



ISSN (P): 2617-7226
ISSN (E): 2617-7234
www.patholjournal.com
2024; 7(3): 235-240
Received: 08-05-2024
Accepted: 19-06-2024

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Histopathological study of nephrectomy specimens in tertiary care hospital

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DOI: <https://doi.org/10.33545/pathol.2024.v7.i3d.606>

Abstract

Background and Aim: Function of human kidneys is to produce about 1 L of a highly concentrated fluid called urine from more than 1700 L of blood per day. Kidney diseases can be divided into those that affect the four basic morphologic components: glomeruli, tubules, interstitium, and blood vessels. The study here is done to observe various histopathological findings in nephrectomy specimens received in our tertiary care hospital which caters both rural and urban population. Study also focuses on age and sex distribution, neoplastic and non-neoplastic distribution along with the histopathological features.

Material and Methods: The study was carried out for a period of 1 year from March 2023 to February 2024 which included all the nephrectomy specimen received in the department of pathology, B.J Medical College, Ahmedabad, Gujarat. A total of 50 nephrectomy specimens were received in the given study period. Patient particulars including age, sex, clinical diagnosis along with gross morphology and microscopic details were noted from the data available with our department.

Result: In the present study male to female ratio is of 2.1:1. Maximum patients with nephrectomy were in the age group of 45-60 yrs. The data according to age incidence, sex incidence and nature of the lesion was prepared and analyzed. 34 (68%) cases were of non-neoplastic lesions while 16 (32%) cases were of neoplastic lesions. Among neoplastic lesions 6 (37.5%) cases are benign and 10(62.5%) cases are malignant. Renal cell carcinoma is most common among malignant lesions.

Conclusion: Chronic Pyelonephritis is most common non-neoplastic cause of nephrectomy. Non-neoplastic lesions were most common cause for nephrectomies. Clear cell renal cell carcinoma is most common among malignant tumors. Increase in availability of early diagnosis and appropriate better targeted treatment facilities for renal disorders can cause decrease in need of surgical treatment for non-neoplastic lesions of kidney.

Keywords: Nephrectomy, renal cell carcinoma, xanthogranulomatous change, wilms tumor

Introduction

Role of kidney is to excrete waste products of metabolism and maintains the appropriate acid-base balance of plasma. It also secretes hormones such as erythropoietin, renin, and prostaglandins, and regulates vitamin D metabolism^[1]. The renal parenchyma is usually last to respond to repeated trauma or insults of the noxious environment^[2].

Kidneys are affected by various non-neoplastic and neoplastic pathological processes. 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 neoplasms of the kidney^{[3][1]}. Nephrectomy is an accepted surgical procedure for nonfunctioning kidneys due to various pathological disease processes. Both benign and malignant tumours occur in kidney and among different malignant tumours, majority of renal neoplasms are malignant, with renal cell carcinoma and Wilms' tumour being the most common^{[5][6]}. Renal cell carcinoma accounts for approximately 2 percent of adult malignancies and 80-85 percent of malignant kidney tumours. Renal cell carcinoma occurs twice as commonly in men than in women, it is primarily a disease of elderly patients, typically presenting in the fifth to seventh decades of life^[6, 7]. Wilms tumour, though ranked fifth in frequency among childhood solid tumours, is the most common childhood abdominal malignancy; however, <1% of Wilms tumour occurs in adults^[8].

For accurate diagnosis histopathology evaluation of renal tumor is necessary. Moreover, currently the ideal standard in the treatment of all tumors of kidney is radical or partial

nephrectomy. Histopathologic examination of tumor in nephrectomy specimens is essential to establish histologic type and to interpret histopathological prognostic markers like i.e. tumor size, histological subtype, nuclear grade, and stage in cases of malignant lesion^[9]. The study was done in tertiary care hospital to evaluate benign and malignant lesions encountered in nephrectomy specimens.

