

# Histopathological Spectrum of Nephrectomy Specimens in a Tertiary Care Hospital

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## Abstract

**Introduction:** Nephrectomy is a standard treatment for many neoplastic and non-neoplastic pathology of kidney. The histopathological study of nephrectomy specimens confirms the clinical suspicion and also throws light on many unsuspected pathologies as well.

**Aim:** The aim of this study was to evaluate the histopathological spectrum of various neoplastic and non-neoplastic conditions of nephrectomy specimens received at our tertiary care hospital.

**Materials and Methods:** The present study was a retrospective study done in the Department of Pathology of Dr MGR Educational and Research Institute - RajaRajeswari Medical College and Hospital where nephrectomy specimens were analyzed with respect to gross and microscopic findings in-between January 2022 to July 2024.

**Result:** During the study period 35 nephrectomy specimens were received. Majority specimens received were of right side kidney accounting to 20(57.1%) cases and remaining were on left side 15cases (42.9%). Out of 35 nephrectomy specimens 22 nephrectomy specimens had a non-neoplastic pathology with chronic pyelonephritis being the most common non-neoplastic pathology. 13 were neoplastic and all were diagnosed malignant, where clear cell renal cell carcinoma was the most commonly encountered malignancy.

**Conclusion:** Nephrectomy is the standard surgical procedure for addressing both neoplastic kidney lesions and non-functioning kidneys. It is essential to subject every nephrectomy specimen to detailed histopathological examination for clinicopathological correlation, which is crucial for effective patient management.

**Key Words:** Nephrectomy, Chronic pyelonephritis, Clear cell renal cell carcinoma

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## INTRODUCTION

One of the most differentiated organ is the human kidneys which filters 1700L of blood into about 1L of highly concentrated fluid urine every day. In doing so the kidneys excretes waste products of metabolism, regulates and maintains balance of plasma constituents and also serves as an endocrine organ. <sup>1</sup> This well differentiated organ kidney has a structural complexity to handle all these physiological key functions. This structural complexity of the kidney subjects it to develop various pathological processes. <sup>2</sup>

Common clinical conditions involving the kidney include the nephritic and nephrotic syndromes, renal cysts, acute kidney injury, chronic kidney disease, urinary tract infection, nephrolithiasis, urinary tract obstruction and various cancers of the kidney. <sup>1,3</sup> These renal conditions are managed medically or surgically.

Nephrectomy is a common surgical procedure done for a variety of neoplastic and non-neoplastic diseases. Nephrectomy refers to surgical procedure of removal of kidney, which is of various types; Partial, simple and radical nephrectomy. Partial nephrectomy involves removing a small portion of the kidney. A simple nephrectomy is removal of the kidney and a section of the attached ureter which is usually done for Symptomatic chronic infections, obstructive calculous disease, severe traumatic injury and end stage renal damage.

Radical nephrectomy involves removing the entire kidney including adrenal gland and the fatty tissue surrounding the kidney which is usually done for neoplastic conditions of kidney. Radical nephrectomy is the gold standard treatment for localized renal carcinoma with a normal contralateral kidney. <sup>4</sup>

Neoplastic lesions of kidney varies from benign to malignant tumors. Malignant kidney neoplasms currently ranks

as the seventh most common cancer in men and the tenth most common in women throughout the world. Kidney cancer is the 16th most common cause of death from cancer worldwide.<sup>5</sup>

The malignant kidney tumors are unique tumors as they can have a broad histological subtypes, in few cases can have spontaneous regression of primary tumors and are known for their potential of cancer to cancer metastasis. Therefore renal cell carcinoma is considered as a great masquerader in medicine as it can produce many clinical presentations unrelated to kidney.<sup>6</sup>

Histopathological examination of the nephrectomy specimens is required for proper diagnosis, histological subtyping, grading and evaluate the prognosis of various such kidney lesions.

The aim of this study was to evaluate the histopathological spectrum of various neoplastic and non-neoplastic conditions of nephrectomy specimens.

**MATERIALS AND METHODS**

The present study was a retrospective study done in the Department of Pathology of Dr MGR Educational and Research Institute - RajaRajeswari Medical College and Hospital where nephrectomy specimens were analyzed with respect to gross and microscopic findings in-between January 2022 to July 2024.

