2 (100%)
TNM Stage							
1	67 (64.4%)	30 (58.8%)	13 (48.1%)		6 (100%)	2 (40%)	0
2	28 (26.9%)	10 (19.6%)	8 (29.6%)		0	0	0
3	9 (8.7%)	6 (11.8%)	6 (22.2%)		0	3 (60%)	0
4	0	5 (9.8%)	0		0	0	2 (100%)
Histologic Grade (WHO / ISUP)							
1	35 (33.7%)	12 (23.5%)	15 (55.6%)		4 (66.7%)	1 (20%)	0
2	45 (43.3%)	23 (45.1%)	7 (25.9%)		2 (33.3%)	0	0
3	22 (21.2%)	13 (25.5%)	4 (14.8%)		0	4 (80%)	0
4	2 (1.9%)	3 (5.9%)	1 (3.7%)		0	0	2 (100%)
Applied Surgical Method							
Radical	83 (79.8%)	46 (90.2%)	22 (81.5%)	16 (100%)	3 (50%)	5 (100%)	2 (100%)
Laparoscopic	38 (36.5%)	20 (39.2%)	8 (29.6%)	3 (18.8%)	2 (33.3%)	2 (40%)	0
Open	28 (26.9%)	17 (33.3)	8 (29.6%)	12 (75%)	1 (16.7%)	1 (20%)	2 (100%)
Robotics	17 (16.3%)	9 (17.6%)	6 (22.2%)	1 (6.3%)	0	2 (40%)	0
Partial	21 (20.2%)	5 (9.8%)	5 (18.5%)	0	3 (50%)	0	0
Laparoscopic	11 (10.6%)	3 (5.9%)	5 (18.5%)	0	3 (50%)	0	0
Open	5 (4.8%)	1 (2%)	0	0	0	0	0
Robotics	5 (4.8%)	1 (2%)	0	0	0	0	0

Other (2.3%): 1 patient each diagnosed with Well-differentiated neuroendocrine tumor, lipomatous hemangiopericytoma, malignant fibrous histiocytoma, B cell lymphoma and Squamous cell carcinoma

In our study, most kidney tumors were detected coincidentally. Subsequently, the most common symptoms were, in order, flank pain, hematuria, and abdominal pain. Over 50% of RCCs are discovered incidentally. Patients with this cancer may present with local or systemic symptoms, but the incidence of kidney masses being detected coincidentally has significantly increased following routine imaging for various medical disorders (11). The widespread use of ultrasonography and cross-sectional imaging is now associated with the incidental detection of many asymptomatic kidney tumors, and some now refer to RCC as the radiologist's tumor (12). In reality, due to the increased detection of incidental kidney masses, there is a decrease in the presentation of concurrent metastatic disease, allowing this cancer to be frequently detected at early stages (13). The most common pathological TNM stage observed in the study was stage 1. According to the WHO/ISUP classification, the most

common histopathological grade was grade 2.

Local symptoms like hematuria, flank pain, or palpable abdominal masses are associated with poorer prognoses. Systemic symptoms, on the other hand, may be largely related to proteins secreted due to paraneoplastic events or metastases. Among these proteins are factors like parathyroid hormone, renin, and erythropoietin, which can lead to conditions such as hypercalcemia, hypertension, and erythrocytosis. Additionally, fever or weight loss can emerge as additional symptoms.

The meticulous and detailed histopathological examination of nephrectomy specimens is essential for the accurate diagnosis, classification, prognosis, and treatment of potential carcinomas (14, 15). In our study, the most common malignant RCC type was Clear Cell Renal Cell Carcinoma (CCRCC), followed by papillary cell carcinoma and chromophobe cell carcinoma, respectively. CCRCC originates from the proximal renal tubular epithelium. The overall prognosis of CCRCC is worse than most other types of RCC (16). These tumors can be sporadic (accounting for 95% of cases) or part of a familial cancer syndrome, such as von Hippel-Lindau disease. This tumor type is characterized by the loss of genetic material on chromosome 3p, either through the loss of the entire chromosome or through the loss of function via hypermethylation (17). Papillary RCC (PRCC) is also derived from the renal tubular epithelium and is the second most common morphotype encountered in RCC. It has traditionally been divided into two types. Type 1 PRCC appears to be a distinct and compact histomolecular entity and possesses a unique immunoprofile positive for CK7, CD10, and racemase. The most common cytogenetic abnormalities are trisomy 7 and 17 and loss of Y in sporadic cases in male patients, while in familial forms, trisomy 7 is the most frequent. Type 2 tumors appear to be a contentious entity consisting of a group of tumors sharing papillary/tubulopapillary structures but having distinct molecular and genetic characteristics. RCCs with fumarate hydratase deficiency, which are high-grade PRCCs previously categorized as “type 2” PRCC, have been reclassified from type 2 PRCC thanks to recent molecular and genetic studies. This reclassification reflects the ongoing evolution in the understanding of RCC subtypes, highlighting the importance of molecular and genetic profiles in accurately diagnosing and treating renal cancers. Type 2 tumors appear to be a controversial entity consisting of a group of tumors with different molecular and genetic characteristics but sharing a papillary/tubulopapillary structure. High-grade PRCCs previously categorized as “Type 2” PRCC, which are RCCs with fumarate hydratase deficiency, have been reclassified within Type 2 PRCC based on recent molecular and genetic studies. The “third” subtype of PRCC, oncocytic papillary RCC, is a papillary RCC consisting of oncocytic neoplastic cells with variable copy number variation patterns (17, 18). Chromophobe Renal Cell Carcinoma (ChRCC) constitutes 5-7% of all renal cell carcinomas. ChRCCs are well-defined and encapsulated tumors with a homogeneous light tan to brown color and central scar tissue. Microscopic examination reveals solid growth with nests, layers, or trabeculae composed of two types of cells. Type 1 ChRCC exhibits voluminous reticular cytoplasm, plant-like cell membranes, and large pale cells. Type 2 ChRCC, on the other hand, presents smaller cells with fine granular eosinophilic cytoplasm in its eosinophilic variant. These tumors demonstrate distinctive irregular wrinkled, coarse chromatin, raisin-like nuclei, and a characteristic perinuclear halo due to the accumulation of cytoplasmic micro-particles. Immunohistochemically, these tumors are positive for CD117 and CK7 while negative for vimentin and CD10, distinguishing them from PRCC (19).

