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Original Research Article

Histopathological Spectrum of Lesions in Nephrectomy Specimens in a Tertiary Care Hospital

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Abstract

Introduction: The standard surgical procedure in urological practice that is performed in end stage/non-functioning kidney or in suspected malignant neoplasm is nephrectomy. It is indicated in patients who present with a wide range of clinical conditions that include obstruction, symptomatic chronic infections, calculus disease as well as severe traumatic injury to renal cell carcinomas. We conducted this study to assess the patterns of neoplastic and non-neeoplastic lesions in the nephrectomy specimen in a tertiary care hospital.

Materials and Methods: This retrospective study was done over a period of twelve year where all nephrectomy cases were taken out from the records of the department and reviewed. Demographic details and the histopathological reports of the patients were recorded.

Results: Total 111 cases were studied. There were 70 non-neoplastic lesions and 41 neoplastic lesions. Most common non-neoplastic lesion was chronic pyelonephritis. Majority of cases of chronic pyelonephritis belonged to age group 21-30 years. Most common neoplastic lesion was RCC in adult. Most of the patients were in age group 41–50 years. Most common neoplastic lesion was wilm's tumor in children. Rare renal pathologies were congenital mesoblastic nephroma in children and angiomyolipoma and squamous cell carcinoma in adult.

Conclusion: A variety of non-neoplastic and neoplastic lesions present in the hospital which undergo nephrectomy. Many lesions can be clinically and radiologically misdiagnosed, so every nephrectomy specimen should be subjected to a detailed histopathological examination.

In renal cell carcinoma, nuclear grade and staging of tumors are necessary for therapy and prognosis.

Keywords: Nephrectomy; Chronic pyelonephritis; Clear cell renal cell carcinoma; Congenital Mesoblastic nephroma; Angiomyolipoma and Squamous cell carcinoma.

Introduction

Kidneys are vital organs of the body with multiple functions. They are essential for not only excretory function but also to maintain water and salt metabolism along with acid base balance. Additionally, they maintain the blood pressure through renin-angiotensin mechanism and produce erythropoietin required for hematopoiesis.[1]

The degeneration in the functioning of the kidneys can occur due to various pathologies. Nephrectomy is the standard surgical procedure performed in the context of end-stage renal disease and in the case of suspected malignant renal disease.[2] Loin pain is the

most common indication for nephrectomy; other indications are hematuria, mass in the abdomen, and radiological evidence of minimal excretory activity of the kidney via procedures of IVP and USG.[1] Simple nephrectomy is indicated in patients with irreversible kidney damage and also indicated to treat renovascular hypertension; whereas radical nephrectomy is the treatment of choice for renal cell carcinoma (RCC).[3,4]

Though benign non-neoplastic are common conditions affecting the functioning of the kidneys, neoplasms of the kidney have been increasing. In the kidney, both benign and malignant tumors occur. RCC and Wilms' tumor are the most common tumors.[5] In majority of patientswith renal tumors, the treatment of choice is radical or partial nephrectomy. RCC accounts for nearly 2% of adult malignancies and 80–85% of malignant kidney tumors.[6] RCC is found twice as commonly in men as compared to women; it is mainly a disease of old age patients, typically presenting in the fifth to seventh decades of life. However, it has been reported in younger patients also.[7] Wilms' tumor is the most common childhood abdominal malignancy, although it is ranked fifth in frequency among childhood solid tumors. However, less than 1% of Wilms' tumor occurs in adults.[6]

Kidneys with end-stage renal disease can result in major complications,like massive bleeding, for which nephrectomy may be indicated.[8] Pain, intractable hypertension, and repeated infections are the other less frequent indications for nephrectomy. In both adults and children, the most frequent type of nephrectomy specimen for nonneoplastic renal diseases is the kidney removed for one of the distinct but related conditions, such as obstructive nephropathy, hydronephrosis, and chronic pyelonephritis.[8] Another indication for nephrectomy is xanthogranulomatouspyelonephritis. Grossly, mass occupying nature of this lesion usually mimics RCC and thus needs to be effectively differentiated.[9]

Almost any non-neoplastic kidney disease may occur in tumor nephrectomy specimens by chance, but most of the renal lesions involve diabetic nephropathy and arterionephrosclerosis.[9] Surgical pathologists should be aware of the significance of both the correct diagnosis of the underlying renal or urothelial neoplasm and the concomitant non-neoplastic kidney,which is likely to be present in such specimens.[10]

The objective of this study was to assess the patterns of neoplastic and non-neoplastic lesions in the nephrectomy specimen in a tertiary care hospital, and to analyze the neoplastic lesion of kidney according to age, gender, site and histopathology.

