



## HISTOPATHOLOGICAL SPECTRUM OF RENAL LESIONS IN POST NEPHRECTOMY SPECIMENS: AN AUDIT IN BURDWAN MEDICAL COLLEGE AND HOSPITAL.

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### Abstract:

**Background:** Nephrectomy is a surgical procedure for certain renal pathologies that include a wide spectrum of non-neoplastic and neoplastic entities, ranging from inflammatory conditions like pyelonephritis to malignant neoplasms such as renal cell carcinoma (RCC). Histopathological examination is the gold standard for definitive diagnosis and classification.

**Aims and Objectives:** To study the clinicopathological profile of renal lesions over a six-year period in a tertiary care hospital in West Bengal **Methods:** This was a hospital based retrospective descriptive study conducted over six years, including 65 nephrectomy specimens. Clinical data, gross morphology, and histopathological specimens were reviewed. The lesions were categorized into non-neoplastic (inflammatory and degenerative) and neoplastic groups (benign and malignant).

**Results:** Among 65 renal specimens analyzed, 38 cases (58.5%) were neoplastic and 27 cases (41.5%) were non-neoplastic. The neoplastic category was dominated by renal cell carcinoma (RCC), comprising 34 cases (52.3%), of which clear cell RCC accounted for 25 cases (73.5%), papillary RCC for 5 cases (14.7%), and chromophobe RCC for 4 cases (11.8%). Non-neoplastic lesions included chronic pyelonephritis (14 cases), hydronephrosis (6 cases), xanthogranulomatous pyelonephritis (3 cases), and advanced chronic kidney disease-related changes (4 cases). The age range of patients was 25–80 years, with a mean age of 52.4 years. Males predominated with a male-to-female ratio of 1.4:1. The left kidney was slightly more involved (56.9%) than the right (43.1%). Most RCC cases presented at stage pT1–pT2, with Fuhrman Grade 2 being most frequent.

**Conclusion:** This study provides a detailed histopathological spectrum of nephrectomies performed at our institution hence provides a reflection of the clinical spectrum in this part of the country. Non-neoplastic inflammatory lesions continue to form a significant proportion of renal pathology. However, renal cell carcinoma, particularly the clear cell subtype, remains the most common malignant lesion. Histopathological evaluation is crucial for accurate diagnosis, subclassification, and grading, directly influencing management and prognosis. In developing countries benign diseases are more common than malignancies.

### Introduction

Kidneys are the paired vital organ in the posterior abdominal cavity. Apart from maintaining fluid and electrolyte balance they secrete hormones like renin, erythropoietin, and 1,25-dihydroxycholecalciferol. Thus, it plays a very important role in maintaining blood pressure, RBC

production and calcium metabolism<sup>[1]</sup>. Kidney may be involved in various pathologies like any other organ and sometimes needs removal of the irreversibly damaged areas.

Simple nephrectomy is preferred for non-functioning kidneys affected by various benign pathologies while Radical Nephrectomy is indicated for malignancies<sup>[2,3]</sup>. Partial nephrectomy is considered for localized and smaller renal masses particularly when nephron-sparing is feasible<sup>[4,5]</sup>.

Renal pathologies present a broad diagnostic spectrum ranging from benign inflammatory diseases to aggressive malignancies<sup>[6]</sup>. While inflammatory lesions such as pyelonephritis and hydronephrosis are common in clinical nephrectomy specimens<sup>[7,8]</sup>, the rising incidence of renal cell carcinoma (RCC) worldwide underscores the importance of histological subtyping and grading for optimal management<sup>[9,10]</sup>. The clear cell variant constitutes the majority of RCCs, with papillary and chromophobe variants forming smaller but clinically relevant subsets<sup>[11,12]</sup>.

This study was undertaken to evaluate the histopathological profile of nephrectomies over six years in a tertiary care hospital

### Aims and Objectives

- To obtain information regarding nephrectomies performed in Burdwan medical college and hospital.
- To study the indications for nephrectomy (neoplastic vs non-neoplastic lesions)
- To gather information regarding clinical presentation and histopathological diagnosis
- To obtain demographical and geographical variation regarding renal pathologies in this part of India.

