Original Article

Histomorphological Spectrum of Lesions in Nephrectomy Specimens- A 5-Year Retrospective Study at a Tertiary Care Centre

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Abstract

Background: Nephrectomy specimens encompass a broad range of non-neoplastic and neoplastic renal lesions. Histopathological examination remains essential for establishing the exact diagnosis, identifying unexpected pathology, and guiding further patient management. The present study was undertaken to evaluate the histomorphological spectrum of lesions encountered in nephrectomy specimens over a 5-year period at a tertiary care centre. **Material and Methods:** This retrospective observational study included all nephrectomy specimens received in the Department of Pathology, NCR Medical College, from 1 January 2021 to 31 December 2025. Clinical details, indication for surgery, and type of nephrectomy were recorded. Archived hematoxylin and eosin-stained slides were reviewed, and special stains were assessed wherever required. The lesions were analyzed with respect to histopathological diagnosis, age, sex, and type of surgery performed. **Results:** A total of 60 nephrectomy specimens were studied. Non-neoplastic lesions constituted the majority of cases (52/60; 86.6%), whereas neoplastic lesions accounted for 8 cases (13.3%). Chronic pyelonephritis was the predominant lesion overall (41 cases; 68.3%) and represented the most frequent non-neoplastic indication for nephrectomy. Among neoplastic lesions, renal cell carcinoma was the most common tumor (5 cases; 8.3%). Other lesions identified included xanthogranulomatous pyelonephritis, renal tuberculosis, pyonephrosis, traumatic kidney, polycystic kidney disease, papillary urothelial carcinoma, primary renal lymphoma, and multilocular cystic renal neoplasm of low malignant potential. The most commonly affected age group was 41–50 years, and males were more frequently affected than females, with a male-to-female ratio of 1.5:1. Most specimens were total nephrectomies, while radical nephrectomy was performed in two malignant cases. **Conclusion:** Non-neoplastic renal lesions were more frequent than neoplastic lesions in nephrectomy specimens in the present study, with chronic pyelonephritis being the leading cause. Careful histopathological evaluation of every nephrectomy specimen is indispensable not only for definitive diagnosis but also for detecting incidental lesions, classifying malignancies, and contributing to appropriate patient management.

Keywords: Nephrectomy, chronic pyelonephritis, renal cell carcinoma, renal lesions, histopathology, tertiary care centre.

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Introduction

Kidney is a commonly involved organ in variety of lesions and many of them involve its removal. Nephrectomy is one common surgical procedure performed for various neoplastic and non-neoplastic conditions like end stage renal disease, renal malignancy, obstructive nephropathies etc.

Depending on the underlying cause, nephrectomy can be a partial, simple or radical. In partial nephrectomy only part of kidney is removed and rest is left in the body. In simple nephrectomy, entire kidney with part of ureter is removed. In Radical nephrectomy entire kidney including fascia, adrenal gland and adjacent fatty tissue are removed.[1]

Common non-neoplastic conditions leading to nephrectomy are non-functional kidney due to obstructive nephropathy, hydronephrosis, polycystic kidneys and chronic pyelonephritis.[2] Radical nephrectomy is preferred over other procedures in cases of malignancy.[3] In cases of bilateral renal malignancy or renal malignancy involving solitary functional kidney, partial nephrectomy is preferred.[4]

Renal cell carcinoma (RCC) accounts for 2-3% of all adult cancers and 85% of all kidney tumours. This increasing incidence is attributed to improved imaging techniques, better healthcare and increased life expectancy.[4,5] Clear cell type is the most common subtype of RCC, accounting for 70% of all cases of renal malignancy.[6] Renal tumors comprise a wide range of benign and malignant neoplasms with distinct features specific for children and adults. Primary Renal Lymphoma (PRL) and Primary neoplasms of renal pelvis are other rare tumors of kidney, accounting for <1% and 7% of all renal tumors, respectively. Urothelial carcinoma (UC) is less common along the upper urinary tract (renal pelvis and ureter) with an incidence of 5-10%.[7]

The importance of histopathological evaluation in nephrectomy

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specimens is stressed upon in many recent studies, as clinical and radiological findings alone may not fully capture the complexity of underlying lesions.[8] Hence, drawing a correlation between clinical presentation, imaging, and histopathological findings can enhance diagnostic accuracy and influence treatment strategies for patients. Nephrectomy specimens can also provide valuable data on prevalence of various diseases, their demographic distribution, and patterns in populations.

Histological exploration of every nephrectomy specimen is required to look for not just changes in kidney but also to find the underlying cause, any occult primary and also for staging and tumor typing, in cases of malignancy.

The current study was taken up to analyse the trend in various renal lesions, types of surgery, gender & age distribution of different entities.