Aim and Objective

To study histopathological findings of nephrectomy specimens received in BJ Medical College. To study age and sex wise prevalence of various neoplastic and nonneoplastic lesions and discuss the result of the study with various other studies which will further aid the management and prognosis of the disease.

Materials and Methods

Study Design and Setting: This present study was conducted at the Histopathology Section, Department of Pathology, B.J. Medical College, Ahmedabad, from March 2023 to February 2024. During the study period total 50 nephrectomy specimens were received

Sample Collection and Processing: Nephrectomy specimens were received and fixed in 10% buffered formalin for 24 hours. Grossing of nephrectomy specimens was done according to the standard protocol^[10, 11]. Sections then undergo routine paraffin processing in which tissue is dehydrated through a series of graded ethanol baths to displace the water, and then infiltrated with wax. The infiltrated tissue is then embedded into wax blocks. A thin rim of section will be cut from wax blocks through microtome. Serial and thinner sectioning was done wherever required. Further section will be stained with H & E, a combination of Hematoxylin and Eosin which is commonly used tissue stain in histopathology.

Multiple sections were studied and pathological evaluation of nephrectomy specimens was done taking into consideration with clinical and radiological findings. Tumors were further classified according to 2022 WHO classification and staging was done according to AJCC Cancer Staging Manual 8th ed. 2017.

Inclusion criteria

Nephrectomy Specimen of any age and sex having non neoplastic or neoplastic (benign and malignant) lesions that has undergone histo-pathological examination following surgery was included in this study.

Exclusion criteria

The patients who underwent core needle biopsies from their renal masses were excluded.

Results

Total 50 cases of nephrectomy specimens were studied in the study period of 1 year. 34 specimens were of male patients and 16 specimens of female patients. Male: Female ratio is calculated which is 2.1:1(Chart 1). Most common age group observed is 45 to 60 years (Chart No. 2). Youngest patient in our study is 1year old and oldest patient in the present study is of 85 years, both the patient biopsy was diagnosed as Chronic pyelonephritis. Lesions were divided into neoplastic 16 cases (32%) and nonneoplastic 34 cases (68%). Among neoplastic cases 6 cases are of benign nature and 10 cases were malignant. Within Non neoplastic

lesion 21 are male and 13 are female. And in neoplastic lesions 13 patients are male and 3 are female (Chart No. 3). Histopathological diagnosis shows Chronic Pyelonephritis (48%) as most common lesions in present study. Renal Cell Carcinoma shows maximum cases in neoplastic lesions (16%). Xanthogranulomatous Pyelonephritis shows 10% distribution with 5 cases. In other nonneoplastic lesions Tuberculous Granulomatous inflammation (4%) and Emphysematous Pyelonephritis (2%) are also diagnosed. Benign cases showing Renal papillary adenomatosis (6%), Hybrid renal Oncocytic/Chromophobe tumor (2%), Multilocular mucinous cystic neoplasm of kidney with low malignant potential (2%) and Angiomyolipoma (2%) are diagnosed in the study. Along with Renal cell carcinoma other malignant cases diagnosed are Wilms Tumor and Neuroblastoma (1 case of each). (Table No. 1) Wilms Tumor and Neuroblastoma are most commonly seen in childhood period^[8, 12]. In present study rare case of adult Wilms Tumor having age of 28yrs is seen while neuroblastoma is diagnosed in 3 year old child.

