Original Article

Clinicopathological analysis of nephrectomy cases

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Abstract

Background: A retrospective and prospective study carried out from 2009 to 2016 which includes 57 cases **Objectives:** To analyse neoplastic and non-neoplastic causes of nephrectomy and correlate histopathological findings with clinical diagnosis and radiological findings. **Methods:** H and E stained sections of all nephrectomy specimens were studied. Special stains were performed when required. **Results:** Out of 57 cases, 39 (68%) were non-neoplastic and 18 (32%) were neoplastic. Chronic pyelonephritis was the commonest non-neoplastic cause comprising 32 (82%) cases, of which 73% cases showed obstructive uropathy. Of the 18 neoplastic cases, 2 were benign (renal papillary adenomas) and 16 were malignant. Most common malignant tumour in adults was Clear cell RCC accounting to 6 (75%) cases. All 7 (39%) cases in the paediatric age group were malignant, 3 of Wilms tumour (commonest), 2 of CCSK, 1 of Mesoblastic nephroma and 1 case of Rhabdoid tumour. All 57 cases correlated with clinical diagnosis and radiological findings. One case of rare dual tumours (Clear cell sarcoma [CCSK] and extra adrenal differentiating neuroblastoma was encountered. **Conclusion:** Histopathological examination helps in confirmation of neoplastic and non-neoplastic renal lesions. Male to female preponderance was 2.3:1. Most commonly involved age group was 1-10 years followed by 51-60 years. Most common presenting symptom was pain in abdomen. Most common lesion was chronic pyelonephritis. Malignant tumours were more common than benign. Most common benign lesion was papillary adenoma while most common malignant tumour was RCC in adults and Wilms tumour in children. Out of 57 cases, 22 cases underwent DTPA scan and showed 100% correlation with histopathology.

Key Words: Nephrectomy, renal cell carcinomas, renal tumours, dual tumours.

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INTRODUCTION

Renal diseases are responsible for a great deal of morbidity but fortunately, are not equally major causes of mortality. Millions of people are affected annually by nonfatal kidney diseases, most notably infections of the kidney or lower urinary tract, kidney stones, and urinary obstruction. Twenty percent of all women suffer from infection of the urinary tract or kidney at some time in their lives. Modern treatments, notably dialysis and transplantation, keep many patients alive who earlier would have died of renal failure, adding to the pool of renal morbidity. The study of kidney diseases is facilitated by dividing them into those that affect the four basic morphologic components: glomeruli, tubules, interstitium, and blood vessels. All forms of chronic kidney disease ultimately destroy all the four components of the kidney, culminating in chronic renal failure and end-stage kidneys. The functional reserve of the kidney is large, and much damage may occur before there is evident functional impairment. Nephrectomy is a standard therapeutic urological procedure for malignancy of kidneys and upper urinary tract, and for damaged kidneys with little or no contribution to the overall renal function. The causes of loss of renal function, which lead to nephrectomy differ between the paediatric and adult population.[1] Vesicoureteric reflux is the leading cause of nephrectomy in children.[2] Some reports list malignancy as the leading cause in adults,[3] while others implicate the sequelae of obstruction, collectively known as obstructive nephropathy, as the main culprit.[4]

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- Indications for nephrectomy in children are divided into benign and malignant conditions. Benign accounting for 58% and malignant accounting for 41%. The malignant lesions necessitating nephrectomy include Wilms tumour and neuroblastoma.
- The non-neoplastic conditions include, a non-functioning kidney as a result of advanced vesicoureteric reflux, urinary tract stones or infection.
- Other conditions in this group include ureterocele, a non-functioning kidney as a result of posterior urethral valve, etc.
- Indications for nephrectomy in adults are divided into neoplastic and non-neoplastic. Non-neoplastic accounting for 76% and neoplastic accounting for 23%.[5]
- In the non-neoplastic group, majority (i.e. 53.3%) of the patients undergo nephrectomy for renal stones. Other conditions in this group include chronic pyelonephritis (20%), neglected ureteropelvic junction obstruction (16%), renal tuberculosis (7.6%) and iatrogenic (2.5%).
- In neoplastic group, 23% patients undergo nephrectomy for malignant conditions i.e. renal cell carcinoma. Malignant tumors are more common in males while benign conditions necessitating nephrectomy are predominant in female patients.[5,6]