Materials and Methods

Study Design: This is a retrospective, observational study done over a period of 05 years (1st January 2021 to 31st December, 2025).

Study Place: Department of Pathology, NCR Medical College.

Ethical Clearence: Study was done after ethical clearance from the ethical society of the institute.

Sampling method and sample collection: All the nephrectomy specimens received during this study period were taken up for study.

Inclusion Criteria

All the patients undergoing nephrectomy irrespective of gender and age.

Exclusion Criteria

a) Needle biopsies not to be included.

b) Patients not willing to be part of study.

Methodology-

1. A record of detailed patient history, indication and type of surgery were retrieved.
2. For retrospective cases, records were maintained from the patient data and H&E slides already available in our department.
3. Detailed gross study and grossing was done for all the nephrectomy specimens received in 10% neutral buffered formalin.
4. H&E staining was performed in all the specimens for routine microscopy. Special stains like PAS, ZN were performed as and when required.
5. At the end of study period, 2.5 months period was used for data compilation and analysis.

Results

All the nephrectomy specimens were total nephrectomy. Out of 60 nephrectomy specimens, non-neoplastic lesions (86.6%) were more common than neoplastic lesions (13.3%). In neoplastic lesions, all cases were malignant and no benign case was there in our study. [Table 1]

Table 1: Distribution of neoplastic and non-neoplastic lesions in nephrectomy specimens

Non- neoplastic	52	86.6%
Neoplastic	08	13.3%

Chronic pyelonephritis was most common non-neoplastic lesion (68.3%) and clear cell RCC was m.c neoplastic entity (08.3%). [Table 2]

Table 2: Spectrum of lesions in Nephrectomy specimens

	No of cases	%age
Non-neoplastic		
Chronic Pyelonephritis	41	68.3%
Xanthogranulomatous Pyelonephritis	04	06.67%
Renal Tuberculosis	02	03.33%
Traumatic Kidney	02	03.33%
Pyonephrosis	02	03.33%
Polycystic Kidney Disease	01	01.67%
Neoplastic		
Renal Cell Carcinoma	05	08.3%
Papillary Urothelial Carcinoma	01	01.67%
Lymphoma Kidney	01	01.67%
Multilocular cystic Renal neoplasm of low malignant potential	01	01.67%

The m.c affected age group by kidney lesions was 41-50 years and males were affected more as compared to females (M:F- 1.5:1). The youngest patient was 10 years old and the eldest was 72 years old. Neoplastic lesions were more common between age group of 41-50 years followed by 51-60 years. While non-neoplastic lesions were commonly seen in age group of 41-50 years followed by 31-40 years. [Table 3-5]

Table 3: Age distribution of nephrectomy specimens

Age group	Number of cases	%age
0-10	01	1.67%
11-20	03	05%
21-30	09	15%

31-40	12	20%
41-50	18	30%
51-60	10	16.67%
61-70	05	08.33%
>70	02	03.33%

Table 4: Sex distribution of nephrectomy specimens

	No. of cases	%age
Male	36	60%
Female	24	40%

Table 5: Age wise distribution of neoplastic and non-neoplastic lesions

Age	Non-neoplastic	Neoplastic
0-10	01	
10-20	03	
21-30	09	
31-40	12	
41-50	13	05
51-60	08	02
61-70	04	01
>70 years	02	

Non-neoplastic lesions were overall common in both males and females. However, neoplastic lesions were more common in males. [Table 6]

Table 6: Gender wise distribution of neoplastic and non-neoplastic lesions

	Non-neoplastic	Neoplastic
Male	29	07
Female	23	01

Amongst females CPN was the m.c lesion leading to nephrectomy. And all the 4 cases of xanthogranulomatous pyelonephritis were seen in females only. Amongst males, CPN was the m.c non-neoplastic and clear cell RCC was the m.c malignant cause of nephrectomy. [Table 7]

Table 7: Gender wise distribution of various renal lesions

	Males	Females
Chronic Pyelonephritis	13	18
Xanthogranulomatous Pyelonephritis	00	04
Renal Tuberculosis	02	00
Pyonephrosis	01	01
Traumatic Kidney	02	00
Renal Cell Carcinoma	04	01
Papillary Urothelial Carcinoma	01	00
Lymphoma Kidney	01	00
Multilocular cystic Renal neoplasm of low malignant potential	01	00

The type of surgery performed was mainly total nephrectomy, partial nephrectomy was not seen in any of the cases. In two cases of renal malignancy, radical nephrectomy was performed. [Table 8]

Table 8: Type of surgery

Type of surgery	No. of cases
Total Nephrectomy	58
Radical Nephrectomy	02
Partial Nephrectomy	00