All the nephrectomy specimens included in this study were received and fixed in 10% buffer formalin & routine tissue processing done, stained with haematoxylin & eosin. Special stains and immunohistochemistry studies were done wherever necessary.

Clinical details, gross finding, microscopic features, histopathological diagnosis, staging and grading of tumors, special stains, immunohistochemistry of all the specimens included in the study were evaluated and analyzed.

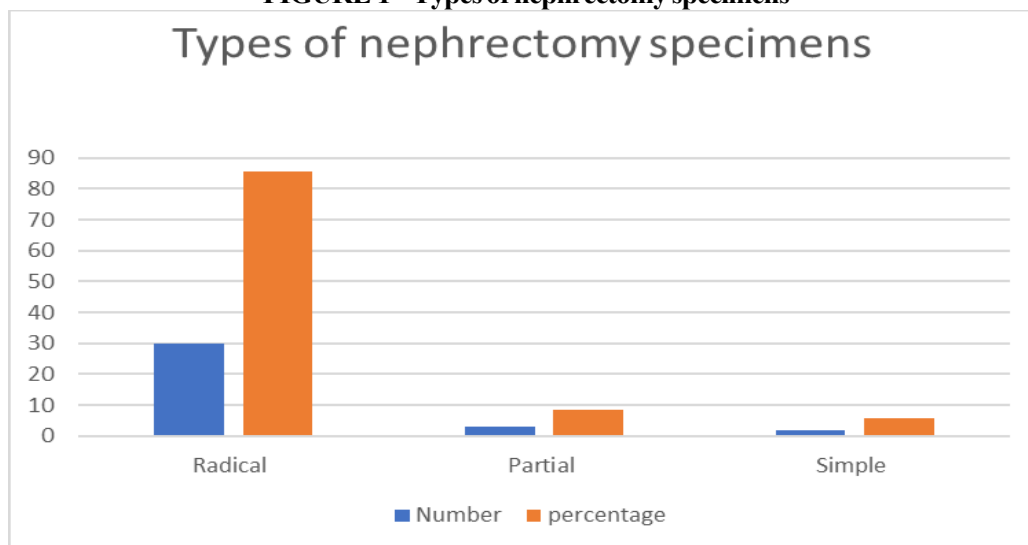
**RESULTS**

During the study period 35 nephrectomy specimen were received. Out of 35 nephrectomy specimens majority (30) were radical nephrectomy specimens with 3 being partial nephrectomy and remaining 2 constituted simple nephrectomy specimens.

**TABLE 1 - Types of nephrectomy specimens**

Specimen	Number	percentage
Radical nephrectomy	30	85.7%
Partial nephrectomy	3	8.57%
Simple nephrectomy	2	5.71%

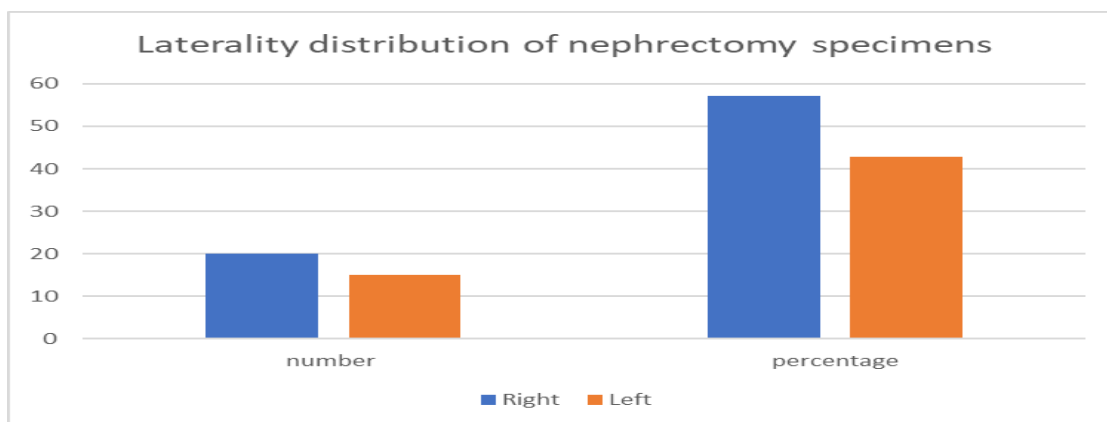
**FIGURE 1 - Types of nephrectomy specimens**



**Laterality distribution of nephrectomy specimens**

Among the 35 nephrectomy specimens which were received, majority specimens received were of right side accounting to 20(57.1%) cases and remaining were on left side 15cases (42.9%).