Types of Nephrectomy and their indications

1. **Simple Nephrectomy**: (Removal of the whole kidney and the ureter) Indications: Chronic infection, obstruction, calculus disease, large polycystic kidney, traumatic injury, to treat renovascular hypertension, nephrosclerosis, pyelonephritis, reflux disease (Grade V), congenital dysplasia of kidney.
2. **Partial Nephrectomy**: (Removal of some part of the kidney, leaving behind healthy kidney tissue) e.g. removal of a tumour. It is also called as nephron sparing surgery (NSS)
3. **Radical Nephrectomy**: (Removal of the kidney, the adrenal gland, surrounding tissue, all the nearby lymph nodes and the Gerota fascia)

Indications: Localized RCC, locally advanced RCC[7]

- RCC accounts for 3% of adult tumours and 85-90% of malignant neoplasms arising from the kidney[8].
- RCC occurs most often in older individuals, usually in 6th and 7th decades of life, and shows a 2:1 male preponderance.
- The number of nephrectomies for neoplastic lesions has increased. This is consistent with the accepted policy that surgery is the only effective treatment for renal carcinomas. [4] Other therapeutic options such as conventional radiation therapy, chemotherapy, and immunotherapy have been unsuccessful.[9]
- Since 1984, radical nephrectomy has become the standard operation for renal cell carcinoma.
- In the period between 1974 and 1984 patients with renal cell carcinoma were treated by either simple or radical nephrectomy.
- Wider use of ultrasonography and computed tomography has contributed to a better detection rate of renal carcinomas.

The advent of modern antibiotics and the advances in the methods of investigations and the aggressive treatment of acute pyelonephritis and the causative condition e.g. vesico-ureteric reflux lead to small decline in the number of nephrectomized pyelonephritic kidneys.[4]

MATERIAL and METHODS

It is a retrospective and prospective study carried out in our Department of Pathology at Bharati hospital, Pune from the year 2009-2016. A total of 57 cases were included in the study. Patients of all age groups and both the sexes who underwent Nephrectomy were included. There was no exclusion criteria. Records from the department were taken out and slides were reviewed. Data analysis and results were calculated using frequency and percentage. Patient particulars such as clinical findings, investigations such as CT scan, USG, MRI scan, DTPA scan and other relevant investigations were also noted. Nephrectomy specimens were examined in detail grossly and a minimum of four sections were taken from the tumors. The tissue was processed as per standard procedure; 4µm thick sections were cut on a rotary microtome. Special stains were done wherever needed.

OBSERVATIONS and RESULTS

In this study, retrospective study was done in 18 cases and 39 cases were studied prospectively. Males constituted 70.18 % (40 cases) and females, 29.82 % (17 cases), of 57 patients who underwent nephrectomy; hence, the male to female ratio was 2.3:1 [Table 1]. The highest percentage of patients belonged to the age group of 1-10 years followed by 51-60 years [Table 2]. The youngest patient was 2 months old and the oldest patient was 76 years old. Majority of the patients presented with pain in abdomen and fever with/ without chills [Table 3].

Table 1: Sex wise distribution of cases

Sex	Number of cases	Approx. Percentage (%)
Male	40	70.18
Female	17	29.82
Total	**57**	**100**

Table 2: Age wise distribution of cases

Age (years)	Number of cases	Approx. Percentage (%)
<1	3	5.1
1-10	13	23
11-20	4	7
21-30	7	12.3
31-40	4	8
41-50	5	9
51-60	11	19.3
61-70	8	14
71-80	2	3.3
Total	**57**	**100**

Table 3: Distribution of cases according to chief clinical presentation

Clinical presentation	Number of cases	Approx. Percentage (%)
Pain in abdomen	13	24
Fever with/without chills	9	17
Nausea and vomiting	6	11
Burning micturition	4	7
Back pain	4	7
Lump in abdomen	3	5
Frequency of micturition	3	5
Hematuria	3	5
Rigors	3	5
Weight loss	2	3.5
Dysuria	2	3.5
Anuria/Oliguria	2	3.5
Others	3	3.5
Total	**57**	**100**

Majority of the non-neoplastic cases were in the age group of 1-10 years. Majority of the neoplastic cases were in the age group of 51-60 years [Table 4]. Maximum number of cases were males. More number of females were seen in the non-neoplastic group as compared to the neoplastic group [Table 5].