Discussion

In present study, out of 60 nephrectomy specimens 52(86.6%) were non-neoplastic and 08(13.3%) were neoplastic. Similar observations were made by Vinay et al,[2] Prasad et al,[5] Chandanwale et al,[10] Aiman et al,[11] R et al,[12] and Hansdah et al.[13] However, neoplastic lesions were more common in study published by Narang et al.[4]

CPN was m.c entity leading to nephrectomy followed by RCC. CPN was also m.c non-neoplastic lesion followed by xanthogranulomatous pyelonephritis, pyonephrosis, traumatic kidney and renal tuberculosis. Clear cell RCC was m.c malignant variant. These observations were similar to Vinay et al,[2] Prasad et al,[5] Chandanwale et al,[10] Aiman et al,[14] and Reddy et al.[15] Cases of xanthogranulomatous pyelonephritis showed a female preponderance.[2,14,11] This is similar to findings by Aiman et al,[10] and Popat et al.[16] In current study, there were two cases each of renal tuberculosis and traumatic kidney lesions. Traumatic kidney was seen in young adults only. Hence, the need

for early diagnosis and better treatment is advocated here as early intervention can easily save kidney in non-neoplastic conditions.

The most common age group affected by overall kidney lesions was 41-50 years. This is in concordance with studies published by Vinay et al,[2] Prasad et al,[5] Chandanwale et al,[10] and Hansdah et al.[13] In study by Aiman et al,[11] m.c age group was 21-30 years while 51-60 years was common age group in study by Ajmera et al.[14] The youngest patient was 10 years with traumatic kidney lesion and eldest was 72 years female with CPN. For non-neoplastic lesions, age group between 41-50 years, was seen to be affected more (22.7%). However, this finding was in contrast to studies by Chandanwale et al,[10] and Aiman et al.[11] This could be due to poor access to better healthcare in our population under study, hence leading to nephrectomies in comparatively younger age group.

Males were slightly more commonly affected as compared to females for overall kidney lesions (1.5:1). Also, malignancy was more common in males (87.5%) and a single case in females. This is similar to the findings published by Vinay et al,[2] Narang et al,[4] Ajmera et al,[14] and Reddy et al.[15]

RCC was m.c renal neoplasm and clear cell RCC was its m.c subtype. Malignant neoplasms were more common as compared to benign neoplasms; 100% malignant in present study. The age ranged from 41-70 years. Males were affected more as compared to females. This was similar to findings by Thakur et al,[1] Vinay et al,[2] Prasad et al,[5] Chandanwale et al,[10] Aiman et al,[11] and Popat et al.[16] RCC can also be diagnosed incidentally without causing symptoms as was seen in one of our cases. Similar findings were also made by Jonsson et al with a rate of 7.1/1000 cases of autopsy.[17]

An interesting case was also seen, where a young 46 year old male with known case of Human Immunodeficiency Virus (HIV) and Hepatitis C (HCV) had undergone total nephrectomy for non-functional kidney. Microscopic examination showed dual pathology comprising of renal tuberculosis and incidental finding of clear cell RCC. This finding would have gone unnoticed if histological examination was not done. Studies have reported an incidence ratio of renal malignancy in HIV/AIDS to be 1.50 with clear cell RCC being the m.c histologic variant.[18,19] [Figure 1,2]

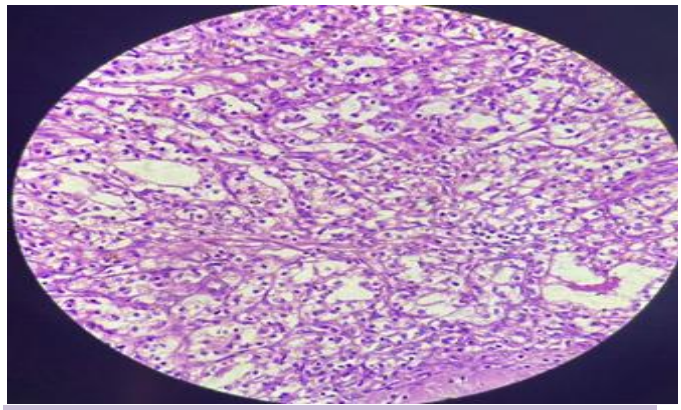

Figure 1: Tumor cells arranged in nests with clear cytoplasm and distinct cell borders. (H&E, 40x)