Materials and Methods

The present retrospective study was conducted in the Department of Pathology in our institute (UP University of medical Sciences U.P. India). In this study, all nephrectomy specimens received in the department over a period of twelve year (January 1, 2008 to December 31, 2019) were included. A total of 111 cases of nephrectomy specimen were studied during this period. In view of the retrospective nature of the study, informed consent of the patients were not taken and no identity of the patients were revealed in the study.

For all nephrectomy cases, paraffin blocks, slides as well as case records were retrieved and studied. As per standard procedure, the tissue was processed; on a rotary microtome, 4 to 5-µm-thick sections were cut. All the nephrectomy specimens were fixed in 10% formalin; gross examination was performed according to standard guidelines.

As per standard protocol grossing of formalin-fixed specimen as well as processing of tissue was performed. Haematoxylin and Eosin stained sections were studied. Special stains and immuno histochemistry were also performed, if required. The cases were reviewed in terms of age, gender, right or left, clinical presentation and pathological diagnosis.

Statistical analysis was carried out wherever necessary.

Result

The present study included all 111 nephrectomy cases received during the study period.

There were 70 non-neoplastic lesions and 41 neoplastic lesions. In our study, males constituted 59 cases (53.15%) and females 52 cases (46.85%) with a M:F ratio of 1.13:1.

Age ranged from 13 days to 76 years. The most common clinical presentation of patients who underwent nephrectomy was flank pain seen in 82.88% patients followed by burning maturation 46.85%, fever 35.13%, hematuria 36.04% and lump 21.62%.

Most common non-neoplastic lesion was chronic pyelonephritis 42.86% (n=30), followed by cyst 14.28% (n=10), chronic pyelonephritis with hydronephrosis 12.86% (n=9) chronic pyelonephritis with stone 8.57% (n=6), Xanthogranulomatous pyelonephritis 5.71% (n=4), chronic granumomatous pyelonephritis 4.28%

Fig. 1: Gross photography of chronic pyelonephritis with multiple stones.

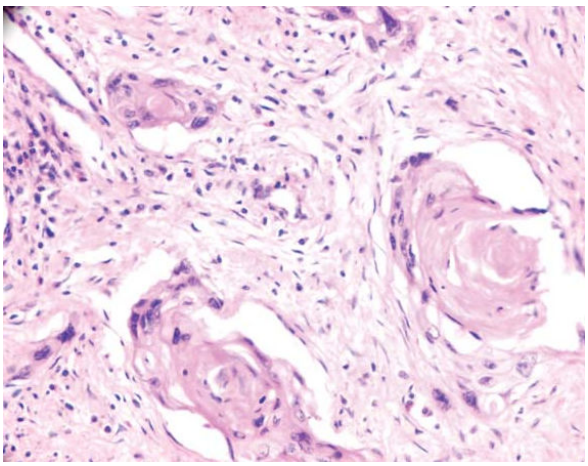

Fig. 2: Microphotography of Squamous cell carcinoma shows pleomorphic squamoid cells. (H & E, 40X).

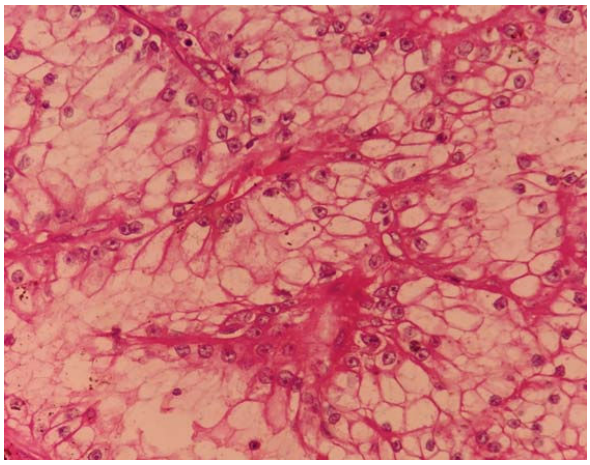

Fig. 3: Microphotography of Clear cell RCC shows groups of tumor cells characterised by round to oval shape nucleus and have prominent nucleoli (H & E, 40X).