Table 4: Age distribution of neoplastic and non-neoplastic cases

Age group (years)	Neoplastic (%)	Non-neoplastic (%)
<1	2 (11)	1 (2.56)
1-10	5 (28)	8 (20.5)
11-20	-	4 (10.25)
21-30	1 (5.6)	6 (15.3)
31-40	-	4 (10.25)
41-50	-	5 (12.8)
51-60	8 (44.2)	3 (7.69)
61-70	1 (5.6)	7 (17.94)
71-80	1 (5.6)	1 (2.56)
Total	**18 (32%)**	**39 (68%)**

Table 5: Sex wise distribution of non-neoplastic and neoplastic cases

Sex	Non-neoplastic	Neoplastic
Male	26 (67%)	14 (78%)
Female	13 (33%)	4 (22%)
Total	**39 (68%)**	**18 (32%)**
Grand total	**57 (100%)**	

Out of the total 57 cases, 39 were non-neoplastic and 18 were neoplastic. Non-neoplastic lesions were more common than neoplastic lesions [Table 6].

Table 6: Distribution of cases according to diagnostic categories

Causes of nephrectomy	Number of cases	Percentage (%)
Non-neoplastic		
Chronic pyelonephritis	32	82
Tuberculosis	2	5
Hypoplastic kidney	2	5
Renal infarct	2	5
Dysplastic kidney	1	3
Total	**39**	**100**
Neoplastic		
Renal cell carcinoma (RCC)	8	44.5
TCC of renal pelvis	1	5.6
Wilms tumour	3	16.7
CCSK	2	11
Papillary adenoma	2	11
Rhabdoid tumour	1	5.6
Mesoblastic nephroma	1	5.6
Total	**18**	**100**
Grand Total	**57**	**100**

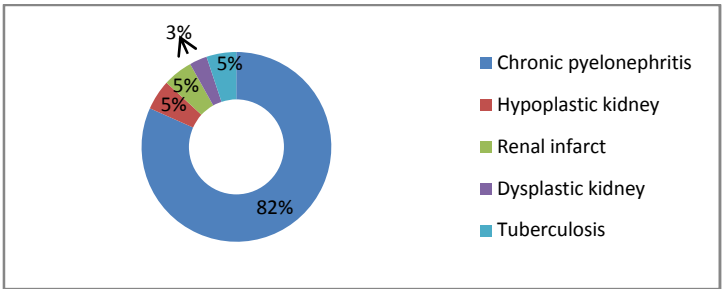

Figure 1: Doughnut diagram showing distribution of non neoplastic cases

The most common non-neoplastic lesion was chronic pyelonephritis [Diagram1].

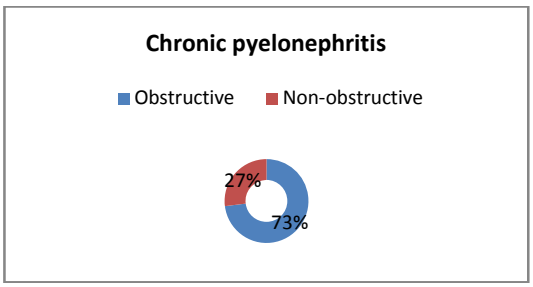

Figure 2: Doughnut diagram showing distribution of chronic pyelonephritis cases according to cause

Amongst chronic pyelonephritis, 73% cases were of obstructive uropathy, 27% cases were of non-obstructive uropathy [Diagram 2]. In obstructive uropathy, 62% cases belonged to nephrolithiasis and rest 38% were due to PUJ obstruction [Table 7].

Table 7: Distribution of cases according to cause of obstructive uropathy leading to CPN and morphologic features seen in these cases

Chronic pyelonephritis due to obstructive uropathy			
Nephrolithiasis (62%)		PUJ obstruction (38%)	
Hydronephrosis	Pyonephrosis	Hydronephrosis	Pyonephrosis
74%	26%	92%	8%
100%		100%	

Majority of the cases of obstructive uropathy were due to Nephrolithiasis. Pyonephrosis was seen more often in cases of nephrolithiasis [Table 7].