### Materials and Methods

After obtaining consent from the Institutional Ethical Committee, all the relevant records were taken from patient who had undergone nephrectomy from Jan 2019 to Dec 2024

All detailed data was collected that includes age, sex, laterality, clinical presentation, surgical approach, histopathological diagnosis, and grading.

This retrospective descriptive cross-sectional study included 65 nephrectomy specimens received in the Department of Pathology over a six-year period (January 2019 to December 2024). Both retrospective and prospective cases were analyzed.

**Inclusion criteria:** All nephrectomy specimens with complete clinical data and histopathological evaluation under Department of Pathology and Urology, Burdwan Medical College.

After collection of relevant data, gross examination noted size, weight, external surface, and cut-section. The nephrectomy specimens were immersed in 10% neutral buffered formalin. The grossing was done according to College of American Pathologists [CAP] protocol. Thin sections were taken from representative parts and then immersed under graded alcohol concentration to water. After proper histopathological tissue processing the sections were stained by Hematoxylin and Eosin Stain then mounted with Distyrene, Plasticizer, and Xylene [DPX]. After this histomorphological and microscopic examination was carried on which gives the final diagnosis.

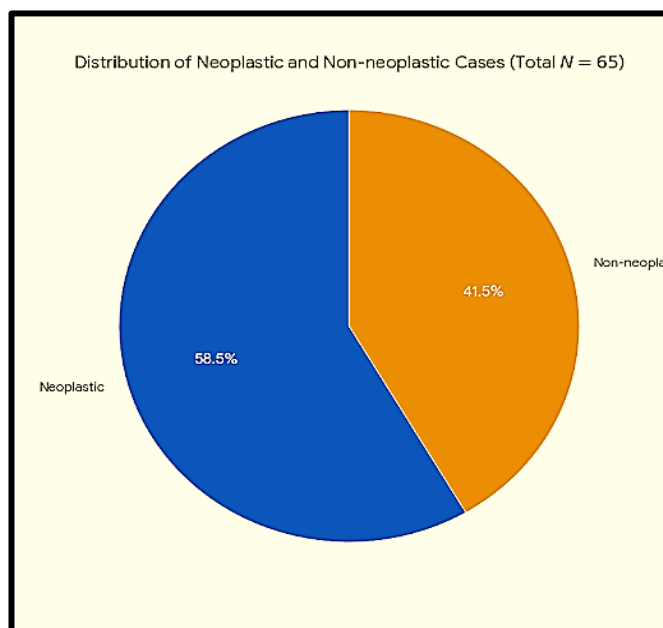
Histopathological features were used to classify the lesions into:

1. Non-neoplastic lesions — chronic pyelonephritis, xanthogranulomatous pyelonephritis, hydronephrosis, and chronic kidney disease–related atrophic changes.
2. Neoplastic lesions — benign and malignant renal tumors, categorized as per WHO classification (2022).

### Results

#### Categorization of Renal pathology

Out of 65 total renal specimens, 38 (58.5%) were neoplastic and 27 (41.5%) non-neoplastic.



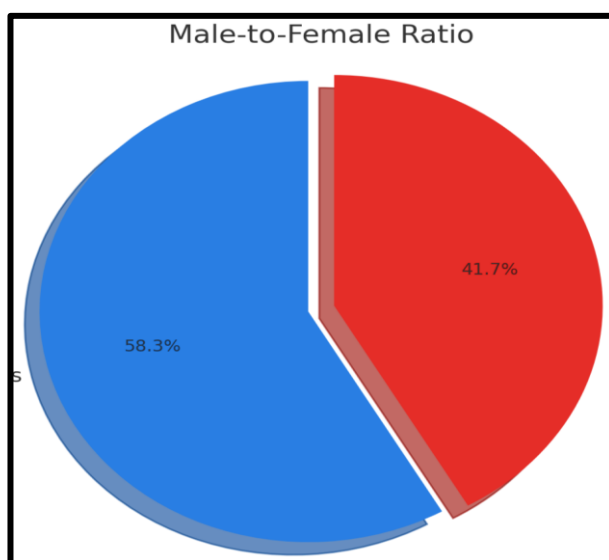
**FIG 1.** Shows the distribution of non-neoplastic and neoplastic lesions

### 1. Age and Sex Distribution:

The following table contains demographic data of the nephrectomy specimens.