**FIGURE 2: Laterality distribution of nephrectomy specimens**



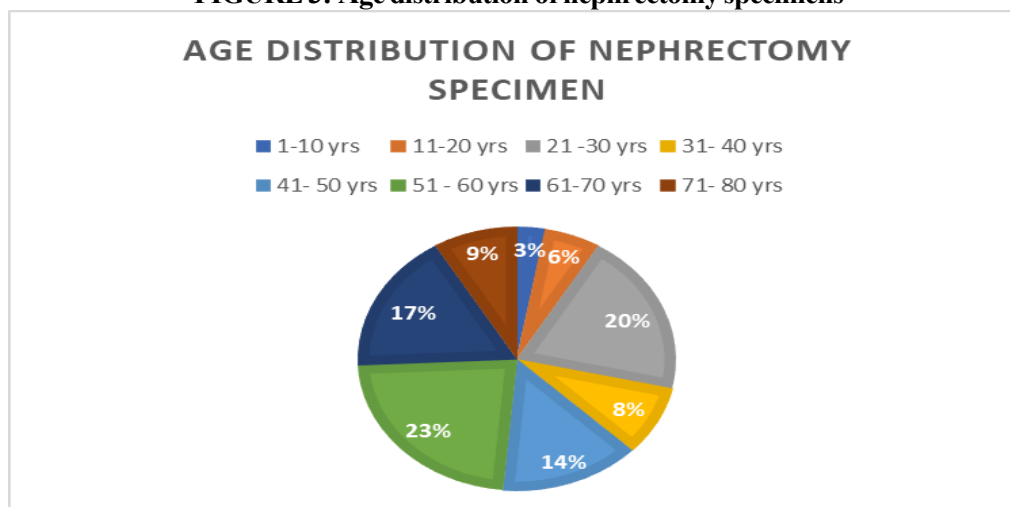
**Age distribution of nephrectomy specimens**

The patients age groups were divided depending on their age at presentation and the frequency of various disease occurring in these groups were analyzed. In our study highest number of cases were seen in age group of 51-60 years which constituted 22.8% cases followed by the age group of 21-30 and 61-70. Which constituted 20% and 17.1% as shown below. The youngest patient was 7years old and the oldest patient was 75years old.

**TABLE 2: Age distribution of nephrectomy specimens**

Age distribution of nephrectomyspecimens	Frequency	Percentage
1-10 yrs	1	2.85%
11-20 yrs	2	5.71%
21 -30 yrs	7	20%
31- 40 yrs	3	8.57%
41- 50 yrs	5	14.2%
51 - 60 yrs	8	22.8%
61-70 yrs	6	17.1%
71-80 yrs	3	8.57%
Total	35	100%

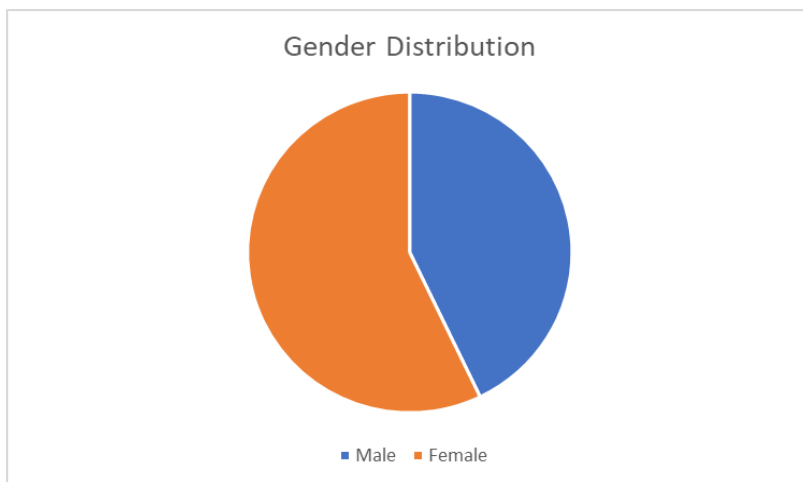
**FIGURE 3: Age distribution of nephrectomy specimens**



