Original Article

Histomorphological Analysis of Nephrectomy Specimens: Experience at a Tertiary Care Institute

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Abstract

Introduction: For a range of kidney abnormalities, including both neoplastic and nonneoplastic disorders, nephrectomy is a popular surgical treatment. We conducted this study to examine the range of lesions found in the nephrectomy specimens obtained and to ascertain the distribution of these lesions by age and sex. **Materials and Methods:** This study was conducted in the department of pathology, from 2017 to 2022. All nephrectomy specimens received during 5 years were included. **Results:** The spectrum of renal lesions observed in the study included both neoplastic (43.75%) and nonneoplastic (56.25%) conditions. Nineteen patients were males (59.37%) and 13 were females (40.62%) (M: F = 1.4:1). The most common entity in the nonneoplastic category was chronic pyelonephritis (n = 9, 28.12%). In our study, we documented two unusual cases of renal replacement lipomatosis (RRL), a type of pseudotumor related to nonfunctioning kidneys. Fourteen patients underwent nephrectomy for neoplastic conditions such as Wilm's tumor and renal cell carcinoma (RCC). **Conclusion:** Nephrectomy for the nonneoplastic condition was performed more frequently in our series. Histopathological evaluation of nonneoplastic nephrectomy specimens must be thoroughly considered, particularly in unusual circumstances such as RRL, where a preoperative erroneous initial impression of a malignant lesion such as angiomyolipoma or liposarcoma is possible.

Keywords: Carcinoma, chronic pyelonephritis, neoplastic, nephrectomy, nonneoplastic, renal cell

Introduction

Nephrectomy is a frequent surgical intervention used for the treatment of a range of kidney abnormalities, including both neoplastic and nonneoplastic disorders. Various types of nephrectomy include partial nephrectomy (where only the damaged or diseased part of the kidney is removed), simple nephrectomy (removal of the entire kidney), and radical nephrectomy (where the kidney, perinephric fat, surrounding lymph nodes, and ipsilateral adrenal gland are all removed together with the whole Gerota's fascia). Patients who have irreparably damaged kidneys due to persistent infections, obstruction, calculus disease, or severe injury by trauma are typical candidates for simple nephrectomy.[1] Partial nephrectomy is indicated in cases of bilateral renal cell carcinoma (RCC) involving just one functional kidney.[2] The most frequent nonneoplastic conditions for which nephrectomy is routinely performed were severe hydronephrosis, pyonephrosis, polycystic kidneys, etc., that result in nonfunctioning kidneys.[2]

This study aimed at analyzing the spectrum of lesions in nephrectomy specimens and determining the age and sex distribution of these lesions.

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Materials and Methods

Study design

This was an observational study.

Sample

All types of nephrectomy specimens (partial nephrectomy, radical nephrectomy, simple nephrectomy, and laparoscopic

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nephrectomy) received in the department were included in the study, and renal biopsy specimens received were excluded from the study.

Sample size

The sample size was 32.

Study duration

The duration of the study was 2017–2022.

Procedure

Clinical details were taken from the record room. Slides and histopathology requisition forms were retrieved from the departmental archives. Following the predesigned proforma, the patient's information, clinical history, pertinent investigation findings, and gross and microscopic features were noted. The 10% formalin-fixed nephrectomy specimens were extensively dissected and thoroughly inspected in accordance with standard protocols. Tissue sections of 3-µm thickness were cut after routine paraffin processing. They were routinely stained with conventional hematoxylin and eosin stains, subjected to detailed light microscopic studies, and recorded. Once the clinical, radiological, and histological results were correlated, a conclusive diagnosis was made. The institutional ethical committee clearance was obtained, and a descriptive analysis of the data was done.

Results

A total of 32 nephrectomy specimens were received, out of which males constituted 59.37% (19 cases) and females constituted 40.62% (13 cases) with a male-to-female ratio of 1.4:1. Patients who were 51–60 years old represented the highest percentage of patients (28.12%). The youngest patient was 8 months old, and the oldest patient was 85 years old [Table 1].