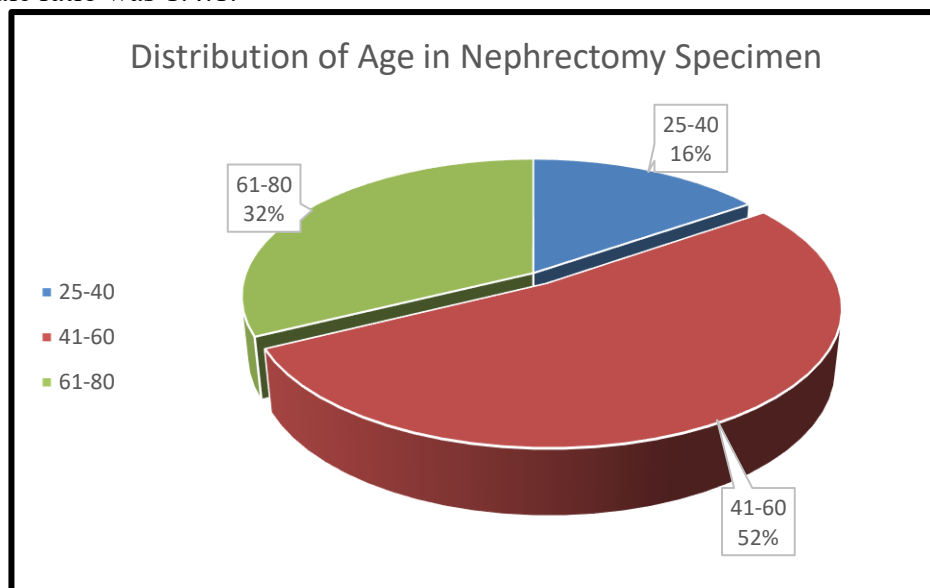
**Table 1. Demographic Profile of Nephrectomy Specimens (n = 65)**

| Parameter           | Category / Finding | No. of Cases (n) | Percentage (%) |
|---------------------|--------------------|------------------|----------------|
| Age (years)         | 25–40              | 10               | 15.4           |
|                     | 41–60              | 34               | 52.3           |
|                     | 61–80              | 21               | 32.3           |
| Mean Age            | 52.4 years         | —                | —              |
| Sex Distribution    | Male               | 38               | 58.5           |
|                     | Female             | 27               | 41.5           |
| Male : Female Ratio | 1.4 : 1            | —                | —              |



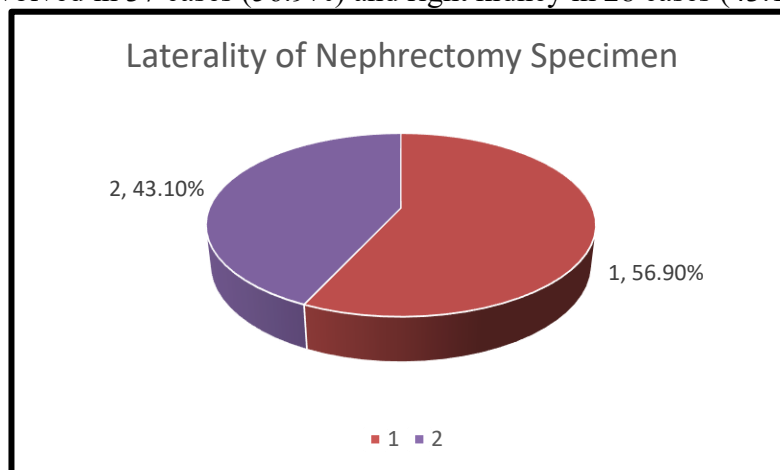
**FIG 2.** Shows the Distribution in Male: Female [Red -Female, Blue - Male]

The age of the patients ranged from 25 to 80 years, with peak incidence noted in the 5th–6th decade. Male-to-female ratio was 1.4:1.