**Gender distribution of nephrectomy specimens**

In our study females constituted 20 cases and males 15 cases of 35 patients who underwent nephrectomy, hence the male : female ratio were 3:4

**FIGURE 4: Genderdistribution of nephrectomy specimens**



**Spectrum of histopathological diagnosis in nephrectomy specimens TABLE 3:**

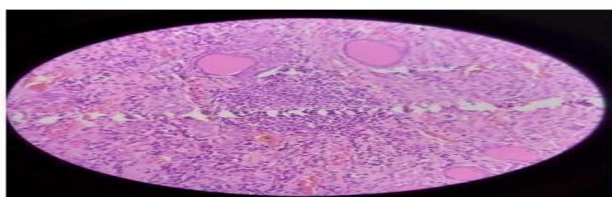
**Non neoplastic renal lesion**

Lesion	Number of cases	Percentage
Chronic pyelonephritis	14	63.6%
Chronic Pyelonephritis with Hydronephrosis	5	22.7%
Xanthogranulomatous pyelonephritis	1	4.54%
Granulomatous pyelonephritis	1	4.54%
Simple renal cyst	1	4.54%
Total	22	100%

**TABLE 4: Neoplastic renal lesion**

Lesion	Number of cases	Percentage
Clear cell RCC	7	53.8%
Chromophobe RCC	2	15.3%
Papillary carcinoma	2	15.3%
Unclassified RCC	1	7.69%
Round cell tumor possibly neuroendocrine carcinoma	1	7.69%
Total	13	100%

**Spectrum of Various Gross, Microscopic Images with Immunohistochemistry Findings in the Nephrectomy Cases Included in our Study**



**FIGURE 5: H&E stain, 40x, Microscopy of chronic pyelonephritis where tubules show peritubular fibrosis along with thyroidisation of tubules, the interstitium show plenty of lymphoid follicles with prominent germinal centre**

**FIGURE 6: Gross image of chronic pyelonephritis, the capsule is easily stripped and external surface of kidney shows scarring. Cut surface - pelvicalyceal system is dilated, reducing the renal parenchyma**



Figure 7: Gross image of chronic Pyelonephritis with hydronephrosis, kidney shows dilated pelvicalyceal system. Cortex thinned out with multiple cysts noted

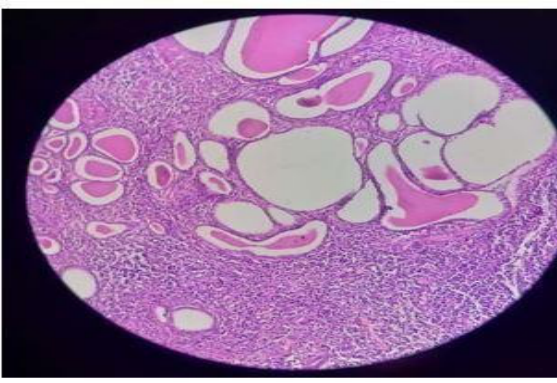


Figure 8: H&E, 10X, Microscopic image of chronic Pyelonephritis with hydronephrosis, kidney shows dilated pelvicalyceal system. Cortex thinned out with multiple cysts noted



Figure 9: Gross image of Xanthogranulomatous pyelonephritis with dilated calyces with grey yellow areas noted and

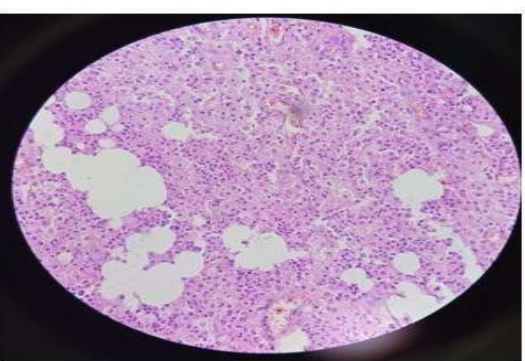


Figure 10: H&E, 40X, Microscopic image of Xanthogranulomatous pyelonephritis showing sheets of foamy histiocytes along with inflammatory cells



Figure 11: Gross image of nephrectomy specimen with granulomatous pyelonephritis showing distorted with irregular areas and perinephric fat noted