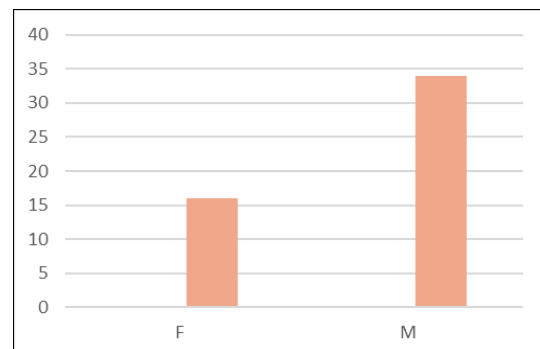


Chart 1: Sex wise distribution of patients

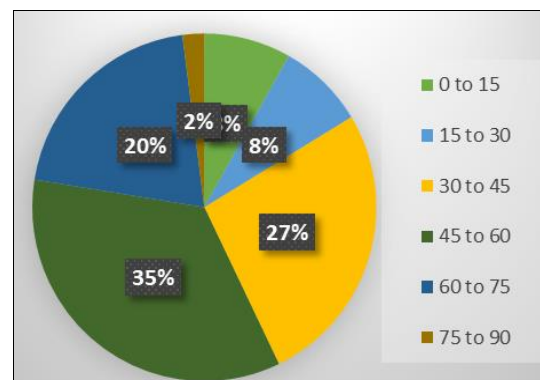


Chart 2: Age wise distribution of patients

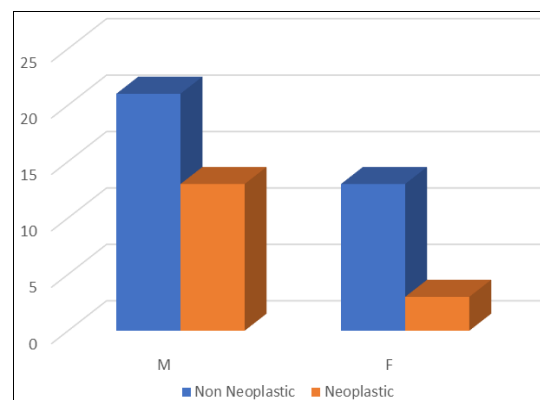


Chart 3: Distribution of Neoplastic and nonneoplastic lesion correlated with sex of patient

Table 1: Distribution of Nephrectomy specimens according to Histopathological lesions

Sr. No.	Diagnoses	No of cases	%
Nonneoplastic			
1	Chronic pyelonephritis	24	48
2	Xanthogranulomatous Pyelonephritis	5	10
3	Pyelonephritis with cystic changes	2	4
4	Emphysematous pyelonephritis	1	2
5	Tuberculous Granulomatous inflammation of kidney	2	4
Neoplastic			
Benign			
6	Renal papillary adenomatosis	3	6
7	Angiomyolipoma	1	2
8	Multilocular mucinous cystic neoplasm of kidney with low malignant potential	1	2
9	Hybrid renal Oncocytic/Chromophobe tumour	1	2
Malignant			
10	Neuroblastoma	1	2
11	Wilms tumour	1	2
12	Renal Cell Carcinoma	8	16