## 2. Laterality:

Left kidney was involved in 37 cases (56.9%) and right kidney in 28 cases (43.1%).



## 3. Non-Neoplastic Lesions (n=27):

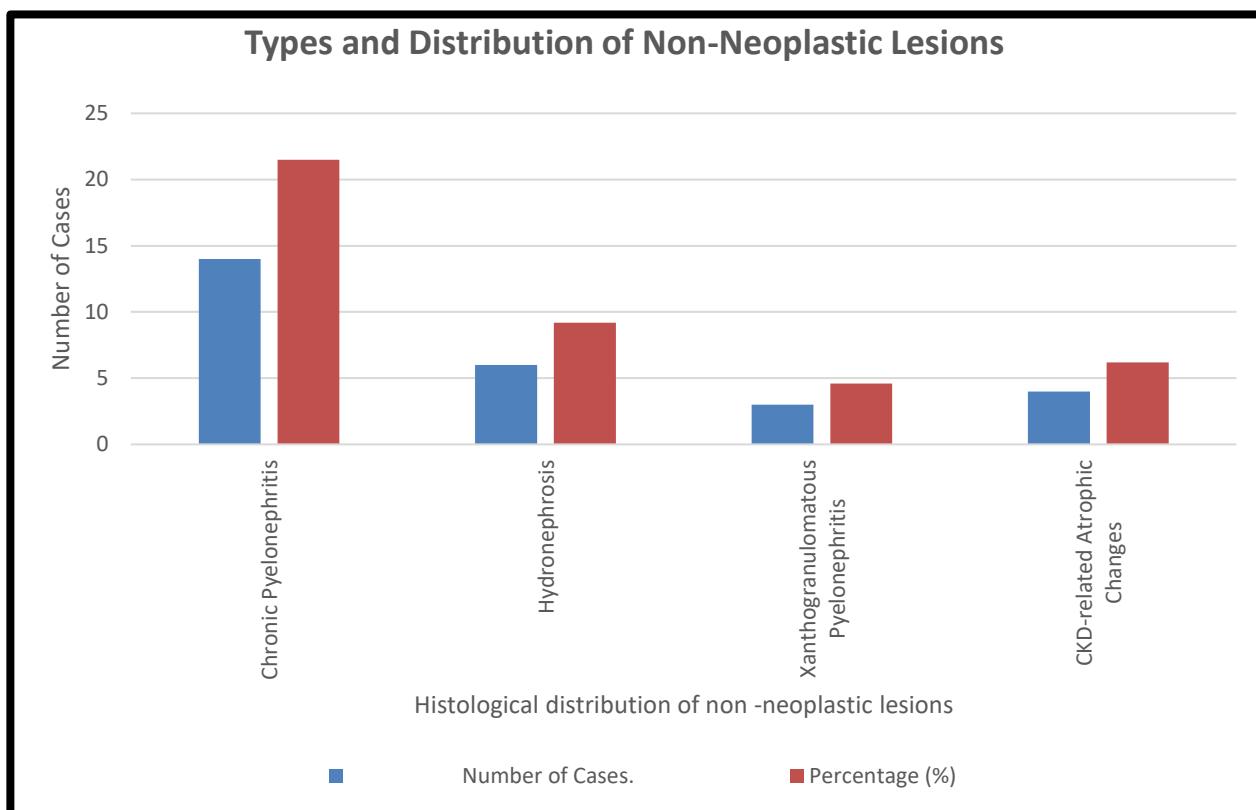
Most non-neoplastic lesions were associated with long-standing obstruction, infection, or end-stage kidney disease.

| TYPE OF LESION                     | Number of Cases. | Percentage (%) |
|------------------------------------|------------------|----------------|
| Chronic Pyelonephritis             | 14               | 21.5           |
| Hydronephrosis                     | 6                | 9.2            |
| Xanthogranulomatous Pyelonephritis | 3                | 4.6            |
| CKD-related Atrophic Changes       | 4                | 6.2            |

**Table Shows the Types and Distribution of Non-Neoplastic Lesions**

### Key Findings:

Chronic Pyelonephritis is the most frequent non-neoplastic lesion, accounting for 14 cases ({21.5%} of N=65). Hydronephrosis is the second most common, with 6 cases {9.2%} of N=65). Xanthogranulomatous Pyelonephritis is the least frequent, with only 3 cases ({4.6%} of N=65).



