

Panoramic View of Histopathology of Nephrectomy Specimens

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Abstract:

Background: Kidneys are affected by various disease processes resulting in permanent deterioration of function causing significant morbidity and mortality. Nephrectomy is the standard surgical procedure performed in cases of suspected malignant renal disease and End Stage Renal Disease (ESRD).

Objectives: To evaluate histopathological features of various lesions in nephrectomy specimens and classify renal neoplasms as per “WHO Classification of Renal Tumors” and study their age and gender distribution.

Materials and Methods: A retrospective study is done for a period of 1 year from January to December 2021 which includes 41 specimens received in the Department of Pathology at Netaji Subhash Chandra Bose Medical College, Jabalpur. Patient particulars and radiological details were noted. According to CAP protocol, representative sections were submitted, H&E staining and reporting was done.

Results: In the 41 received specimens, the age varied from 1-78 years, majority were in 31-50 years with 20 cases (50%). The male: female ratio was 1:1.1. Non-neoplastic lesions were 30(73%) and neoplastic were 11(27%), all were malignant. Among malignant lesions, 3 cases each of Papillary Renal Cell Carcinoma and Chromophobe Renal Cell Carcinoma (60%), 2 cases (20%) clear cell Renal Cell Carcinoma, 1 case of post chemotherapy Wilm's tumour were reported. A rare case with hidden malignancy of “Urothelial Carcinoma and glandular differentiation” and Xanthogranulomatous Pyelonephritis was also reported in a nephrectomy specimen of nephrolithiasis. Among 30 non-neoplastic lesions, most common diagnosis was chronic pyelonephritis with 24 cases (80%) followed by 2 cases each of necrotizing granulomatous pyelonephritis and xanthogranulomatous pyelonephritis (13.4%). Out of 24 cases of chronic pyelonephritis, 1 case showed squamous metaplasia of calyx. Another rare case of post chemotherapy myeloid sarcoma also showed chronic pyelonephritis.

Conclusion: Meticulous histopathological examination of surgical specimens is necessary for proper diagnosis and further treatment as it not only confirms clinical diagnosis but may also detect unsuspecting associated malignant lesions.

Keywords: Nephrectomy, chronic pyelonephritis, RCC, urothelial carcinoma.

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Introduction

Kidney is an organ with cellular diversity and performs variety of complex physiological processes including excretion of the waste products of metabolism, regulation of the salt and water metabolism and maintaining the appropriate acid-base balance of plasma. The disease processes that affect the kidney may result in permanent deterioration of its function causing significant morbidity and mortality. Nephrectomy is the standard surgical procedure performed in End Stage Renal Disease (ESRD) and in renal malignancies. It can either be a simple or a radical nephrectomy. The approximate incidence of ESRD in India is 150-200 per million population.[1] As per GLOBOCAN 2020 data, renal cancer is overall the 15th most common cancer worldwide with an estimated 431288 new cases and 179368 deaths, whereas in India, it is overall the 21st most common cancer with an estimated 16861 new cases (1.3 %) and 9897 deaths.[2]

Materials & Methods

This was a retrospective analysis conducted for 1 year, from January 2021 to December 2021 at the Department of Pathology, Netaji Subhash Chandra Bose Medical College. The aim of this study was to evaluate histopathological features of various lesions in nephrectomy specimens, to classify renal neoplasms as per "WHO Classification of renal tumors" and to study the age and gender distribution of various renal lesions. A total of 41 nephrectomy specimens were received and their histopathological features were analyzed. For each patient, the details such as age, sex, laterality of lesion, type of nephrectomy and final histopathological diagnosis were recorded. Grossing of the formalin fixed nephrectomy specimens was done according to CAP protocol.[3] The

representative sections were processed, Hematoxylin & Eosin staining and reporting was done. The data was analyzed based on SPSS 23.0 software.

Results

The present study includes 41 nephrectomy cases analysed during the period from January 2021 to December 2021. The youngest patient was 1 year old who presented with gross hydronephrosis while the oldest patient was 78 year old diagnosed with clear cell renal cell carcinoma. A higher incidence was observed with 10 cases (24.3%) each in the fourth and fifth decade. There was a relative female preponderance with a male to female ratio of 0.95:1.