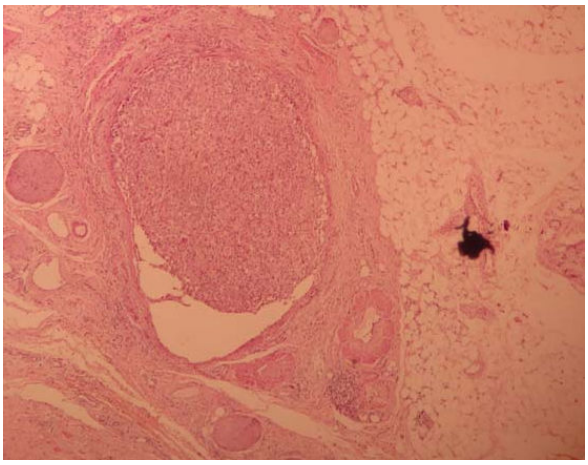

Fig. 4: Microphotography of vascular invasion of tumor cells.

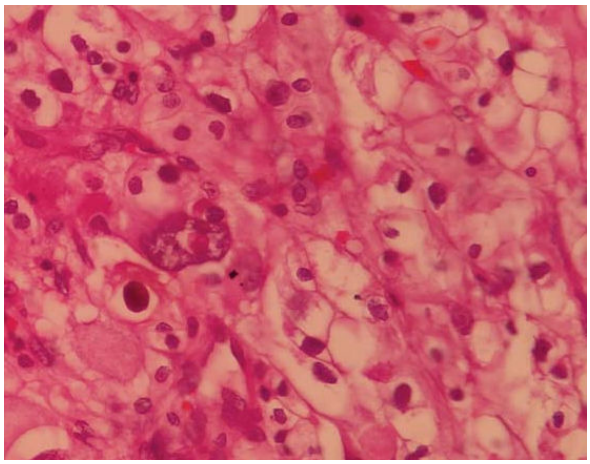

Fig. 5: Microphotography of Clear cell RCC grade-4 shows groups of tumor cells characterised by round to oval shapewith irregular outline nucleus, prominent nucleoli and bizzzare cell. (H & E, 40X).

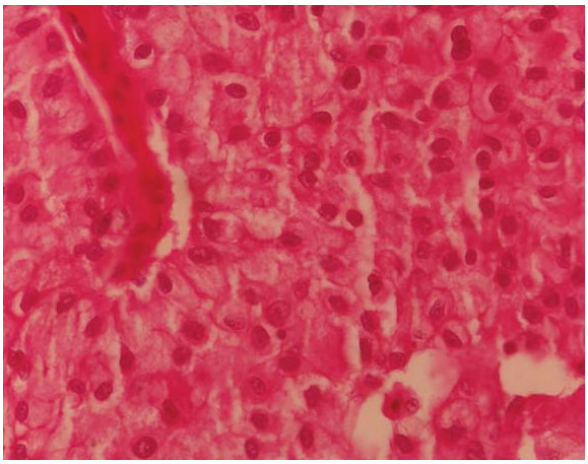

Fig. 6: Microphotography of Chromophobe RCC shows groups of tumor cells, acinar growth pattern with individual cells showing clear to eosinophilic flocculent cytoplasm and few of them have perinuclearhalos (H & E, 40X).

(n=3), tuberculous pyelonephritis 2.86% (n=2), lacerated 5.71% (n=4), atrophy 1.43% (n=1), and infarction with fat necrosis 1.43% (n=1).

In patients with non-neoplastic lesions, in all the age groups, most of the patients had chronic pyelonephritis. Majority of cases of chronic pyelonephritis 11.43% belonged to age group 21–30 years. The 4 case of chronic Pylonephritis with stone was in age group 41–50 years, 3 cases of chronic pylonephritis with hydronephrosis was in 11–20 years and that of 2 Xanthogranulomatous pyelonephritis was in age group 21–30 years. Three cases of cysts belonged to 31–40 years, two in 0–10 years, two in 61–70 years age group. Details of rest of the lesions are given in Table 1. None of the case reported was from patient above 80 years age. There was no significant difference in age in non-neoplastic lesions (P = 0.628).

Most common neoplastic lesion was RCC 68.29% (n=28), followed by wilm'stumor14.63% (n=6), cystic nephroma 4.88% (n=2), metastatic adenocarcinoma 2.44% (n=1), squamous cell carcinoma (SCC) 2.44% (n=1), congenital mesoblastic nephroma 4.88% (n=2) and angiomyolipoma 2.44% (n=1).