Table 8: Changes seen on cut surface of non-neoplastic lesions

Cut surface on gross examination	Approx. Percentage (%)
Dilated PCS	24.59
Cortex thinning	21.31
Loss of CMD	19.67
Cystic areas	11.47
Stones	6.55
Scarring	3.27
Shrunken kidney	9.38
Normal kidney	3.27
Total	**100**

Majority of the non-neoplastic cases showed dilatation of PCS (Pelvicalyceal system) and thinning of the cortex [Table 8]. Out of the total 18 neoplastic cases, 7 were children. Out of which 3 cases were of Wilms tumour. Of these 3 cases, 1 case was one year old and other two cases both were 2 years of age. All the 3 cases of Wilms tumour microscopically showed triphasic differentiation with favourable histology and all belonged to Stage I according to Paediatric Staging of Renal Neoplasms [Table 9].

Table 9: Distribution of malignant tumours in children

Malignant tumours	Number of cases
Wilms tumour	3
CCSK	2
Mesoblastic nephroma	1
Rhabdoid tumour	1
Total	**7**

Out of the total 18 neoplastic cases, 11 were adults and 7 were children. Two papillary adenomas in adults were incidental findings. Malignant tumours were more common than benign tumours. Most common malignant tumours were Wilms tumour in children and Clear cell Renal cell carcinoma (RCC) in adults. No benign tumour was found in paediatric age group. The cases of Clear cell RCC were further classified according to Fuhrman nuclear grading and WHO classification. Histopathological findings in these cases were analyzed. Analysis was also done depending on age, sex, site, commonest clinical feature and clinicopathologic correlation of RCC.

Table 10: Distribution of malignant tumours in adults

Malignant tumours	Number of cases
Clear cell RCC	6
Papillary RCC	1
Multilocular cystic RCC	1
TCC	1
Total	**9**

Clear cell RCC was the most common type of RCC in adults [Table 10]. Maximum number of RCC were found in the age group of 51-60 years. Majority of RCC were seen in males. Left kidney was more commonly involved by RCC.

Table 11: Distribution of cases according to site of RCC

RCC	Number of cases	Percentage (%)
Upper pole	3	37.5
Mid region	3	37.5
Lower pole	1	12.5
Pelvis	-	-
Whole kidney	1	12.5
Total	**8**	**100**

Majority of RCC were restricted to the upper pole and mid pole of the kidney [Table11].

Table 12: Distribution of Clear cell RCC according to Fuhrman Grading

Fuhrman Grading	Number of cases	Percentage (%)
Grade I	1	17
Grade II	4	66
Grade III	1	17
Grade IV	-	-
Total	**6**	**100**

Most common Fuhrman Nuclear Grade was Grade II [Table 12]. Majority of the cut surfaces of RCC showed yellowish appearance. Out of the 8 cases of RCC, only 2 cases showed areas of necrosis and haemorrhage. Lymphovascular emboli were not seen. Other rare tumour encountered in adults was Transitional cell carcinoma (TCC) of the renal pelvis.

Clinical and radiological findings correlated with histopathologic findings in all the cases.

An interesting case of rare dual tumours

- An 11 month male presented with fever, acute gastroenteritis, and poor weight gain
- O/E non-tender mass in right lumbar and hypochondriac regions
- USG (A+P) a 6.1x2 cm heterogeneous hypoechoic mass right lower pole of kidney

- MSCT Chest, Abdomen and Pelvis with contrast: Malignant right renal mass and pre-aortic lymph node mass
- Nephrectomy and biopsy of pre-aortic mass (? LN metastasis) were done
- Remaining pre-aortic mass was removed 15 days later
- The renal mass was diagnosed histopathologically as CCSK (Clear cell sarcoma of the kidney) and the preaortic mass was diagnosed as differentiating neuroblastoma.
- CCSK was later confirmed on IHC which showed positivity for

Cyclin D_1 and Vimentin.