In this study, the second most common pathological diagnosis in cases who underwent nephrectomy was pyelonephritis. Pyelonephritis is the inflammation of the renal parenchyma and can be acute or chronic. Acute pyelonephritis is characterized by fever, costovertebral angle pain, and nausea-vomiting triad. Chronic pyelonephritis (CPN) progresses with recurrent acute attacks and sometimes can be identified as a cause of end-stage renal disease (ESRD) (20). CPN has variants such as xanthogranulomatous pyelonephritis, emphysematous pyelonephritis, and unspecified variants (21). CPN has been reported as the cause in approximately 4-6% of patients requiring dialysis due to ESRD (20). CPN is the most common cause of renal biopsies and nephrectomies. In studies, this rate varies between 29% and 63% (22-26). Although malignant tumors of the kidney are more common than benign pathologies, the frequency of benign lesions has been increasing recently (27). Kidney benign lesions include renal adenoma, metanephric adenoma, renal oncocytoma, nephrogenic adenofibroma, mesoblastic nephroma, capsuloma, juxtaglomerular cell tumor, medullary fibroma, cystic nephroma, cystic hamartoma, angiomyolipoma (AML), leiomyoma, hemangioma, lipoma, xanthogranulomatous pyelonephritis, malakoplakia, renal cysts, and fibroepithelial polyps (28). Studies have shown that the incidence of benign lesions in the kidney varies approximately between 15-20% (27, 29-31). In this study, the rate of nephrectomy performed due to benign lesions was 33.5%. The most common ones were oncocytoma, benign cystic disease, and AML, respectively.

Oncocytoma and AML are the most common benign renal pathologies (32). Renal oncocytoma is the most common benign pathology of the kidney and is often seen in adults (33). It constitutes roughly 5% of renal masses. It is usually asymptomatic and detected incidentally. Currently used imaging methods cannot make a clear distinction between oncocytoma and malignant lesions, so a definitive diagnosis is only made through biopsy or resection. Paying attention to pathological characteristics and using immunostains together can help distinguish oncocytoma, characterized by granular, eosinophilic cytoplasm, from other kidney tumors, especially chromophobe renal cell carcinoma (34).

Most kidney cysts are benign and asymptomatic, having no impact on kidney function. These “simple” cysts are typically managed conservatively. However, some kidney cysts may be symptomatic or have atypical radiological findings, leading to suspicion of malignancy; in such

cases, surgical evaluation may be indicated. Other cystic kidney diseases are genetic or acquired later in life, often associated with malformation syndromes, and can impair kidney function. In such cases, a nephrectomy may be necessary (35).

Angiomyolipoma is a benign mesenchymal tumor belonging to the perivascular epithelioid cell tumor family. Most of these pathological kidney lesions are found incidentally, similar to other renal masses. The prevalence varies between 0.2% and 0.6% and is most commonly seen in females (36). While 80% of cases are sporadic, the remaining 20% develop in association with tuberous sclerosis complex or pulmonary lymphangioleiomyomatosis (37). Inherited lesions typically manifest at a younger age and tend to be larger, bilateral, and more aggressive (38).

In this study, 41.8% of cases underwent right nephrectomy, while 58.2% underwent left nephrectomy. Although this ratio shows similarity to some previous studies (39,40), it has been observed differently in other studies (41).

In our study, malignant tumors had a tumor size >7 cm. There are several studies indicating no correlation between tumor size and malignancy in kidney tumors, with a particular focus on RCC. Tumor sizes in studies conducted in Pakistan, Saudi Arabia, and India were similar to our study (39, 42-44). However, tumor sizes have been reported smaller in studies conducted particularly in the West (45-47).

In this study, the most commonly encountered grades in malignant tumors were grade 2 CCRCC and grade 2 PRCC. Different studies have reported different grades (39, 41, 48, 49). These discrepancies may be related to the tumor size, which can vary depending on whether cases present early or late.

In the past, radical nephrectomy was the standard treatment option for kidney masses. However, with advancements in surgical techniques and considering the high prevalence of benign lesions in small-sized tumors, nephron-sparing surgery is now more commonly used. Nephron-sparing surgery is as successful as radical nephrectomy in tumor control, as demonstrated by several studies (50). In this study, the rate of nephron-sparing surgery was around 14%. The reason for this difference may be related to the fact that the majority of the masses detected in the cases included in the study were >7 cm, the large number of malignant masses, and the surgeon's perioperative decisions.

LIMITATION

The absence of survival, follow-up, and comorbid conditions in the study could be a limitation. However, including them might have extended the study duration. Larger, multicenter, and long-term follow-up studies are necessary to determine the prognostic value of histological types and other tumor characteristics in kidney tumors.

CONCLUSION

According to the study findings, malignant tumors are more common than benign pathologies in patients undergoing nephrectomy in our region. The most common malignant tumor type is clear cell renal cell carcinoma (CCRCC). Malignant tumors are typically larger in size and have a higher nuclear grade. Despite advancements in imaging technologies, the histopathological diagnosis of kidney masses cannot be determined preoperatively, and surgical intervention is required for diagnosis.

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