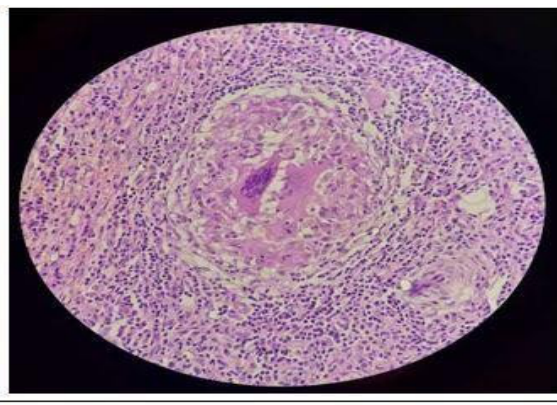


Figure 12: H&E, 40X, microscopic image of nephrectomy specimen with granulomatous pyelonephritis showing Granulomas composed of epithelioid cells, collarette of lymphocytes and multinucleated giant cells



Figure 13: Gross appearance of clear cell RCC, external surface-bosselated. Cut surface- shows a grey tan, tumor involving entire kidney with areas of necrosis. Focal areas of cystic change with mucin identified along with hemorrhagic

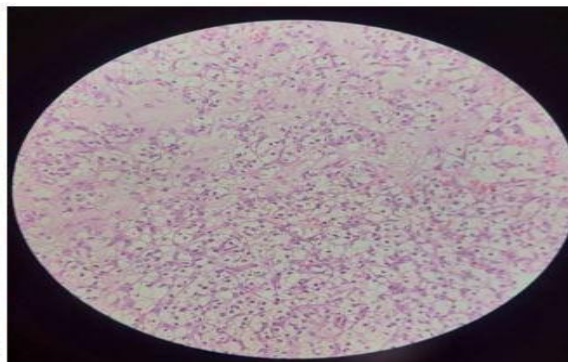


Figure 14:H&E, 10X, Microscopy of clear cell RCC, Cells are clear with optically clear cytoplasm and round to oval nuclei with inconspicuous nucleoli



Figure 15: Gross appearance of chromophobe RCC, entire kidney is replaced by a grey tan fleshy and necrotic mass with central scar.

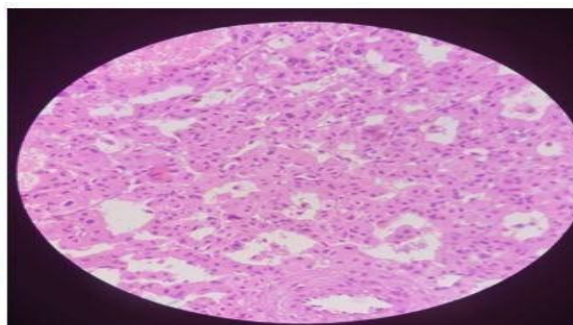


Figure 16:H&E, 40X, Microscopy of chromophobe RCC, Cells are eosinophilic, with abundant eosinophilic granular cytoplasm and prominent cell membranes. Perinuclear haloes noted. Nuclei are moderately pleomorphic, have irregular raisinoid / wrinkled appearance.

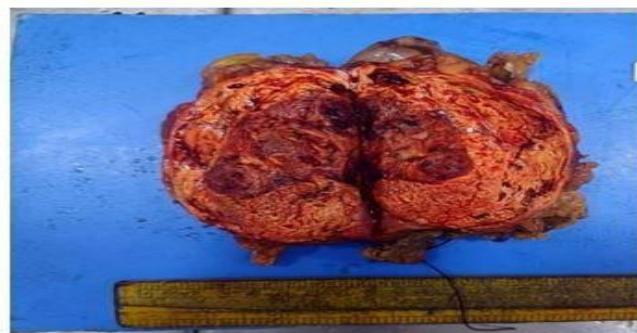


Figure 17: Gross appearance of Papillary RCC, the tumor exhibits a variegated appearance with areas of necrosis and calcification.