Patients who had nephrectomy most frequently presented with flank pain (n = 21). Moreover, the least common was burning micturition (n = 1). Other clinical features included mass per abdomen (n = 6), hematuria (n = 2), and abdominal distension (n = 2) in decreasing trend.

The majority of the nephrectomy specimens (n = 18, 56.25%) were nonneoplastic in nature with a maximum number of cases being chronic pyelonephritis (n = 9, 28.12%). Other nonneoplastic lesions which led to nephrectomy were hydronephrosis, renal replacement lipomatosis (RRL), and cystic renal dysplasia. Neoplastic lesions constituted 14 cases (43.75%), out of which RCC (n = 8, 25%) was the most common. Wilm's tumor and urothelial carcinoma constituted the rest [Table 2].

Nonneoplastic lesions

Chronic pyelonephritis

In our study group, this made up the majority of the nonneoplastic lesions, with a total number of 9 cases (28.12%) out of 18 nonneoplastic cases. All these kidneys were diffusely enlarged without any corticomedullary junction differentiation. Dilated and distorted pelvicalyceal system was noted with two cases showing multiple hard brownstones. Microscopic examination revealed dilated tubules with thyroidization, varying degrees of glomerular atrophy, periglomerular fibrosis, interstitial infiltrates of lymphocytes, and congested blood vessels [Figure 1a and b].

Hydronephrosis

This was the second-most common nonneoplastic entity encountered with a total number of six cases (18.75%). Grossly, the kidneys were cystically dilated and few were multiloculated with thinned out atrophied cortex, dilated pelvicalyceal system, and blunting of calyces. Microscopy showed dense interstitial lymphocytic infiltrates, dilated pelvicalyceal system, fibrosis, and atrophy of renal tubules [Figure 1c and d].

Renal replacement lipomatosis

There were two cases of RRL (6.25%). Gross features consisted of loss of renal parenchymal architecture

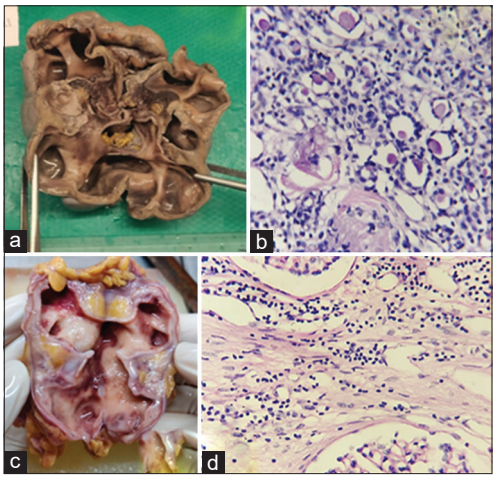

Figure 1: (a and b) Chronic pyelonephritis. (a) Grossly enlarged, distorted kidney. (b) Dilated tubules with thyroidization and dense interstitial lymphocytic infiltrate (H and E, ×40). (c and d) Hydronephrosis. (c) Kidney with the dilated pelvicalyceal system. (d) Interstitial lymphocytic infiltrates with fibrosis (H and E, ×40)

Table 1: Age- and gender-wise distribution of lesions in nephrectomy specimens

Age (years)	<10	11-20	21-30	31-40	41-50	51-60	61-70	>70	Total	Percentage
Male	3	0	2	3	3	5	2	1	19	59.37
Female	2	1	0	1	1	4	2	2	13	40.62
Total	5	1	2	4	4	9	4	3	32	100
Percentage	15.62	3.12	6.25	12.5	12.5	28.12	12.5	9.37	100	

with fatty tissue proliferation replacing the renal parenchyma. Both cases showed an association with a staghorn calculus. Microscopic examination revealed extensive fibrofatty tissue, few tubule-like structures with thyroidization, granuloma composed of necrosis, epithelioid histiocytes, and multinucleated giant cells [Figure 2a-c].