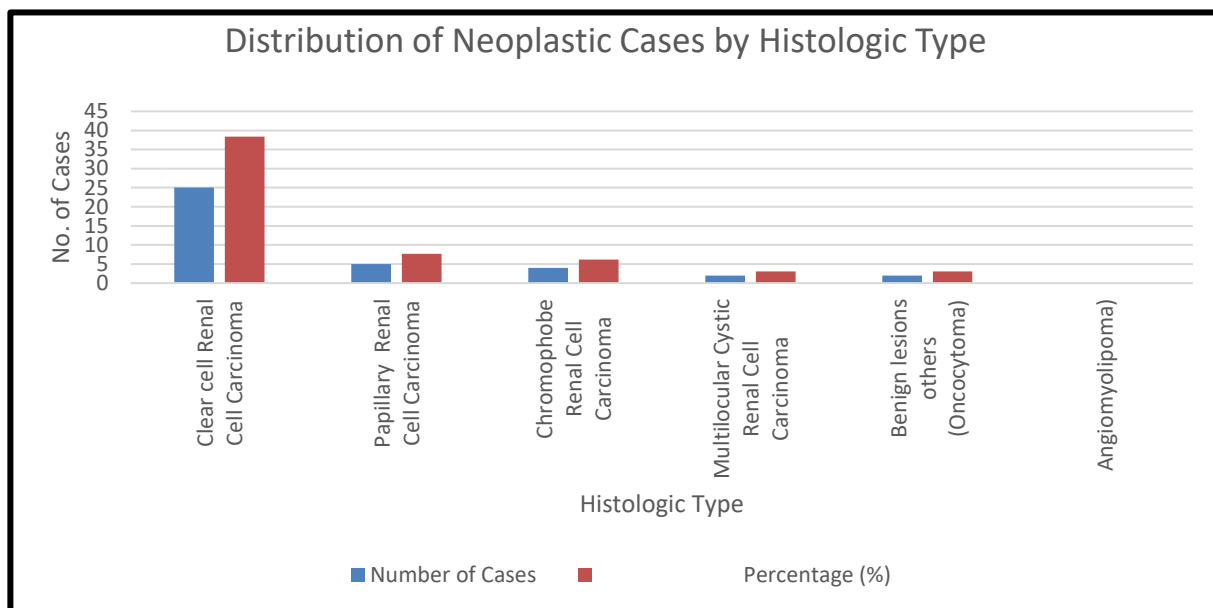
**Fig3** The graph uses two distinct metrics on two separate Y-axes for accurate comparison: Left Y-axis Shows the Number of Cases ( $\{n=27\}$  for this non-neoplastic group), indicating the absolute frequency. Right Y-axis : Shows the Percentage (%) of the Total Sample ( $\{N=65\}$ ), which indicates the proportional occurrence relative to all studied biopsies.

#### 4. Neoplastic Lesions (n=38):

##### Key Findings:

Clear cell RCC is overwhelmingly the most common type, accounting for 25 cases (38.4% of  $N=65$ ). Papillary RCC is the next most frequent with 5 cases (7.7% of  $N=65$ ). Benign lesions (Oncocytoma, Angiomyolipoma) and Multilocular Cystic RCC share the lowest frequency with 2 cases each (3.1% of  $N=65$ ).

| <i>Histologic Type</i>                                        | <i>Number of Cases</i> | <i>Percentage (%)</i> |
|---------------------------------------------------------------|------------------------|-----------------------|
| <b>Clear cell Renal Cell Carcinoma</b>                        | 25                     | 38.4                  |
| <b>Papillary Renal Cell Carcinoma</b>                         | 5                      | 7.7                   |
| <b>Chromophobe Renal Cell Carcinoma</b>                       | 4                      | 6.2                   |
| <b>Multilocular Cystic Renal Cell Carcinoma</b>               | 2                      | 3.1                   |
| <b>Benign lesions others (Oncocytoma)<br/>Angiomyolipoma)</b> | 2                      | 3.1                   |