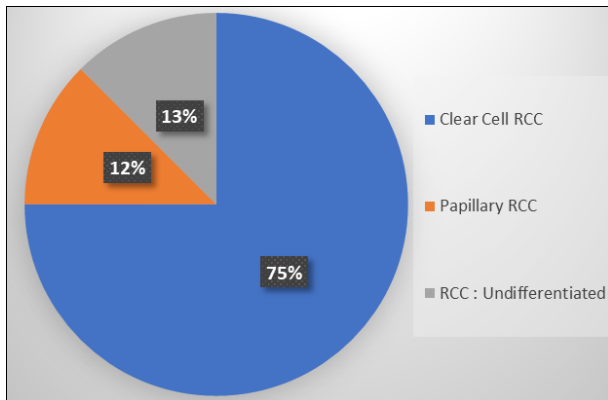


Chart 4: Distribution of Histological variant of Renal Cell Carcinoma

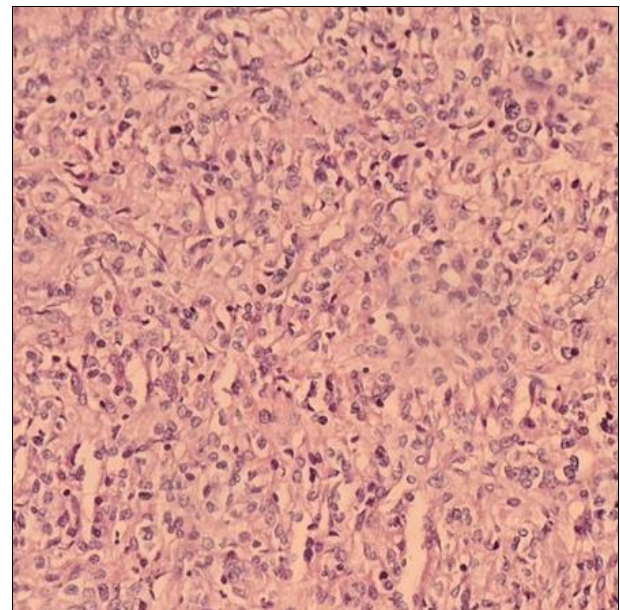


Fig 2: H&E section of Clear cell RCC



Fig 1: Gross of RCC kidney specimen showing growth with hemorrhage and necrosis

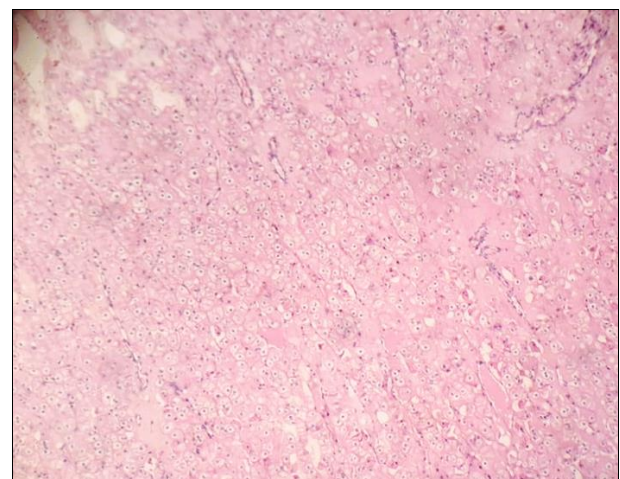


Fig 3: Hybrid Renal Oncocytic Tumor, H&E staining

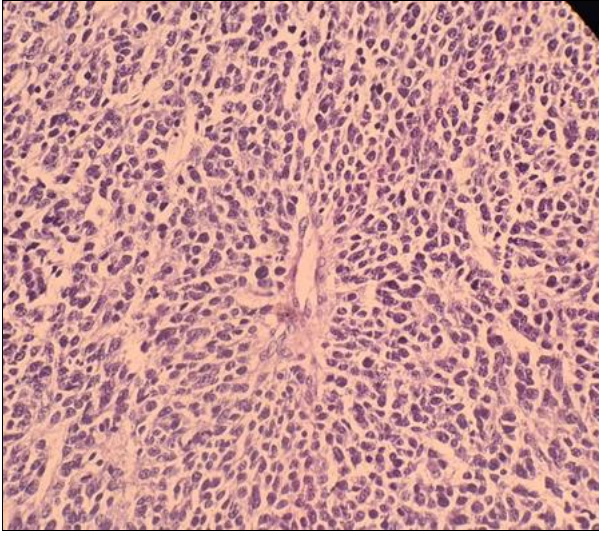


Fig 4: H&E of Neuroblastoma showing pseudorosette

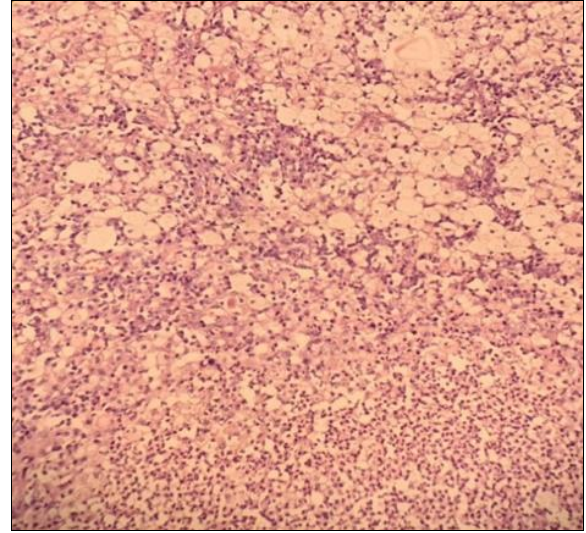


Fig 5: Xanthogranulomatous Pyelonephritis, H&E staining

Table 2: Microscopic findings in Chronic Pyelonephritis.