Cystic renal dysplasia

In our study, there was one case of cystic renal dysplasia (3.12%). Grossly, it was enlarged, gray-white in color with a cut surface showing an uniloculated cyst and no corticomedullary junction could be made out. Microscopic examination revealed a fibromuscular wall with flattened to the cuboidal epithelial lining, a few primitive ducts surrounded by a mesenchymal collar of spindle cells, and primitive glomeruli were seen [Figure 2d].

Table 2: Spectrum of renal lesions in nephrectomy specimens

Diagnosis	Number of cases (n=32), n (%)
Nonneoplastic	18 (56.25)
Hydronephrosis	6 (18.75)
Chronic pyelonephritis	9 (28.12)
Renal replacement lipomatosis	2 (6.25)
Cystic renal dysplasia	1 (3.12)
Neoplastic	14 (43.75)
Renal cell carcinoma	8 (25)
Wilm's tumor	5 (15.62)
Urothelial carcinoma	1 (3.12)

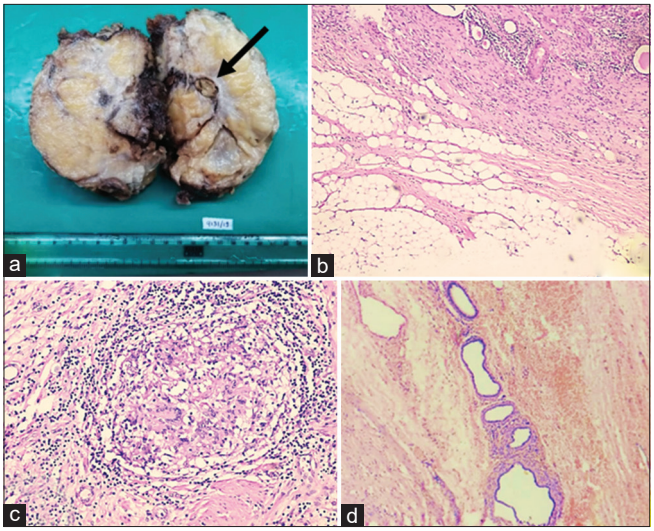

Figure 2: (a-c) Renal replacement lipomatosis. (a) Right nephrectomy specimen showing renal parenchyma replaced by fatty tissue proliferation and a staghorn calculus (arrow). (b) Extensive fibrofatty tissue with few tubule-like structures showing thyroidization (H and E, ×20). (c) Granuloma composed of necrosis, epithelioid histiocytes, and multinucleated giant cells (H and E, ×40). (d) Cystic renal dysplasia. Primitive ducts are surrounded by a mesenchymal collar of spindle cells and primitive glomeruli (H and E, ×40)

Neoplastic lesions

Renal cell carcinoma

A total of eight cases (25%) of RCC were observed. Five cases (62.5%) were males and three cases (37.5%) were female patients. The ages of the patients were in the range of 31–90 years, and a maximum incidence was seen after 60 years of age. Grossly, the tumor ranged from 3 cm to 10.5 cm in size. They were solid growths having variegated appearance with abundant areas of necrosis, hemorrhage, and yellowish areas. In the majority of cases, the upper pole of the kidney was more frequently affected (n = 1, 50%) and the lower pole of the kidney was least involved (n = 1, 12.5%). Microscopically, the majority of the cases (n = 5 62.5%) were of the clear cell type of RCC, followed by papillary RCC (n = 2, 25%) and chromophobe RCC (n = 1, 12.5%). The WHO/ISUP grading was done for clear cell and papillary RCC, where nuclear Grade 1 was the most common. Renal sinus and perinephric fat invasion were seen in three cases and renal vein invasion in one case [Figure 3a-d].

Wilm's tumor

Wilm's tumor (nephroblastoma) constituted the second-most common neoplastic lesion in our study. The age ranged from 1 to 10 years in all five cases of Wilms' tumor (15.62%). They were characterized by a grossly enlarged, lobulated kidney with hemorrhagic and necrotic areas. Microscopically, all of them were of the triphasic type with blastemal, epithelial, and stromal components [Figure 4a and b].