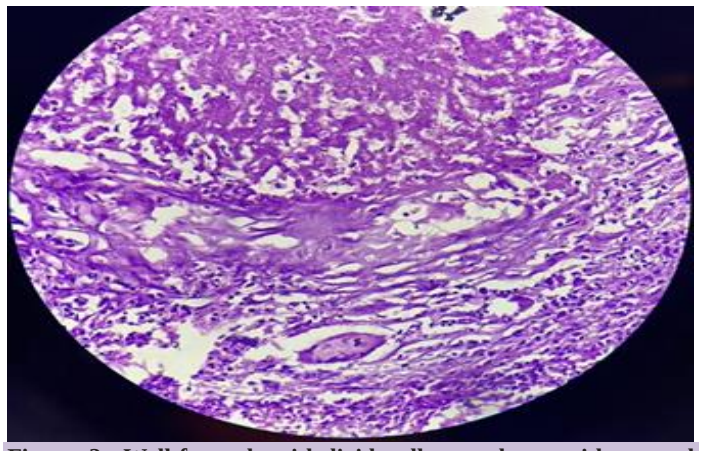

Figure 2: Well-formed epithelioid cell granuloma with central necrosis and multinucleated giant cell. (H&E, 40x)

We had 1 case of lymphoma kidney which was PRL and reported as diffuse large B-cell lymphoma. It was seen in a 53 years old male patient who presented with flank pain. It was CD 19 and CD 20 positive with high ki 67index. Primary renal lymphomas are rare tumors forming <1% of all renal masses. [20] Similar, findings were noted by Nasrollahi et al. [21] CNS involvement is commonly seen in PRL. Hence, diagnosing it very important for further follow-up of the patients.[20] [figure 3,4]

Figure 3: Gross of lymphoma kidney showing diffusely involved renal parenchyma.

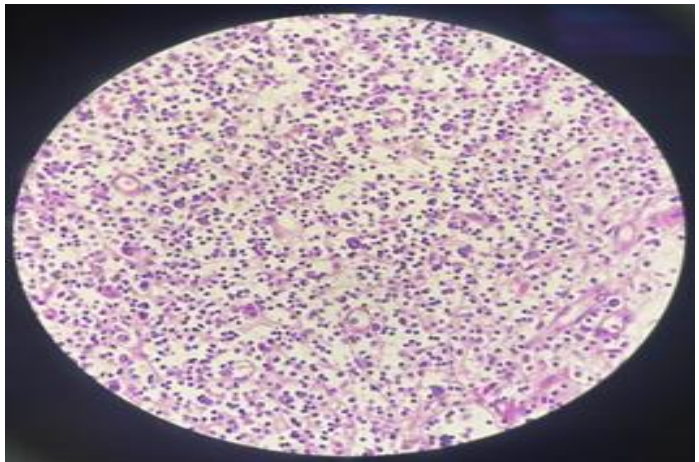

Figure 4: Singly scattered large atypical lymphoid cells. (H&E,10x)

1 case of Papillary urothelial neoplasm of renal pelvis was seen. Gross showed papillary projections diffusely involving the renal pelvis and ureter. Microscopy showed malignant tumor arranged in papillary pattern with transitional cell type morphology. Incidence of UC generally peaks in ages of 70-90 years. [7] But in our study, the patient was of younger age group 47 years.

Another rare tumor, multilocular cystic renal neoplasm was also seen in single patient. It comprises of multiple cystic spaces separated by thin fibrous septae. The tumor cells were monomorphic with clear cytoplasm. Similar case was also reported by Narang et al,[4] [Figure 5,6].

Figure 5: Gross specimen showing a multicystic tumor at upper pole of kidney.

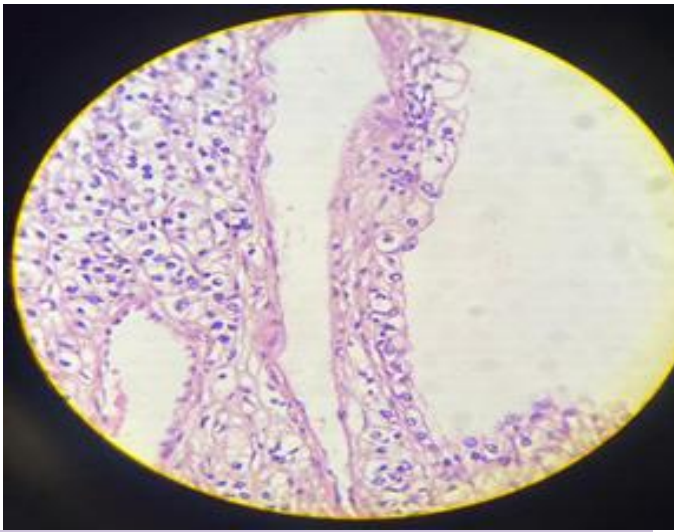

Figure 6: Cystic space lined by cells with clear cytoplasm and bland nuclei. (H&E, 40x)

Conclusion

Histopathological examination of every nephrectomy specimen provides an insight into not only morphological details and variations of the pathology of the lesion but also guides in diagnosis and further, its management. It also helps in staging and grading of the malignant lesions. Hence, histopathology forms an important part of all the nephrectomy specimens.

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Conflicts of interest

There are no conflicts of interest.

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