Histological findings in CPN	No. of cases of CPN	% of Cases
Glomerular Sclerosis with hyalinization	20	83.3
Tubular atrophy	11	45.8
Thyroidization of tubules	21	87.5
Interstitial inflammation (Acute or chronic)	23	95.8
Interstitial fibrosis	2	8.3
Atrophic renal parenchyma	4	16.66
Hyalinized vasculature	12	50

Table 3: Microscopic findings in Renal Cell Carcinoma

Microscopic Features	Clear Cell RCC	Papillary RCC	RCC: Undifferentiated
Rhabdoid features			1
Sarcomatoid features			1
Necrosis	5	1	1
Hemorrhage	2	1	
Lymphovascular permeation	2		
Capsular invasion		1	1
Perinephric fat invasion	2	1	1
Renal sinus fat invasion	4	1	
Renal pelvis invasion	3	1	
Ureter and renal vessel invasion			
ISUP grading			
Grade 1	2		
Grade 2		1	
Grade 3	4		
Grade 4			1
Pathological tumor grading			
T ₁	2		
T ₂		1	1
T ₃	4		
T ₄			

Studying the microscopic findings of Chronic pyelonephritis, Tubular atrophy and Thyroidization of tubules were seen in 11 and 21 cases respectively. Maximum number of cases i.e. 23(95.8%) cases were found to have interstitial inflammation as shown in Table no. 2. Glomerular sclerosis with hyalinization and hyalinized vasculature were seen in 83% and 50% cases respectively. Among malignant cases, RCC includes 6 cases of Clear Cell Carcinoma, 1 case of Papillary Carcinoma and 1 case of Undifferentiated RCC (Chart No.3). Table No. 3 shows the microscopic features of Renal cell carcinoma. In clear cell RCC out of 6 cases 4 cases exhibited ISUP nuclear grade 3 and 2 cases shows ISUP nuclear grade 1. One case of

Papillary RCC exhibits ISUP nuclear grade 2 and one case of RCC: Undifferentiated exhibits ISUP nuclear grade 4. Most common microscopic finding in RCC is necrosis. Most frequent invasion recorded in RCC is Renal sinus fat invasion. AJCC Pathologic tumor grading T₃ is reported in 4 cases of Clear cell RCC and 2 cases of Clear cell RCC reported as pT₁. Both Papillary RCC and RCC: Undifferentiated are reported as pT₂.

Wilms Tumor reported in 28 year male patient showed histology of 3 components undifferentiated blastema, stromal tissue, and epithelial tissue. Neuroblastoma reported in 3 year male patient is reported as Undifferentiated Neuroblastoma Stroma Poor Type. In one case of classical

Angiomyolipoma., cut section shows multiple yellowish areas and microscopically fatty tissue, blood vessels and muscle component are seen. Multilocular mucinous cystic neoplasm of kidney with low malignant potential and Hybrid renal Oncocytic/Chromophobe tumour are rare benign cases diagnosed in the study. Both patients presented in 4th decade of age.

Discussion

In the present study, out of 50 nephrectomy specimens studied, 68% had benign lesions and 16% had malignant lesions. Thus, benign lesions outnumber the malignant lesions. This is similar to the study done by Aiman A *et al.* [4], Gupta A *et al.* [13]. Males constituted 34 cases (68%) and females constituted 16 cases (32%) with a M:F ratio of 2.1:1. Gupta A *et al.* [13] study shows 61% male and 39% female, Shah N. *et al.* [14] shows 62% male patients and 38%

female. In our study maximum cases were seen in the age group of 45-60 years, similar to the study by Kumar M *et al.* [15], Aggarwal S *et al.* [16].