Flank pain was the most common presenting complaint, observed in 20 cases (48.7%) followed by hematuria (34.1%), difficulty in micturition (9.9%) and lump in the abdomen (7.3%). Out of 41 nephrectomy specimens, 30 cases (73.2%) were non-neoplastic and 11 cases (26.8%) were neoplastic lesions. In the histopathological spectrum, the most commonly diagnosed lesion was chronic pyelonephritis (CPN) with 24 cases (58.5%) followed by 2 cases (4.9%) each of necrotizing granulomatous pyelonephritis, xanthogranulomatous pyelonephritis and simple renal cyst.

A case of chronic pyelonephritis showed squamous metaplasia of calyx. Among the malignant lesions, an equal preponderance of papillary renal cell carcinoma and chromophobe renal cell carcinoma with 3 cases (7.3%) each followed by 2 cases (4.9%) of clear cell renal cell carcinoma, 1 case (2.4%) each of squamous cell carcinoma and urothelial carcinoma was noted. A single case of post chemotherapy Wilm's tumour was also reported. A rare

case with hidden malignancy of “Urothelial Carcinoma with glandular differentiation” and Xanthogranulomatous Pylonephritis

was reported in a nephrectomy specimen which was performed with an indication of non-functioning kidney due to renal calculi.

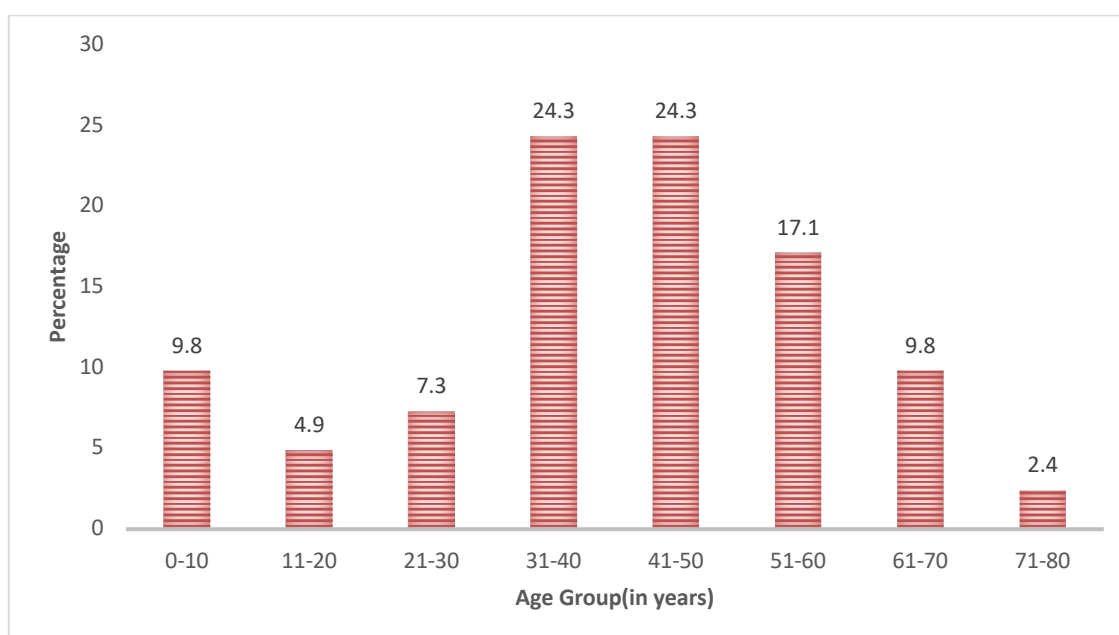


Figure 1: Distribution of cases with respect to Age



Figure 2: Distribution of lesions with respect to Gender

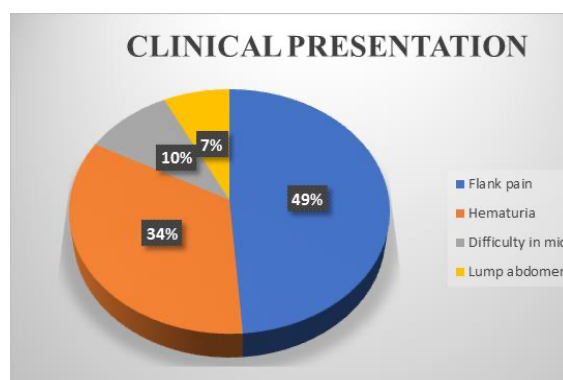


Figure 3 Clinical Presentation in patients who underwent nephrectomy

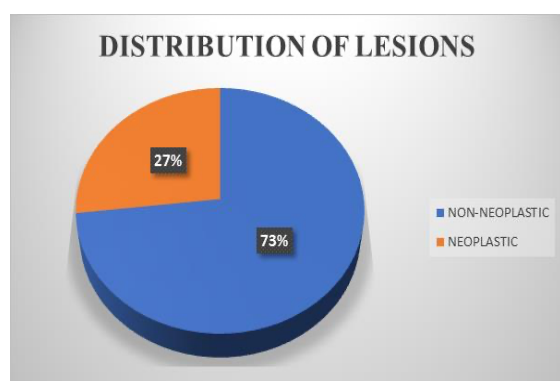


Figure 4: Distribution of non-neoplastic and neoplastic lesions in nephrectomy specimens

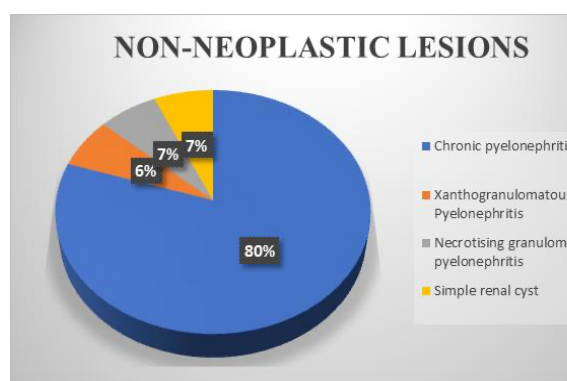


Figure 5: Distribution of various non-neoplastic lesions in nephrectomy specimens

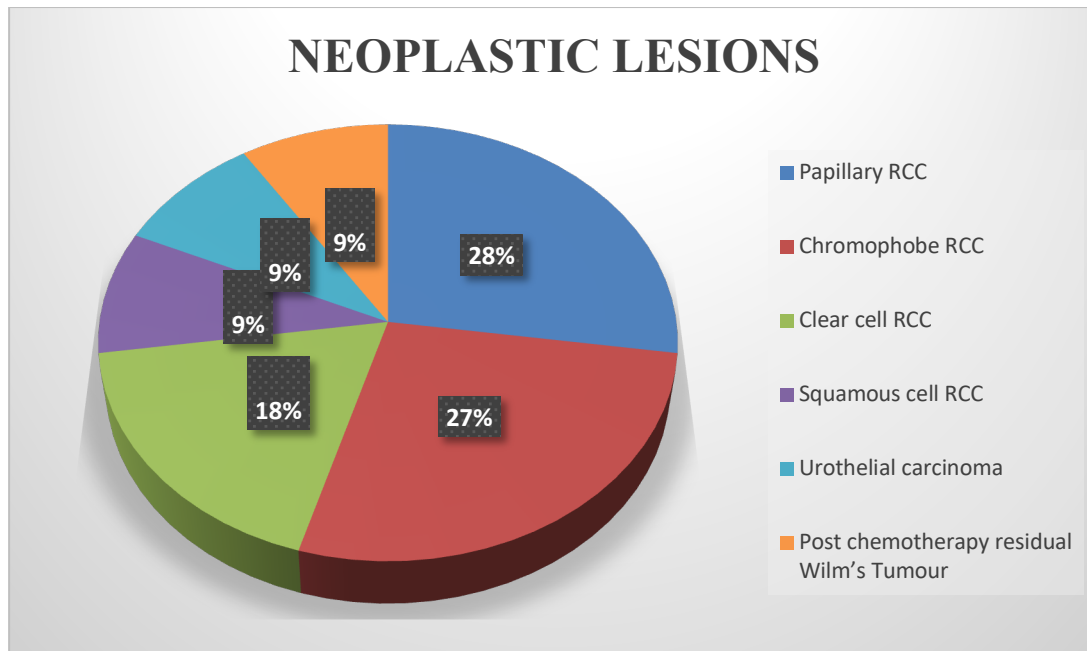


Figure 6: Distribution of various neoplastic lesions in nephrectomy specimens

Discussion

In the present study, a wide spectrum of renal diseases employ nephrectomy as the common procedure for both neoplastic and non-neoplastic conditions.

