

Histopathological analysis and reporting of renal lesions in Nephrectomy specimens: A 3-year descriptive study at Tertiary Care Hospital

Muni Bhavani Itha^{1*}, Yarlagada Krishna Bharathi², Satyanarayana Veeragandham³

¹Assistant Professor, Department of Pathology, Katuri Medical College and Hospital, Guntur, Andhra Pradesh, India

²Professor, Department of Pathology, Katuri Medical College and Hospital, Guntur, Andhra Pradesh, India

³Professor & Head, Department of Pathology, Katuri Medical College and Hospital, Guntur, Andhra Pradesh, India

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Abstract

Background: Kidneys are paired retroperitoneal organs and are the one, among the most highly differentiated organs in the body. They regulate several complex physiologic processes and, are greatly impacted by a broad spectrum of pathological conditions. In urology practice, nephrectomy (removal of entire or part of the kidney) is the widely performed surgical procedure for end-stage/nonfunctioning kidneys or any renal mass. **Objectives:** 1. Based on histomorphology, the main objective of our study is to analyze the spectrum and frequency of the different renal lesions in nephrectomy specimens at our tertiary care hospital. 2. To know the common indication/ cause for the nephrectomy procedure. 3. And also to study the distribution of renal lesions including both neoplastic and non-neoplastic lesions concerning age, gender, and histomorphological features. **Materials and Methods:** This was a retrospective and prospective review of histopathological lesions encountered in different age groups & genders amongst nephrectomy specimens received in the Department of Pathology, Katuri Medical college Chinnakondrupadu, Guntur, Andhra Pradesh, India. **Results:** In this study, the most common lesions were non-neoplastic (53.3%, 16 cases), the vast majority being chronic pyelonephritis accounting for 23.4% (07 cases). The neoplastic lesions accounting for 46.7% (14 cases), the majority were malignant neoplasms 13 cases in number and only one case of benign neoplasm was reported. Clear cell renal cell carcinoma was the most common malignant renal tumor and Oncocytoma was the only benign tumor reported in our study. And also we reported a rare case of coexisting urothelial carcinoma and renal tuberculosis in the same kidney on the left side in a 54-year-old female patient with a previous history of treated pulmonary tuberculosis. The most common age group affected was the 4th to 6th decade of life. Both non-neoplastic and neoplastic lesions show male preponderance. **Conclusion:** This study highlights that a complete and detailed histopathological examination of every nephrectomy specimen is mandatory to know the histologic type, for tumor grading and staging. In summary, not only the pathologist, every clinician should have a better understanding of the histomorphology of renal lesions that are found in nephrectomy specimens to facilitate earlier diagnosis and more targeted treatment options, thereby improving overall and disease-free survival of the patient. In our study, non-neoplastic lesions were more the most common, followed by malignant tumors, and the least common were benign tumors. Chronic pyelonephritis was the most common non-neoplastic lesion for which nephrectomy was done. Clear cell renal cell carcinoma was the most common malignant tumor and Oncocytoma was the only benign tumor reported. Also reported, a rare and interesting case of coexisting papillary urothelial carcinoma and renal tuberculosis in the same side of the kidney. The most commonly affected age group was the 4th to 6th decade of life. Both non-neoplastic and neoplastic lesions showed male preponderance.

Keywords: Pyelonephritis, Clear Cell Renal Cell Carcinoma, Renal Oncocytoma, Renal Cell Carcinoma.

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Introduction

The kidneys are paired retroperitoneal organs surrounded by perinephric fat contained within the renal fascia (Gerota's fascia)[1]. Embryologically, kidneys are developed from intermediate mesoderm, nearly 30 different cell types together form a complex of filtering capillary loops and segmented nephrons, and are enveloped by dynamic interstitium.

Because of their cellular diversity kidneys are said to be one of the most highly differentiated organs in the body and regulates a variety of complex physiologic processes. The major functions of the kidney are excretion of waste metabolites, maintaining water and electrolyte balance, acid-base balance, regulates the blood pressure through the renin-angiotensin pathway, and produce erythropoietin required for hematopoiesis, and also mediates endocrine functions[2].