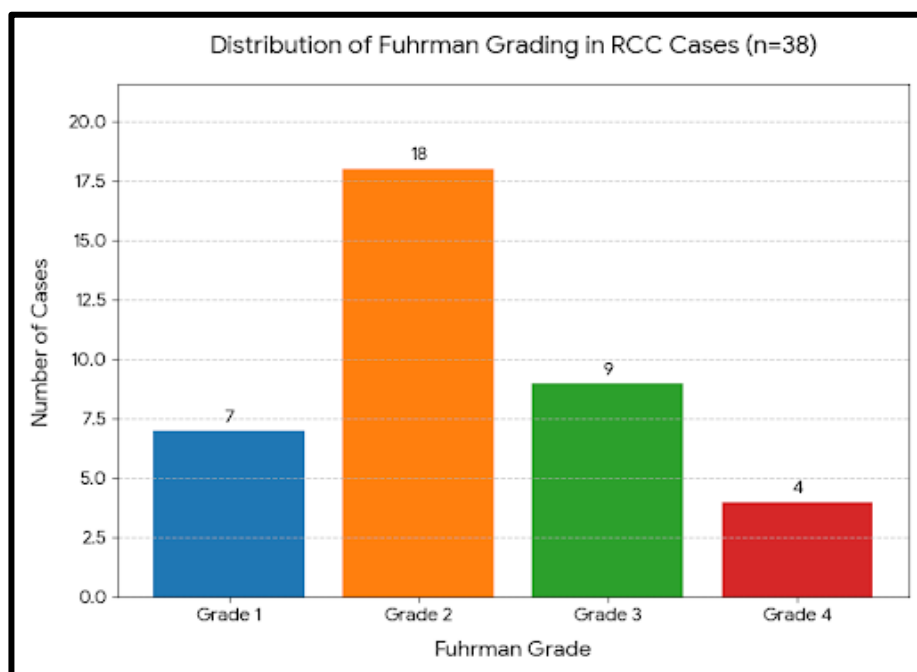
**Fig4.** The graph uses a dual Y-axis to accurately represent the two distinct metrics: Left Y-axis Represents the Number of Cases ( $\{n=38\}$  for this group), showing the absolute frequency of each type. Right Y-axis: Represents the Percentage (%) of the Total Sample ( $\{N=65\}$ ), which indicates the overall impact of each type on the entire study population.

## 5. Grading and Staging (RCC only):

### Fuhrman Nuclear Grade

|                |                |               |
|----------------|----------------|---------------|
| <b>GRADE 1</b> | <b>7 CASES</b> | <b>10.77%</b> |
| <b>GRADE 2</b> | 18 cases       | 27.69%        |
| <b>GRADE 3</b> | 9 cases        | 13.85%        |
| <b>GRADE 4</b> | 4 cases        | 6.15%         |
| <b>TOTAL</b>   | 38 cases       | 58.46 %       |

Here is the bar graph illustrating the distribution of Fuhrman Grades for the Renal Cell Carcinoma (RCC) cases.



### Pathologic Stage (AJCC):

| Pathologic Stage Fuhrman Grading | Total Cases | Gross Pathology          |
|----------------------------------|-------------|--------------------------|
| pT1a/b                           | 22 cases    | Capsular invasion        |
| pT2                              | 10 cases    | Renal vein invasion      |
| pT3                              | 6 cases     | Perinephric fat invasion |