The age range of cases in the present study was 1 year to 78 years, similar to a study conducted by Hansdah et al.[4] Most common age group to undergo nephrectomy was between 31-50 years (48.6%) in concordance with Gond et al and Ajmera S et al (38.4%).[5,6] The male to female ratio of 0.95:1 in our study is in concordance with 0.98:1 in the study conducted by Mukhiya et al.[1] The most common presenting complaint in the present study was flank pain (73.1%), comparable to study done by Gupta et al[7] and Shanmugasamy et al[8] where flank pain was present in 73% and 82.3% of the cases respectively.

In the present study, out of 41 nephrectomy specimens, 30 (73.2%) lesions were non-neoplastic, and 11 lesions (26.8%) were neoplastic. Chronic pyelonephritis (58.5%) was the most diagnosed lesion followed by renal cell carcinoma (21.9%). A similar predominance was observed in Hansdah et al (23%), Gond et al (54.3%) and Aiman et

al (91.6%). The proportion of renal cell carcinoma in these studies were 21.2%, 15.2% and 78.1% respectively. [4,5,9] An equal prevalence of 4.8% each of other non-neoplastic lesions like xanthogranulomatous pyelonephritis, necrotizing granulomatous pyelonephritis and simple renal cyst has been observed in our study. This pattern of equal prevalence is like the study conducted by Mukhiya et al (2.27%), Hansdah et al (3.9%) and Salma et al (6%) [1,4,10]

There were 11 cases of renal tumours, all lesions were malignant. Renal cell carcinoma was the most common. Papillary renal cell carcinoma and chromophobe renal cell carcinoma were the most common histological subtypes with a prevalence of 7.3% each. However, clear cell carcinoma was the most diagnosed malignant lesion in the studies done by Mukhiya et al (16.5%) and Hansdah et al (17.3%) [1,4]. The incidence of urothelial carcinoma has a similar prevalence between the present study (2.4%) and Gond et al (2.1%).[5]

On gross examination, specimens received for non-functioning kidney revealed irregular coarse scarring, dilatation of the

pelvicalyceal system with loss of cortico-medullary junction and cortical thinning on sectioning. Some of the specimens also had lodged calculi in their calyces. Microscopically, chronic pyelonephritis showed peri-glomerular fibrosis, glomerular sclerosis in a few cases with marked tubular atrophy and thyroidisation of the renal tubules. Diffuse interstitial lymphoplasmacytic inflammation and fibrosis was also noted. Xantho-granulomatous pyelonephritis is a rare type of chronic pyelonephritis grossly characterised by multiple yellow nodular areas around the calyces cases which may be confused with renal cell carcinoma. The

microscopy revealed mixed inflammatory infiltrate composed of a variable number of xanthomatous histiocytes with foamy cytoplasm, neutrophils, lymphocytes, plasma cells and multinucleate giant cells along with fibrosis. The foamy histiocytes may be mistaken with clear cell carcinoma, however, the neoplastic cells of clear cell carcinoma have a water clear cytoplasm.

There were 2 cases of necrotising granulomatous pyelonephritis which showed granulomas composed of epithelioid cells, foreign body and Langhans type of giant cells bordered by lymphocytes and fibrosis.[11]