The kidneys are greatly impacted by a broad spectrum of pathological conditions and some of which may demand their surgical removal i.e. nephrectomy. In urology practice, nephrectomy is a widely accepted surgical operation performed in end-stage/nonfunctioning kidneys or any renal mass. Nephrectomy has many indications, for both simple and radical approaches. Simple nephrectomy is commonly advised to patients with irreversibly damaged kidneys resulting from symptomatic chronic infections, obstruction, calculus disease to severe traumatic injury. Nephrectomy may also be indicated to deal with reno-vascular hypertension from non-correctable renal artery disease, or for severe unilateral parenchymal damage resulting from nephrosclerosis, pyelonephritis, reflux dysplasia, or congenital

*Correspondence

Dr. Muni Bhavani Itha

Assistant professor, Department of Pathology, Katuri Medical College and Hospital, Guntur, Andhra Pradesh, India.

E-mail: drbhavanikm@gmail.com

dysplasia. It is the treatment of choice in renal cell carcinomas[3]. For a great proportion of patients with renal tumors, radical or partial nephrectomy is the treatment of choice[4]. The Indications for nephrectomy may show geographic variations with different urologic causes in different countries worldwide. However, nephrectomy remains the standard of care for patients presenting with renal mass. Renal cell carcinoma is the primary malignant tumor of renal epithelial cell origin, which accounts for approximately 2% of global cancer diagnoses and deaths, and is projected to increase in burden worldwide. According to the Global Cancer Statistics GLOBOCAN 2018 report estimates that out of 18.1 million new cases (17.0 million excluding nonmelanoma skin cancer) renal cancers accounts for 4,03,262 (2.2% of global cancer diagnosis) and out of 9.6 million cancer deaths (9.5 million excluding nonmelanoma skin cancer) renal cancers accounts for 1,75,098 (1.8% of global cancer deaths) worldwide[5]The objective of the present study is to know the spectrum and frequency of the various pathological lesions encountered in nephrectomy specimens received in our pathology department and to know the indications for the same in our community practice. We also analyzed the age and sex distribution of neoplastic and non-neoplastic lesions along with other histomorphologic features.

Material and methods

The present study was done for a period of three years from July 2018 to June 2021 which includes all the nephrectomy specimen received in the Department of Pathology, Katuri Medical College and Hospital, Results

Guntur, Andra Pradesh, India. It is a prospective and retrospective study. A total of thirty (30 in number) nephrectomy specimens were included in the present study. Patient particulars like age, sex, relevant clinical details, radiological details like USG and CT findings along with gross morphology and microscopic details were noted from the records available in our department. All the received nephrectomy specimens were fixed in 10% formalin and multiple sections were taken from the representative areas following the guidelines given in Rosai, [6] and sections were processed routinely and stained with Haematoxylin & Eosin stains. All the histological sections were examined microscopically and findings were recorded. Wherever necessary, the World Health Organization/International Society of Urological Pathology (WHO/ISUP), a four-tiered grading system recommended by WHO was applied for grading of clear cell renal cell carcinoma and papillary renal cell carcinoma[7].

Inclusion criteria

All simple, partial, and radical nephrectomy specimens were included in the study.

Exclusion criteria

Small biopsies/core biopsies/ inadequate specimens were excluded from this study.

Ethical approval was taken from the Institutional ethics committee.

Statistical analysis

A descriptive analysis of the data was done and statistical analysis was not done.

Table 1: Distribution of Lesions in nephrectomy specimens.

Histological type	Number of cases (Total 30 cases, 100%)	
Non neoplastic lesions	16(53.3%)	
Neoplastic lesions	14 (46.7%)	
	Benign	Malignant
	01	13

Table 2: Histopathological spectrum of neoplastic and non-neoplastic lesions in the nephrectomy specimens.

Histological type	Total number of cases (30)	Percentage (100%)
Chronic Pyelonephritis(CPN)	7	23.4%
Chronic pyelonephritis with hydronephrosis	5	16.7%
Hydronephrosis (HN)	2	6.7%
Granulomatous pyelonephritis	2	6.7%
Papillary Urothelial Carcinoma of the ureter and pelvis with renal tuberculosis.	1	3.3%
Clear Cell Renal Cell Carcinoma (Clear cell RCC)	5	16.7%
Papillary Renal Cell Carcinoma (Papillary RCC)	3	10%
Mixed RCC (Clear cell and chromophobe RCC)	1	3.3%
Wilms tumor	1	3.3%
RCC unclassified	1	3.3%
Transitional Cell Carcinoma - Pelvis	1	3.3%
Renal Oncocytoma	1	3.3%

Table 3: Age-wise distribution of nephrectomy lesions.