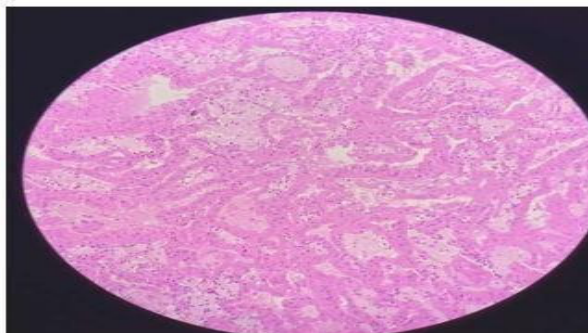


Figure 18: The papillae and tubules are lined by cuboidal to columnar neoplastic epithelium with predominant cells showing bright eosinophilic cytoplasm, pleomorphic vesicular nucleus with prominent eosinophilic nucleoli



Figure 19: Gross appearance of Unclassified RCC, the tumor has replaced the entire kidney exhibits a variegated appearance with areas of necrosis and calcification. Capsular breach in the lower pole is seen

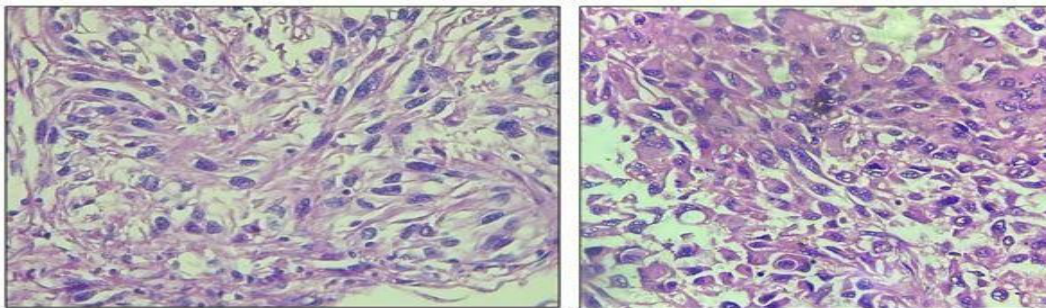


Figure 20:H&E, 40x, Microscopy of Unclassified RCC, the tumor cells shows sarcomatoid and rhabdoid morphology

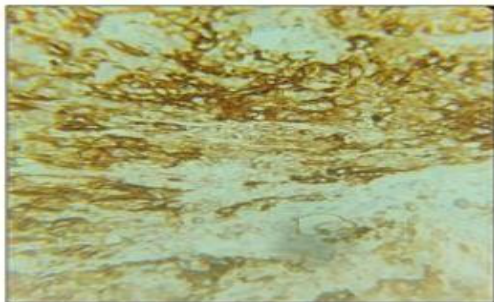


Figure 21:CD10, 40x, Positivity of tumor cells in Unclassified RCC

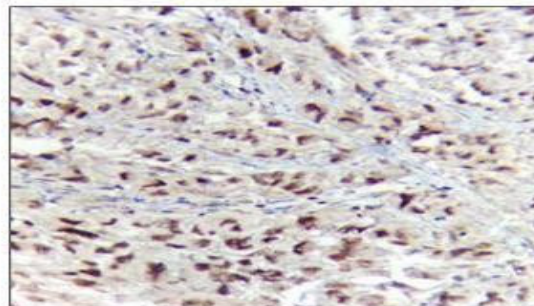


Figure 22: PAX8, 40x, Positivity of tumor cells in Unclassified RCC

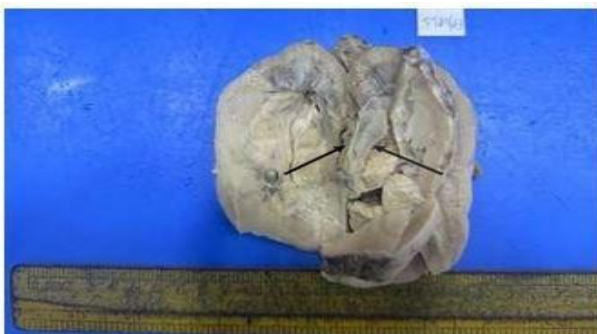


Figure 23: Gross appearance of neuroendocrine carcinoma of kidney showing a grey white tumour in the mid