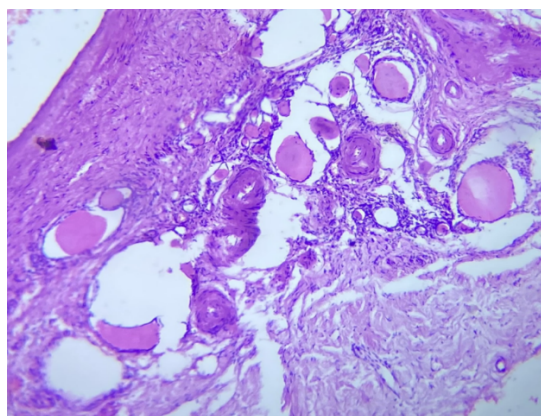
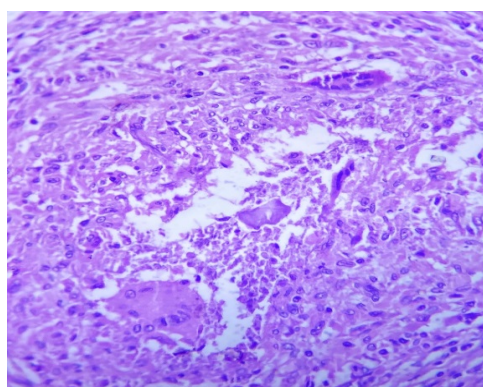
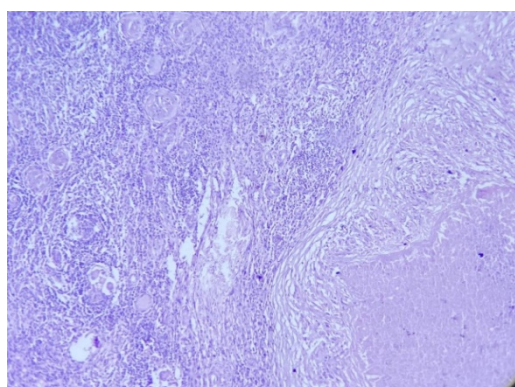


Figure 7: Chronic Pyelonephritis.

- (a) Gross photograph -Dilatation of the pelvi-calyceal system with cortical thinning
(b) Microphotograph showing tubular atrophy with Thyroidisation of tubules, interstitial inflammation and fibrosis. (H&E,100X)



(a)

(b)

- Figure 8: Necrotizing granulomatous pyelonephritis. Microphotograph showing:**
(a) Caseous necrosis along with glomerular sclerosis (H&E stain, 100X)
(b) Granulomas composed epithelioid cells and Langhans type of giant cells with a cuff of lymphocytes. (H&E stain, 400X)

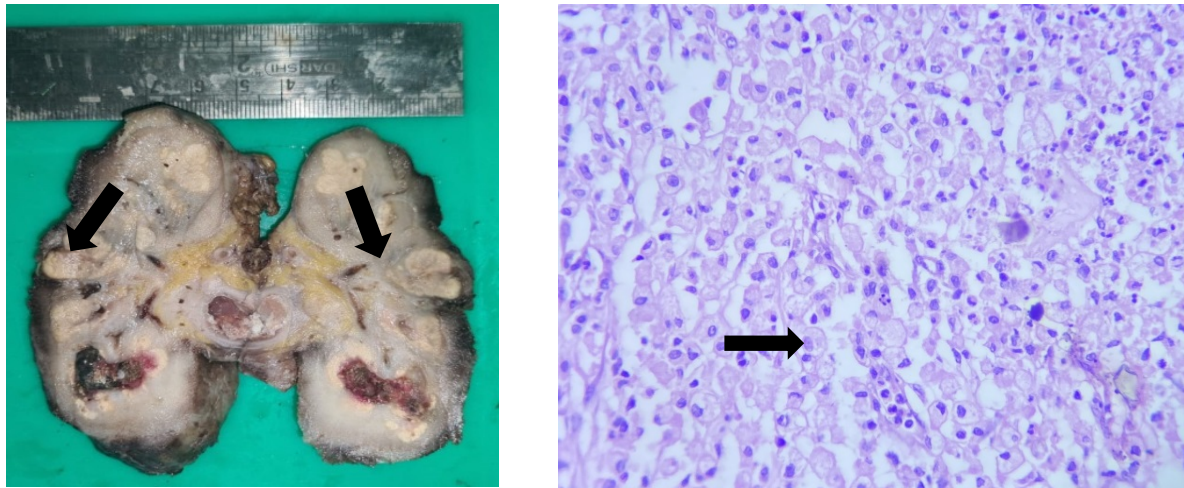


Figure 9: Xanthogranulomatous Pyelonephritis:
(a) Gross photograph -yellow nodular areas around calyces
(b) Microphotograph-Foamy histiocytes along with mixed inflammatory cell. (H&E stain,400X)

Histopathological Features of Renal Cell Carcinoma [11,12]

Grossly clear cell renal cell carcinoma displayed a circumscribed spherical tumor with yellow greyish-white variegated cut surface due to haemorrhage, necrosis and cystic changes. Histopathological examination showed tumor cells arranged in nested, alveolar clusters and microcystic patterns. Cells were round or polygonal cells with distinct membranes and optically clear or eosinophilic cytoplasm with centrally located nuclei. A fine network of arborizing small caliber blood vessels essentially surrounded these nests of tumor cells were seen.