Table 4: Comparison of distribution of nonneoplastic and neoplastic lesion with other studies

Sl. No.	Authors	No. of cases	Non neoplastic	Neoplastic
1	Thakur A. <i>et al.</i> [3]	100	70%	30%
2	Kumar M <i>et al.</i> [15]	50	72%	28%
3	Aggarwal S <i>et al.</i> [16]	32	63%	37%
4	Present Study	50	68%	32%

In this study it was observed out of total 50 cases, 34 i.e., 68% were non neoplastic and 16, i.e., 32% were neoplastic which is similar to study of Thakur A. *et al.* [3].

Table 5: Comparison of different lesions in nephrectomy specimen with other studies

Sr No.	Lesions	Gupta A <i>et al.</i> [13]	Kumar M <i>et al.</i> [15]	Aggarwal S <i>et al.</i> [16]	Present Study
1	Chronic pyelonephritis	52.7%	42%	56%	48%
2	Xanthogranulomatous Pyelonephritis	5.4%	4%	6.5%	10%
3	Pyelonephritis with cystic changes	-	-	-	4%
4	Emphysematous pyelonephritis	-	-	-	2%
5	Tuberculous Granulomatous inflammation of kidney	-	6%	-	4%
6	Renal papillary adenomatosis	-	-	-	6%
7	Angiomyolipoma	-	4%	-	2%
8	Neuroblastoma	-	-	-	2%
9	Hybrid renal oncocytic/chromophobe tumor	-	-	-	2%
10	Multilocular mucinous cystic neoplasm of kidney with low malignant potential	-	-	-	2%
11	Wilms tumor	3.6%	-	6.5%	2%
12	Renal Cell Carcinoma	10.9%	20%	25%	16%

The discrepancy in distribution of lesions in compared studies may be due to differences in study sample size or geographical variation Chronic pyelonephritis is the commonest non-neoplastic lesion encountered and Renal cell carcinoma is commonest neoplastic lesion, which is similar to other studies as describe in table no.5. Hybrid renal oncocytic/chromophobe tumour and Multilocular mucinous cystic neoplasm of kidney with low malignant potential are rare cases reported both cases are presented in 4th decade.

Most common histological finding in chronic pyelonephritis is Interstitial inflammation (95.8%) followed by Thyroidisation of tubules (87.5%) in present study. In Aggarwal S *et al.* [16] study maximum number of cases shows Interstitial inflammation (100%) followed by tubular atrophy (80%). The difference in the finding may be due to variability in views of different histopathologist and is depends on subjective observability.

Among subtypes of RCC, clear cell RCC (75%) is most commonly seen. Gupta A *et al.* [13] (67%) and Aggarwal S *et al.* [16] (33%) study has similar finding. The variation in the percentage may be due to small sample size in the present study.

Conclusion

A wide histopathological range of lesions comprised of neoplastic and non-neoplastic lesions is found in the current study. Renal cell carcinoma is the commonest renal tumor encountered and Chronic Pyelonephritis is most common benign lesion. Study provides a fair insight into the histological patterns of lesions in nephrectomy specimens.

In RCC, ISUP Nuclear grade and stage of tumor are needed for therapeutic decisions and help in prognosis, thus systematic gross and histopathological examination of nephrectomy specimens are necessary.

Acknowledgement

"We thank Dr. Mahadevan and Dr. Dharti for his expertise and guidance, which contributed to the success of this publication."

Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

Financial Support

Not available

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How to Cite This Article

Parikh S, Goswami H, Parikh U. Histopathological study of nephrectomy specimens in tertiary care hospital. *International Journal of Clinical and Diagnostic Pathology.* 2024;7(3):235-240.

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