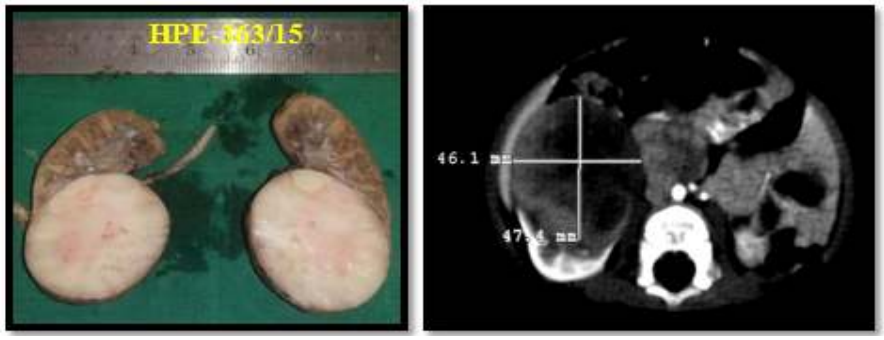

Figure 1: H and E 400X

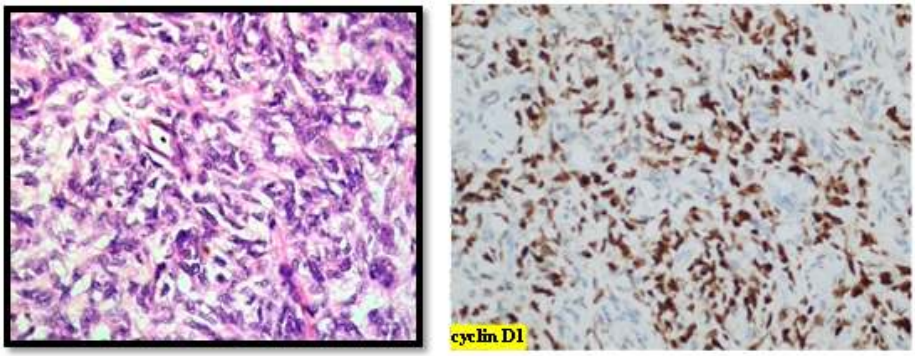

Figure 2:

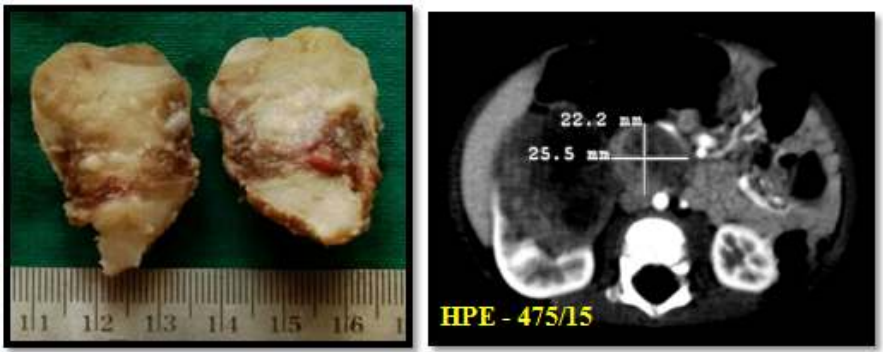

Figure 3: Clear cell sarcoma kidney (CCSK)

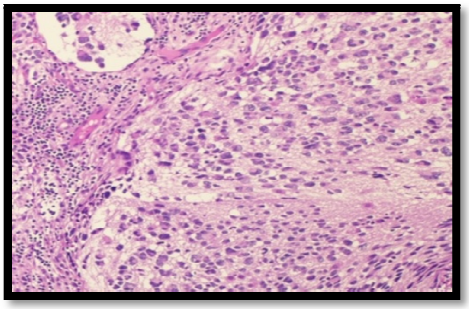

Figure 4:

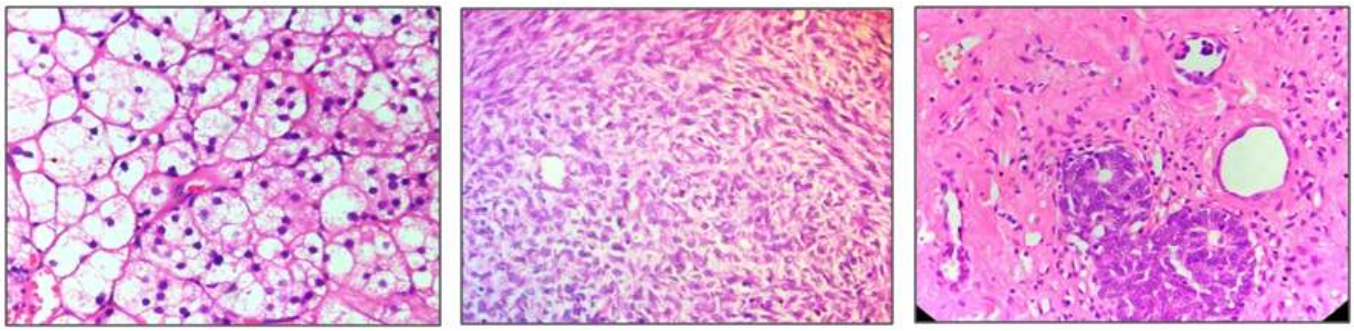

Figure 5: Clear cell RCC (HPE - 1020/15)
Figure 6: Mesoblastic nephroma (HPE - 1056/13)
Figure 7: Wilms tumour (HPE - 2626/15)