Papillary renal cell carcinoma microscopically showed papillary and tubulopapillary architecture with fibrovascular cores which contained foamy histiocytes lined by cuboidal cells with scant basophilic cytoplasm, mildly

pleomorphic nuclei with inconspicuous nucleoli.[12]

Chromophobe renal cell carcinoma showed a circumscribed tumor with a tan to light brown cut surface. Histopathological examination showed a solid growth pattern of the tumor along with nests and alveoli separated by dense hyalinized septa. Large cells with sharply defined plant cell like cell borders and abundant clear wispy to reticulated cytoplasm along with cells having densely eosinophilic and granular cytoplasm with perinuclear halo. Nuclei were irregular, wrinkled giving a raisinoid appearance.

Squamous cell carcinoma, microscopically showed the malignant squamous epithelial cells arranged in sheets, nests and islands, displaying nuclear pleomorphism, increased mitosis, intercellular bridges and keratin pearls formation.

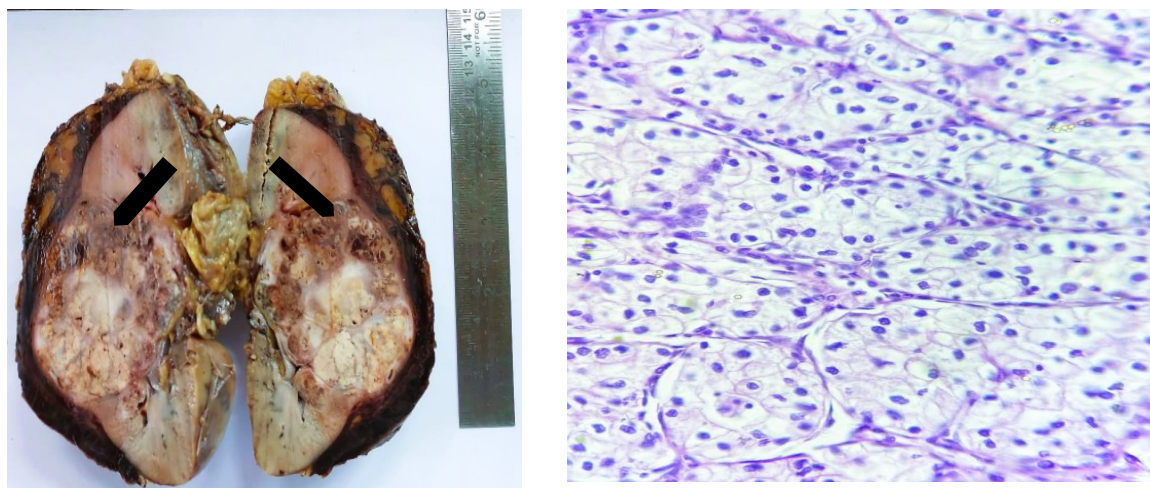


Figure 10: Clear cell Renal Carcinoma:

- (a)Gross Photograph-Tumor at the middle pole abutting the renal capsule**
(b)Microphotograph-Nested architecture and prominent network of thin walled blood vessels. (H&E Stain, 400X)