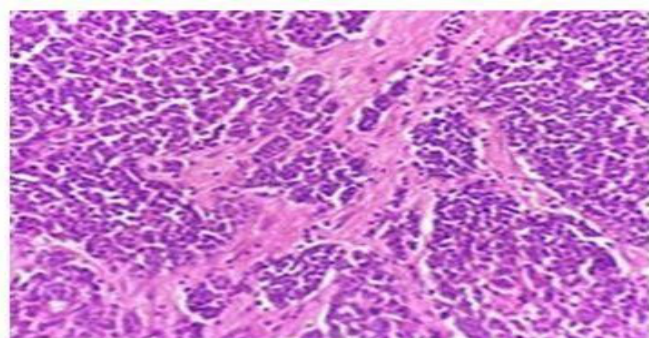
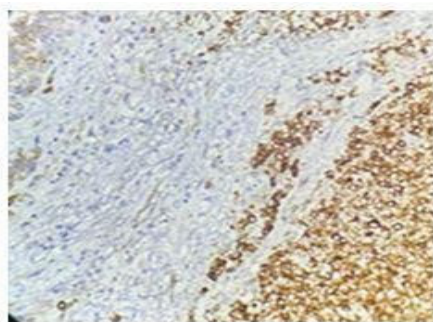
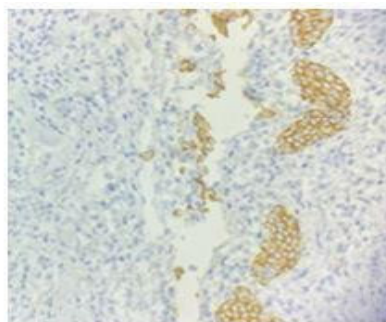


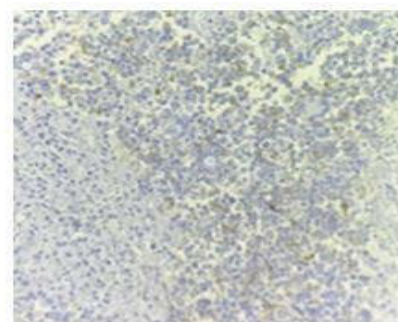
Figure 24:H&E, 40x, Microscopy of neuroendocrine carcinoma of kidney,



**Figure 25:CD10, 10x,  
Positivity of tumor cells in  
neuroendocrine carcinoma  
of kidney**



**Figure 26: PAN CK,  
10x, Positivity of tumor  
cells in neuroendocrine  
carcinoma of kidney**



**Figure 27:  
SYNAPTOPHYSIN,  
40x, Positivity of tumor  
cells in neuroendocrine  
carcinoma of kidney**

## DISCUSSION

Nephrectomy is a standard treatment offered to patients who present with benign as well as malignant mass lesions in the kidney. Radical nephrectomy is the gold standard treatment for renal cell carcinoma with a normal contralateral kidney.<sup>2,3,4</sup>

In our study out of 35 nephrectomy specimens 22 nephrectomy specimens had a non-neoplastic pathology which was compatible with the studies of to Salma M[6] et al and Basnet D[10] et al.

Out of the 22 non-neoplastic pathology 14 nephrectomies were diagnosed as pyelonephritis which was similar to Vaghani JA [12] et al, kubba [13] et al, and Malik et al. [14] but different from that of schiff and Glazier [15]. Pyelonephritis is divided into acute and chronic forms, with chronic pyelonephritis is a complex disorder leading to coarse, focal fibrosis in the kidney, causing cortical and papillary scars, dilated calyces, and distorted medullary architecture.

Out of 22 non-neoplastic pathology in this study 5 cases got diagnosed as Hydronephrosis which refers to the dilation of the renal pelvis and calyces, which is linked to the progressive atrophy of the kidney caused by an obstruction in urine outflow which was similarly seen in Sanmughaswamy [7] et al study.

In our study there were no nephrectomy cases with renal tuberculosis which was consistent with the studies of Kubba, et al [13] and Malik et al [14] where there were no tuberculosis cases which is consistent with their findings where patients with renal tuberculosis are uncommon in developed countries.

A rare entity called Xanthogranulomatous pyelonephritis was diagnosed in one of the nephrectomy specimen in our study which is a rare, distinct form of chronic pyelonephritis characterized by yellow, lobulated masses that replace renal architecture.