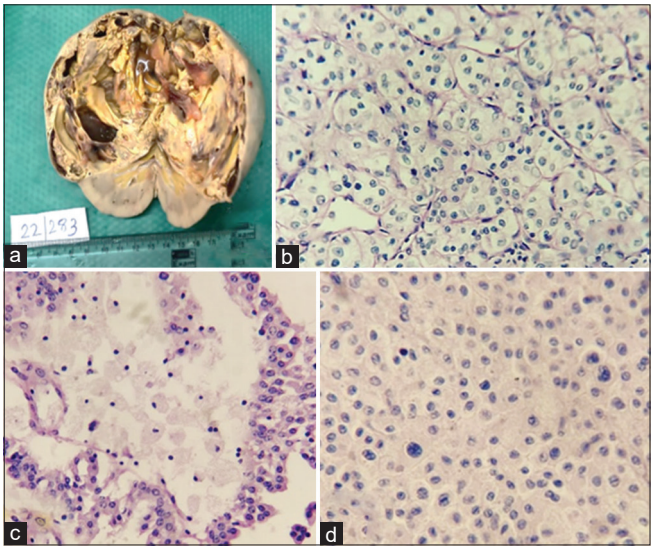

Figure 3: (a-d) Renal cell carcinoma. (a) Solid and cystic friable growth having a variegated appearance with abundant areas of necrosis, hemorrhage, and tan-yellow to red-brown areas. (b) Clear cell RCC – Compact nests and sheets of cells with clear cytoplasm and distinct cell membrane (H and E, ×40). (c) Papillary RCC – Papillary or tubulopapillary architecture with foamy macrophages in the fibrovascular core (H and E, ×40). (d) Chromophobe RCC – Sheets of cells having sharply defined plant-like cell borders, finely granular eosinophilic cytoplasm with irregular, wrinkled nuclei (H and E, ×40). RCC: Renal cell carcinoma

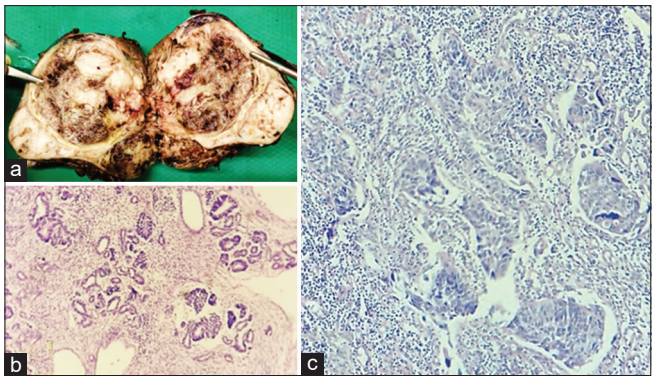

Figure 4: (a and b) Wilm's tumor. (a) Grossly enlarged, lobulated kidney with hemorrhagic and necrotic areas. (b) Blastemal, epithelial and stromal components seen – triphasic Wilm's tumor (nephroblastoma) (H and E, ×20). (c) Urothelial carcinoma. Pleomorphic tumor cells are arranged in a nested pattern and sheets with an increased N:C ratio

Urothelial carcinoma

Only one case of urothelial carcinoma (3.12%) was seen in our study. The kidney was irregular and bosselated with a gray-white lesion in the pelvicalyceal system. Microscopy showed tumor cells in nested patterns and in sheets, a high nuclear-cytoplasmic ratio, a moderate amount of cytoplasm, and pleomorphic nuclei with prominent nucleoli [Figure 4c].