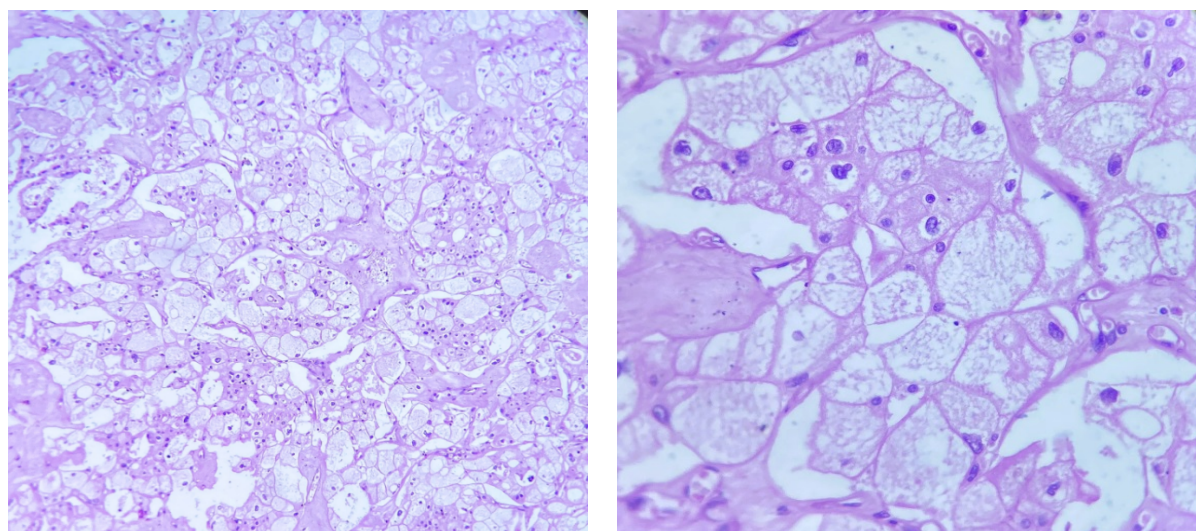


Figure 11: Microphotograph of Chromophobe Renal Cell Carcinoma-

- (a)Tumor arranged in nested and alveolar architecture separated by hyalinized septa (H&E Stain,100X)**
(b) Cells with thick plant cell like borders with abundant clear reticulated cytoplasm (H&E Stain,400X)

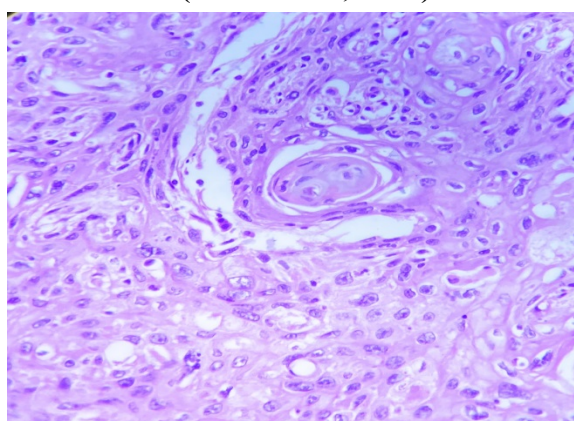


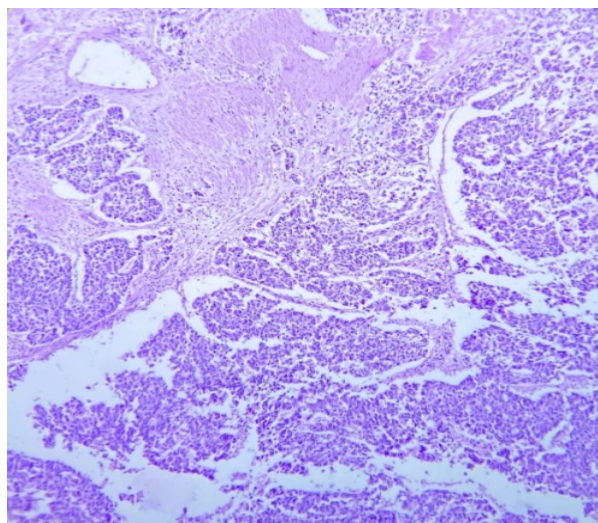
Figure 12: Microphotograph of squamous cell carcinoma (H&E stain,400x)

In this study, one nephrectomy specimen received for a non-functioning kidney due to renal calculi, gross examination revealed xanthogranulomatous areas along with one of the calyces showing protrusion of a grey white mass while the adjacent calyces showed an irregularly thickened mucosa. On histopathological examination, in addition to histological features of xanthogranulomatous pyelonephritis, sections from the protruding mass revealed

a tumor composed of nests and sheets of tumor cells with nuclear stratification and glandular lumen formation. IHC analysis confirmed the diagnosis of urothelial carcinoma with glandular differentiation. Therefore, a final diagnosis of Urothelial carcinoma with glandular differentiation along with xanthogranulomatous pyelonephritis and nephrolithiasis was made.