Age in years	Number of cases (Total 30 cases)		Total Number of cases
	Type of lesions		
	Neoplastic (14)	Non- neoplastic (16)	
0-10	1	Nil	1
11-20	Nil	Nil	Nil
21-30	1	2	3
31-40	2	4	6
41- 50	3	5	8
51-60	6	2	8
61-70	1	3	4
71-80	Nil	Nil	Nil
More than 80	Nil	Nil	Nil

Table 4: Distribution of nephrectomy lesions among males and females.

Gender	Histological type		
	Neoplastic (14 cases)		Non-neoplastic (16cases)
	Malignant	Benign	
Male (Total 30)	8	1	9
Female (Total 20)	5	0	7

During the three years study period; we received a total of thirty nephrectomy specimens. The number of non – neoplastic lesions was 16 cases (53.3%) and neoplastic lesions were 14 cases (46.7%) shown in [Table - 1]. The histopathological spectrum of neoplastic and non-neoplastic lesions in the nephrectomy specimens was shown in [Table - 2].

Among the non-neoplastic lesions, chronic pyelonephritis (23.4%) was the most common cause for which nephrectomy was done followed by chronic pyelonephritis with hydronephrosis (16.7%). Neoplastic lesions were 14 in number (46.7%). Malignant lesions (13 cases) were more when compared to benign lesions (only 1 case). Among the malignant tumors, Clear cell renal cell carcinoma (5 cases) was the most frequent. Other were three cases of Papillary renal cell carcinoma, one case each of mixed variant RCC exhibiting Papillary with focal chromophobe features Transitional cell carcinoma of the renal pelvis, Wilms tumor, RCC unclassified, and also a rare case of coexisting Papillary urothelial carcinoma involving ureter and pelvis and renal tuberculosis in the same kidney on the left side. Oncocytoma was the only benign tumor encountered in our study.

The highest number of patients belongs to the age group of 41 – 50years (non-neoplastic) and 51 - 60 years (neoplastic). The least affected age group was 1st decade with only one case of Wilms tumor presented in a nine-year-old male child. No cases were seen in the age group of 11-20 years and beyond 70 years of age group in our study. Age-wise distribution of nephrectomy lesions was shown in [Table - 3].

In our study male to female ratio was 1.5:1. Both non-neoplastic and neoplastic lesions showed male preponderance shown in [Table - 4].

Discussion

In our study, a total of thirty nephrectomy specimens were received in the histopathology section of the department of pathology, KMCH, Guntur, Andhra Pradesh, India, and the present study findings were compared with other studies.

In our study, the maximal number of cases was non-neoplastic. Out of 30 nephrectomy specimens studied, non-neoplastic lesions were 16 (53.3%) and neoplastic lesions were 14 (46.7%) in number. Similar findings were seen with studies by Mukhiya Gk et al., Vinay KS and Sujatha S, Thakar BD and Singh K, Shanmugaswamy K et al., Ajay Kumar, Reddy KD et al., Amin AN et al., Aiman A et al., Shaila S et al., where non-neoplastic lesions were most common indication for nephrectomy[8-16]. Present study findings showed little contrast to the study finding by Vikram Narang et al. where neoplastic lesions were a slightly more common indication for nephrectomy procedure than non –neoplastic lesions[17].

In the present study, among non-neoplastic conditions, the most common indication encountered for nephrectomy was chronic pyelonephritis accounting for 07 cases, (23.4%) [Figure-1]. Chronic pyelonephritis has been reported as the most common clinical indication in the studies by Ghalayini IF and Popat V et al. [3,18]. The second most common cause for nephrectomy was chronic pyelonephritis with hydronephrosis accounting for 05 cases (16.7%).