Discussion

Nephrectomy (partial nephrectomy, simple nephrectomy, or radical nephrectomy) is frequently used as standard treatment for patients who have kidney mass lesions, whether they are benign or malignant. In addition, it is considered the preferred method of treatment for severe renal disorders that have significantly damaged the kidneys and rendered them completely ineffective.[3] The procedure is also done in cases when renal function is impaired, such as recurring pelvic inflammatory disease, calculi, and reflux disorders.[3]

In this study, out of 32 nephrectomy specimens received, 18 cases (56.25%) had nonneoplastic lesions while 14 cases (43.75%) had neoplastic lesions. In our analysis, nonneoplastic lesions made up the great majority. A similar predominance of nonneoplastic lesions was observed in a study by Aiman *et al*., and Rafique.[1,4] We encountered male preponderance with a m: f ratio of 1.4:1 which is in accordance with studies conducted by Basnet *et al*., Nggada *et al*., and Eke and Echem.[5-7] In our study, 51–60 years old was the most common age range for nephrectomies.

The most common clinical presentation was flank pain (65.6%) which is in accordance with the study done by Popat *et al*.[8] This was followed by mass per abdomen (18.7%), hematuria (6.2%), abdominal distension (6.2%), and burning micturition (3.1%).

Chronic pyelonephritis was our study's most prevalent cause of nephrectomy (n = 9, 28.12%), followed by RCC (n = 8, 25%). Chronic pyelonephritis has also been reported as the most common clinical indication in the study by Shah and Goyal.[9]

In our study, an interesting case of RRL was seen in two cases (6.25%). Flank pain was a common symptom at the time of presentation. Radiological examination showed nonfunctioning kidneys. Both cases were associated with a staghorn calculus. This condition is a relatively uncommon chronic pathological kidney condition marked by renal parenchymal damage, atrophy, and excessive fat proliferation that starts in the renal sinus, gradually replacing the entire parenchyma with a fatty pseudo tumor, mimicking xanthogranulomatous pyelonephritis on imaging tests. It is difficult to differentiate at times due to shared etiological factors such as chronic inflammation and renal calculus. It occurs as a result of severe renal atrophy or destruction secondary to chronic calculus disease, long-standing inflammation such as chronic pyelonephritis, and renal tuberculosis.[10-14]

There was only one case of cystic renal dysplasia (3.12%) which was the least common nonneoplastic condition. A similar result was seen in a study done by Datta *et al*.[15]

Out of all nephrectomies performed for neoplastic lesions, RCC (n = 8, 25%) was the most common cause. A similar result was also seen in studies by Narang *et al*.[2] Among the histologic subtypes of RCC, clear cell type RCC was the most common which is in accordance with the study done by Thaker and Singh[16] and Gupta *et al*.[17]

In this study, Wilm's tumor was seen in five cases (15.62%) and accounted for the second-most common neoplastic lesion and the most common neoplastic lesion in the pediatric age group, i.e., 1–10 years with an average age of 4.5 years. All five cases of Wilms' tumor were of triphasic (blastemal, epithelial, and mesenchymal) type–Wilm's tumor which is the most common histologic type in our study. A similar result was also reported by Shaila *et al*.[18]

Urothelial carcinoma of the renal pelvis was the least common neoplastic lesion present in our study (n = 1, 3.12%) which was seen in a 60-year-old female patient.

Conclusion

The present study showed a wide histopathological spectrum of lesions comprising both neoplastic and nonneoplastic lesions which were encountered in nephrectomy specimens in our institution. When compared to neoplastic lesions, nonneoplastic lesions were treated with nephrectomy more frequently.

Out of all nonneoplastic lesions, chronic pyelonephritis was found to be the most common cause and the most common neoplastic lesion was RCC. The most common histologic subtype of RCC was the clear cell subtype. There was male preponderance in our study group with peak age incidence of nephrectomy cases seen between 51 and 60 years. Flank pain was the most common clinical presentation.

Because the majority of the nephrectomies were performed for nonneoplastic causes, our study provides insight into

situations, in which many such nephrectomies can be avoided if treated early. All nephrectomy specimens must be subjected to a detailed histopathological examination along with clinicomorphological correlation to ensure proper management.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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