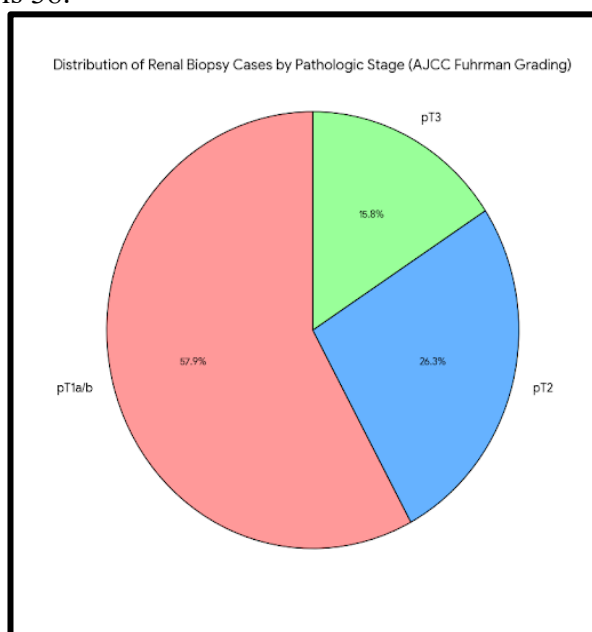
pT1a/b: 22 cases

pT2: 10 cases pT3: 6 cases

This is a pie chart showing the distribution of the renal biopsy cases based on the provided table. The chart includes the percentage for each pathologic stage:

- pT1a/b accounts for the largest share at 57.9% (22 cases).
- pT2 is 26.3% (10 cases).
- pT3 is the smallest proportion at 15.8% (6 cases).

The total number of cases is 38.



### Discussion

The histopathological evaluation of 65 nephrectomy specimens under a tertiary care center reveals that neoplastic renal lesions (58.5%) outnumber their non-neoplastic counterparts (41.5%), reaffirming the predominance of renal cell carcinoma (RCC) [2,3,9]. Clear cell RCC constituted the major histological subtype, followed by papillary and chromophobe RCC, mirroring global and regional incidence trends [1,10,11]. However, presence of geographical disparity can't be excluded in developing countries [13,14].

There is predominance of Fuhrman Grade 2 and stage pT1–pT2 tumors, that indicates a moderate-grade disease spectrum, often associated with favorable survival when appropriately managed [15]. Routine histopathological evaluation remains gold standard not only for tumor diagnosis but also for identifying concurrent inflammatory or degenerative conditions, such as chronic pyelonephritis or xantho-granulomatous pyelonephritis [7,8,16].

The male preponderance and mean age of 52.4 years are consistent with established demographic data for RCC. The marginally higher involvement of the left kidney (56.9%) may represent an anatomical, hemodynamic, Hereditary or Obstructive predilection, though further large-scale analysis is warranted. Importantly, the detection of early-stage RCC emphasizes the potential role of nephron-sparing surgery or Cryosurgery in future for selective cases, highlighting the clinical value of early imaging and timely referral [17].

To enhance prognostic stratification, immunohistochemical (IHC) profiling should be incorporated in future studies. Markers such as PAX8 confirm renal epithelial origin, while CK7 and CD10 aid in subtyping papillary and clear cell variants respectively. Vimentin expression correlates with tumor dedifferentiation, whereas carbonic anhydrase IX (CAIX) and CD117 assist in differentiating clear cell and chromophobe RCC. Additionally, Ki-67 labeling index or epithelial expression of AMACR serves as a surrogate for proliferative activity and may complement histologic grading in predicting tumor aggressiveness and recurrence risk.

## Conclusion

In this six-year study, a significant proportion of nephrectomy specimens were non-neoplastic, emphasizing the burden of chronic renal inflammatory disease in a developing country compared to a developed country. There is a geographical disparity regarding nephrectomy indications. Chronic pyelonephritis and hydronephrosis often result from longstanding obstruction or recurrent urinary tract infections, commonly leading to non-functioning kidneys necessitating surgical removal.

Among the neoplastic lesions, RCC represented the predominant malignancy. Clear cell RCC accounted for nearly three-fourths of malignant cases. The male predominance and peak incidence in the 5th–6th decade correspond to known epidemiologic patterns. Papillary and chromophobe variants, though less frequent, showed distinctive histological features aiding in differential diagnosis. Fuhrman Grade 2 was most common, denoting intermediate differentiation, while advanced grades were associated with larger tumor size and capsular invasion. The presence of benign tumors such as oncocytoma and angiomyolipoma was rare, highlighting the relative rarity of these entities in surgically resected kidneys compared to malignant RCC.

## References

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