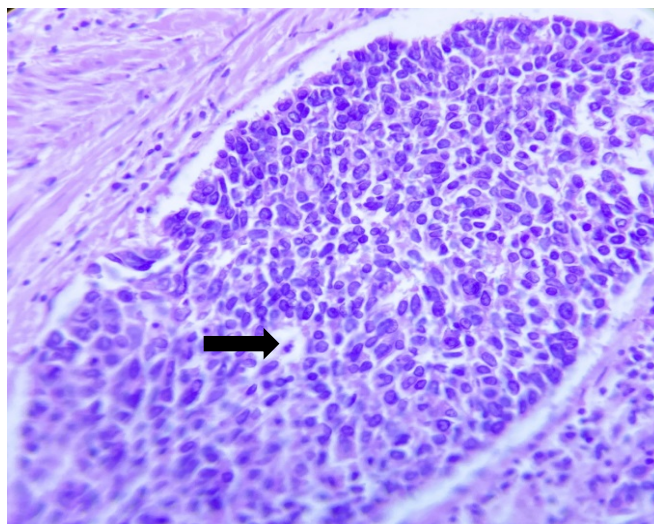


(a)

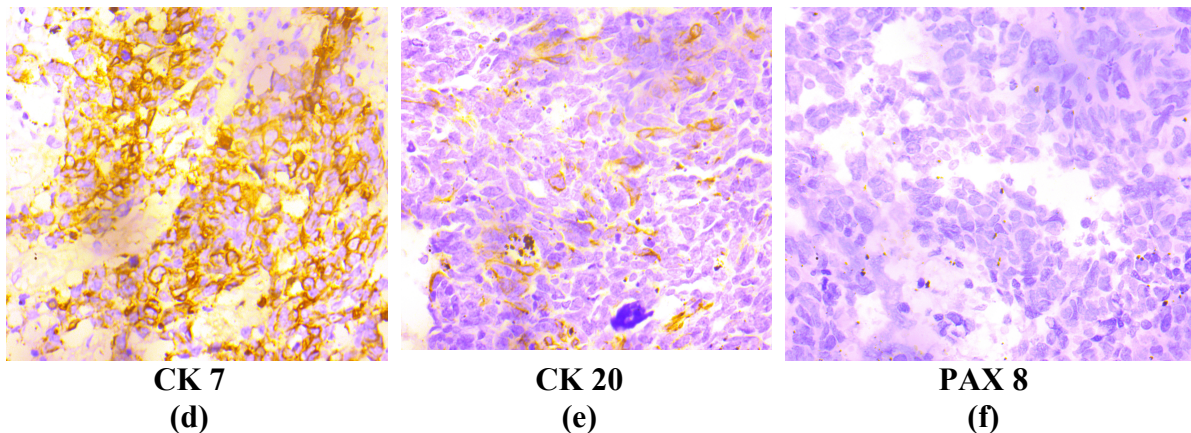


(b)

Figure 13: (a) Gross photograph showing protrusion of mass from the calyx. (b) Microphotograph from the calyx with parts of tumor. (H &E stain, 100X)



(c) Nests of cells with nuclear stratification and glandular formation (H&E Stain, 400X)



(d) CK 7 showing moderate to strong cytoplasmic positivity in 70-80% tumor cells

(e) CK 20 showing moderate to strong cytoplasmic positivity in 20-30% tumor cells

(f) PAX 8 negative ruling out the renal tubular origin of the tumor

Conclusion

Our study reveals that nephrectomies were done more commonly for non-neoplastic lesions when compared to neoplastic lesions. Chronic pyelonephritis is the most common non-neoplastic lesion and Renal Cell Carcinoma was the most commonly diagnosed neoplastic lesion.

The present study provides a fair insight into the histological patterns of lesions in nephrectomy specimens in our institution. A wide range of lesions are encountered on histopathology of nephrectomy specimens, with some long standing cases of renal calculi presenting with dual pathology like squamous metaplasia of the calyces.

This study also emphasizes on the fact that meticulous sampling along with histopathological diagnosis is important as it not only confirms clinical diagnosis but may also detect unsuspected associated malignant lesions as was the case of an incidentally diagnosed Urothelial carcinoma with glandular differentiation for a nephrectomy specimen, even when there no suspicion of malignancy clinically.

It is therefore concluded that meticulous histopathological examination of the surgical specimen is necessary for proper diagnosis and further management.

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