Xanthogranulomatous pyelonephritis can occur at any age. The youngest reported case was in 11 months and the oldest was 89 years. It most commonly occurs in adults between 5th to 7th decade, with a female preponderance of 2:1<sup>16</sup>

One rare case of simple renal cyst was diagnosed in one nephrectomy case in our study. The simple renal cysts are the most common renal cystic abnormality, which were seen similarly in the study conducted by Aiman A[8] et al These cysts are usually asymptomatic and often detected incidentally, though they can cause pain if complicated by hemorrhage or infection. They are typically located in the renal cortex and can be solitary or multiple and bilateral. Their exact origin is unclear, but they are believed to arise from diverticula of cortical tubules.<sup>3,9</sup>

In our study out of 35 nephrectomies, 13 were neoplastic and all were diagnosed malignant which constitutes 37% which is similar to studies conducted by Basnet et al[10] which was 17(24.29%) cases, Suryawanshi et al[17]and Kumar et al[18] in which 9(27.27%) and 14(28%)cases were neoplastic.

Out of 13 neoplastic cases, 7 nephrectomies were diagnosed as Clear cell RCC which accounts for 53.8%. This correlates with many studies showing higher incidence of clear cell RCC done by Aiman A et al[8], Suryawanshi et al[17], Vaghani JA et al[12], Basnet D et al[10].In our study the nephrectomy specimens with clear cell RCC were well-defined and primarily located in the renal cortex having a variegated appearance with hemorrhage or necrosis.

In our study out of 13 neoplastic cases, two nephrectomy specimens were diagnosed as Papillary RCC & other two as Chromophobe RCC accounting to 15.3%.

Papillary RCC is the second most common subtype of renal cell carcinoma, accounting for 15% to 18% of cases

in various studies.<sup>10, 12</sup> Papillary RCC can be further divided into two types: Type 1, characterized by papillae lined with a single layer of cells with scant pale cytoplasm, and Type 2, which features papillae lined by pseudostratified epithelium composed of cells with abundant eosinophilic cytoplasm and prominent nucleoli.<sup>3,5</sup>

Two cases of Chromophobe RCC in our study had a typically well-circumscribed and solitary homogeneous gray to brown appearance on the cut surface lacking any signs of hemorrhage or necrosis.

One nephrectomy in our study was diagnosed as Unclassified RCC with low grade. RCCs that don't match the well-defined subtypes are labeled as "RCC, unclassified type." This nephrectomy specimen in our study showed a large tumor which almost replaced the entire kidney exhibiting a variegated appearance with areas of necrosis and calcification. A Capsular breach was noted in the lower pole. Microscopy revealed sarcomatoid and rhabdoid areas, with pancreatic and adrenal invasion seen. Immunohistochemistry showed strong positivity to CD10 and PAX8 with negative desmin and myogenin confirming the diagnosis of Unclassified RCC. These tumors are usually large, high grade, and high stage, but a rare subset may be low grade. It's crucial to note the low grade nature in such cases, as "unclassified RCC" is often associated with very high-risk disease.<sup>5</sup>

Small cell neuroendocrine carcinomas of the kidney, resembling those in the lung, exhibit neuroendocrine differentiation both ultrastructurally and immunohistochemically. In our study one nephrectomy was diagnosed as neuroendocrine carcinomas of the kidney with tumor cells arranged in nested and trabecular pattern having salt and pepper chromatin, which was confirmed by immunohistochemistry studies with positive CD10, PANK, synaptophysin. Such cases should be distinguished from urothelial carcinoma with neuroendocrine features with the help of special studies on immunohistochemistry.<sup>3,5</sup>

Thus the various spectrum of neoplastic and non-neoplastic conditions were individually studied and evaluated in the present study.

## CONCLUSION

Nephrectomy is the standard surgical procedure for addressing both neoplastic kidney lesions and non-functioning kidneys. Studies from developing countries indicate that non-neoplastic conditions remain the primary reason for nephrectomy. The current study highlights the morphological patterns of lesions observed in nephrectomy specimens at our institution, revealing that non-neoplastic lesions are the most prevalent in our setting. Chronic pyelonephritis emerges as the leading cause of nephrectomy in our study, underscoring its significance. Each nephrectomy case should be thoroughly investigated to determine the underlying cause, ensuring accurate diagnosis and treatment. It is essential to subject every nephrectomy specimen to detailed histopathological examination for clinicopathological correlation, which is crucial for effective patient management. Comprehensive histopathological analysis of nephrectomy specimens is vital for classifying lesions and grading neoplastic conditions, which in turn guides treatment decisions.

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