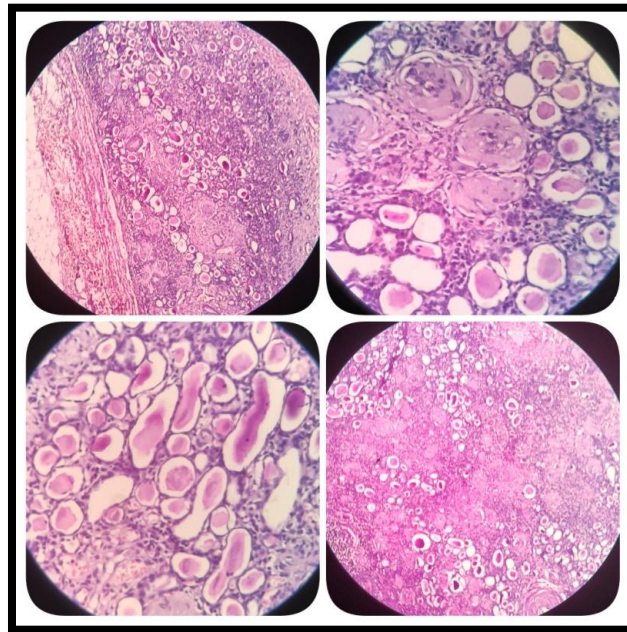


Fig 1 : A Case of Chronic Pyelonephritis HP.No. 909/2021 : Photomicrograph of H&E stained sections (4x and 10x view) of Chronic Pyelonephritis showing sclerotic glomeruli, thyrodisation of tubules, interstitial chronic mononuclear inflammatory cell collection with germinal centre formation.

Out of 30 cases of nephrectomy specimens, neoplastic lesions were 14 in number (46.7%). Malignant lesions (13 cases) were most common as compared to benign lesions (01 cases). Among the malignant lesions, Clear cell renal cell carcinoma (05 cases) was the most frequent [Figure-2]. These findings were similar to the study done by Mukhiya Gk et al., Thakar BD and Singh K., Aiman A et al., Shaila S et al. and Shah N et al [8,10,15,16,19]. Out of 5 cases of clear cell

RCC, one case of locally aggressive clear cell Rcc was presented in a 53- year-old male patient who had a chronic smoking history with complaints of haematuria, showed Clear cell RCC features with WHO/ISUP nuclear grade 2 morphology, lymph node metastasis, and tumor cell infiltration into peri-nephric fat, capsular invasion, and vascular invasion.

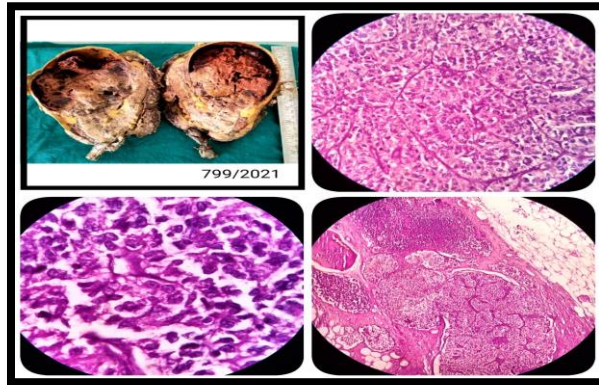


Fig 2: A Case of Clear Cell Renal Cell Carcinoma HP.No. 799/2021: Gross appearance and H& E stained photomicrograph of Clear cell RCC showing sheets of tumour cells having clear cytoplasm and round to oval nuclei with nuclear grade 2 morphology and metastatic deposit in perinephric lymphnode.

Others were three cases of Papillary renal cell carcinoma, one case each of mixed variant RCC exhibiting Papillary renal cell carcinoma with focal chromophobe features, Transitional cell carcinoma of the renal pelvis, Wilms tumor, RCC unclassified, and also we reported a rare case of coexisting Papillary Urothelial Carcinoma involving mainly the distal ureter and renal tuberculosis in the same kidney on the left side in a 54-year-old female patient, with a known history of treated pulmonary tuberculosis, presented with loin pain and haematuria of 2months duration [Figure -3]. The occurrence of urothelial carcinoma and renal tuberculosis in the same kidney is rare. Feeney et al. estimated that the likelihood of these diseases occurring

simultaneously in an individual is approximately 1 in 10 billion[20]. The present case findings were similar to the case report published by Feeney D et al. and Sheray N. Chin et al. and S C Hiremanth et al.[20-22]. A recently published nationwide cohort study by Y.C. Lien et al.[23] in Taiwan reported that urinary tuberculosis is associated with the development of urothelial carcinoma (1.2% of patients with urinary TB versus 0.3% of nonurinary TB patients developed urothelial carcinoma, resp. ($P < 0.001$)) but there was no association with renal cell carcinoma.