Figure 8: Wilms tumour (HPE - 2626/15)
Figure 9: HPE - 2226/16 Renal cell carcinoma kidney (RCC)
Figure 10: Chronic pyelonephritis (CPN) with staghorn calculi

DISCUSSION

The present study provides a fair insight into the morphological patterns of lesions in nephrectomy specimens in our institution. Fifty seven cases of nephrectomy were studied. Majority, 70% were males and 30% were females. M:F ratio was 2.3:1. This is in concordance with the studies done by Ashima N Amin *et al*[10] 57% males and 43% females, Shreedhar VV *et al*[11] 64% males and 36% females, Vikram Narang *et al*[12] 63% males and 37% females. Most common age groups observed were 51-60 years for neoplastic conditions. This is similar to the studies done by Nusrat Bashir *et al*[13] 51-60 years for neoplastic conditions, Vikram Narang *et al* 51.4 years (average age), B Datta *et al*[14] 54.5 years (average age). In present study, non-neoplastic lesions were more common than neoplastic lesions (39% cases). A similar predominance of non-neoplastic lesions was observed in studies done by Aiffa Aiman *et al*[15] (75.3% cases), Ashima N Amin *et al* (63.2% cases), Shreedhar VV *et al* (43% cases). In the present study, the most common clinical presentation was pain in abdomen (24% cases). Similar findings were noted in studies done by Aiffa Aiman *et al* (66% cases), Shreedhar VV *et al* (49% cases), B Datta *et al* (73% cases). Most common indication for nephrectomy was non-neoplastic lesion such as chronic pyelonephritis due to obstructive uropathy (73% cases). Similar findings were noted by Shreedhar VV *et al* (72.7% cases). Non-neoplastic lesions

were more common than neoplastic lesions in females. Similar findings were observed by Aiffa Aiman *et al* in their study. In the present study, cut surface of majority of the non-neoplastic lesions showed dilatation of pelvicalyceal system (24.59% cases) followed by thinning of the cortex (21.31% cases). Similar findings were seen in studies done by Ashima N Amin *et al* and Shreedhar VV *et al*. Of the neoplastic category, malignant tumours exceeded benign tumours in the present study (89% malignant tumours). Similar concordance was seen in studies done by Ashima N Amin *et al* (43% malignant tumours), Vikram Narang *et al* (96% malignant tumours), Nusrat Bashir *et al* (89% malignant tumours) and B Datta *et al* (91.6% malignant tumours). Papillary adenomas were found incidentally in the present study. In present study, most common malignant tumour in adults was RCC (Clear Cell) while in children Wilms tumour was the most common. Similar results were seen in studies done by Aiffa Aiman *et al*, Ashima N Amin *et al*, Vikram Narang *et al*, Nusrat Bashir *et al*. RCC was more common in left kidney, upper pole and mid region in the present study. Similar findings were noted by Ashima N Amin *et al*. RCC was more common in males in the present study. Similar results were noted by Aiffa Aiman *et al* in their study. In the present study, most common age group for RCC was 51-60 years. Aiffa Aiman *et al* showed 40-60 years as the most common age group for RCC in their study. In the present study, cut surface of most cases of RCCs showed yellowish appearance. Furhman nuclear grade II was the most common (4 cases). Similar concordance was seen in studies done by Aiffa Aiman *et al* (13 cases) and Vikram Narang *et al* (31 cases). Wilms tumour was the most common paediatric tumour encountered in the present study. Males affected were more than females. This is in concordance with the studies done by Ashima N Amin *et al* and Vikram Narang *et al*. Triphasic differentiation was the most common histologic subtype encountered in the present study. Similar findings were observed in the study done by Ashima N Amin *et al*. Rare cases encountered were: rare dual tumours (CCSK with extra adrenal differentiating neuroblastoma) and transitional cell carcinoma of the renal pelvis. CCSK was also confirmed later on immunohistochemistry.

CONCLUSION

A wide range of lesions are encountered on histopathology of nephrectomy specimens, many of which may be misdiagnosed clinically and radiologically. Therefore, it is mandatory that every nephrectomy specimen be subjected to a detailed histopathological examination for a clinico-morphological correlation to ensure proper management.

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