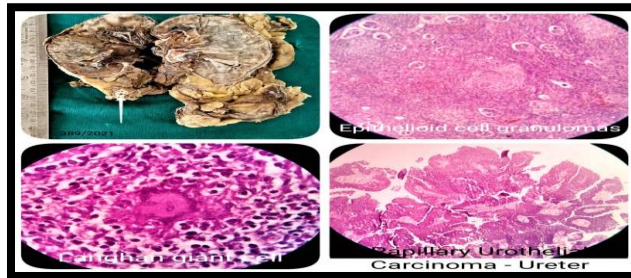
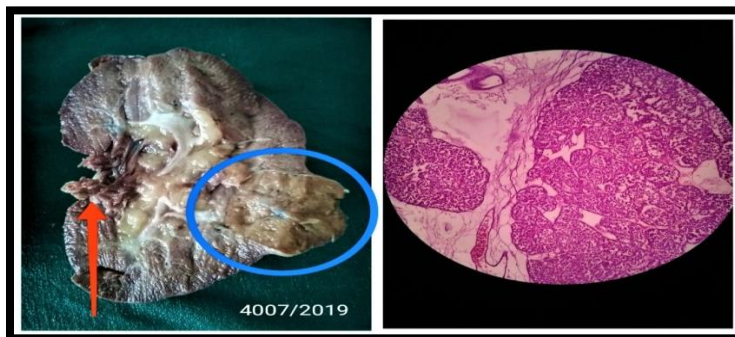


Fig 3:A Case of coexisting Urothelial carcinoma and renal tuberculosis HP.No. 389/2021: Gross appearance and H& E stained photomicrograph of Papillary Urothelial Carcinoma Ureter (white arrow) and epithelioid granulomas admixed with langhans type of multinucleated giant cells in the renal parenchyma.

Oncocytoma was the only benign tumor encountered in our study, presented in a 64-year-old male patient [Figure -4]. Similar findings were seen with studies by Vinay KS and Sujatha S, where one case of oncocytoma and one case of angiomyolipoma were reported[9].



[Figure-4]: A Case of Oncocytoma HP.No. 4007/2019: Gross appearance of Oncocytoma- Kidney with renal pelvis and ureter (orange arrow), showing a well circumscribed lesion of Oncocytoma (Blue circle). H&E stained 4x (scanner view) photomicrograph of Oncocytoma- composed of large eosinophilic cells.

In our study, out of 30 nephrectomy cases, males were 18 cases and females were 12 cases with a male to female ratio of 1.5:1. These findings were similar to the study done by Vinay KS and Sujatha S, Thaker BD et al., Reddy KD et al., Amin AN et al., Swarnlatha Ajmera et al., Which have shown male predilection [9,10,13,14,24]. However, Rafique et al. found slight female preponderance in their study[25]. In our study, the highest number of patients belongs to the age group of 41 – 50 years (non-neoplastic lesions) and 51 - 60 years (neoplastic lesions). Similar findings were seen with studies by Shah N et al., where out of 74 cases studied, the maximal number of nephrectomies were done in the age group of 51 to 60 years accounting for 17 cases and followed by 41 to 50 years of age group accounting for 15 cases [19] and studies by Vinay KS and Sujatha S, where out 71 cases studied, the maximal number of nephrectomies were done in the age group of 41 to 50 years accounting for 19 cases and followed by 51 to 60 years of age group accounting for 13 cases.[9] In our study, no cases were seen in the age group of 11-20 years and beyond 70 years of age group.

Conclusion

Nephrectomy is a widely performed surgical procedure to deal with end-stage/non-functioning/seriously damaged kidneys or in any renal mass. Kidneys can be affected by a wide range of pathological conditions. Many of these conditions possess several diagnostic challenges, in addition to clinical and radiological findings, a complete and detailed histopathological examination of every nephrectomy specimen is essential for a clinico-morphological correlation to ensure proper management protocols and to achieve a better clinical outcome of the patient.

In summary, our study showed that non-neoplastic lesions were the most common finding reported in nephrectomy specimens., Chronic pyelonephritis was being the most common among the non-neoplastic lesions. Among neoplastic lesions, Clear cell renal cell carcinoma was the common malignant tumor and Oncocytoma was the only benign lesion reported. The most commonly affected age group was 41 to 60 years of age. In our study male to female ratio was 1.5:1. Both non-neoplastic and neoplastic lesions showed male preponderance. In our study, we also reported a rare case of coexisting Papillary urothelial carcinoma and renal tuberculosis in the same kidney.

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