Most of the cases of RCC belonged to age group 41–50 years (n=8), followed by 51–60 years (n=6), and 61–70 years (n=6). One cases of metastatic adenocarcinoma, belonged to 41–50 years. One case of SCC was in age group 31–40 years. Four case of wilm's tumor belonged to 0–5 years and two cases, 6–10 years age group. Two cases of congenital mesoblastic nrphroma belonged to 0–5 years age group. Details of the lesions are given in Table 3. There was a significant difference in age in neoplastic lesions (P=0.002).

Table 1: Distribution of age in non neoplastic lesions.

Age	Ch. PN	Ch. PN with Stone	Ch. PN with HN	XG PN	Ch. G PN	TB PN	Cyst	Lacerated	Atrophy	Infarction with Fat Necrosis	Total	%
0–10	1		1				2				4	5.71
11–20	5		3					1	1		10	14.28
21–30	8		2	2	2		1	1		1	17	24.28
31–40	6		2	1		1	3	1			14	20
41–50	7	4	1	1	1		1	1			16	22.86
51–60	2					1	1				4	5.71
61–70		2					2				4	5.71
71–80	1										1	1.43
81–90											0	0
91–100											0	0
Total	30	6	9	4	3	2	10	4	1	1	70	100
%	42.86	8.57	12.86	5.71	4.28	2.86	14.28	5.71	1.43	1.43	64.22	

Table 2: Distribution of gender in non-neoplastic lesions.

Age	Ch. PN	Ch. PN with Stone	Ch. PN with HN	XG PN	Ch. G PN	TB PN	Cyst	Lacerated	Atrophy	Infarction with Fat Necrosis	Total	%
M	16	4	3	0	0	1	5	4	1	1	35	50
F	14	2	6	4	3	1	5	0	0	0	35	50
Total	30	6	9	4	3	2	10	4	1	1	70	

Table 3: Distribution of age in neoplastic lesions.

Age	RCC	Wilm's tu	SCC (well differ.)	Metastatic Adenocarcinoma	Cystic Nephroma	Congenital Mesoblastic Nephroma	Angiomyolipoma	Total	%
0–5	0	4	–	–	–	2	–	6	14.63
6–10	0	2	–	–	–	–	–	2	4.88
11–20	2	0	–	–	–	–	–	2	4.88
21–30	0	0	–	–	1	–	–	1	2.44
31–40	4	0	1			–	–	5	12.19
41–50	8	0	–	1	1	–	–	10	24.39
51–60	6	0	–	–	–	–	1	7	17.07
61–70	6	0	–	–	–	–	–	6	14.63
71–80	2	0	–	–	–	–	–	2	4.88
Total	28	6	1	1	2	2	1	41	100
%	68.29	14.63	2.44	2.44	4.88	4.88	2.44	36.94	

Out of 70 cases of non-neoplastic lesions, 35 were from male and 35 from female patients. Details of the lesions are given in Table 2.

In non-neoplastic lesions, majority of the patients were in age groups 21–30 years (24.28%) and 41–50 years (22.86%). Most of the cases in males were from age group 41–50 yearsfollowed by 21–40 years. Majority of the cases in females were from age group 21–30 years followed by 31–50 years.

Most of the males and female both belonged to age group 21–30 years. There was no significant difference in gender in different age groups in patients with non-neoplastic lesions (P=0.590).

In neoplastic lesions, majority of the patients were in age groups 41–50 years (24.39 %) and 51–60 years (17.07 %) followed by 61–70 years (15.38%). Most of the males (19.51 %) belonged to age groups 41–50 years and 14.63 % in 61–70 years, and most of the females 12.19% were in 51–60 years, 9.76% in 0–10 years of ageand 2.44% in 11–20 and 2.44%in 21–30 years. Details of the lesions are given in Table 3 and 4. There was no significant difference in gender in different age groups in patients with neoplastic lesions (P=0.115).

A total of 28 cases of renal cell carcinoma were seen, of which 64.28% (n=18) were male and 35.71% (n=10) were female. Details of the lesions are given in Table 6. Age range was 11–80 years; maximum number of cases 28.57% was in age group 41–50 years. Details of pattern of RCC are given in Table 5. There was no significant difference of pattern of RCC in males and females (P>0.05).

In RCC out of 28 cases, 17 (60.71%) cases exhibited Furhman nuclear grade 2 and 6 cases (21.43%) shows Furhman nuclear grade 3. Table 7 shows the Furhman nuclear grading.

One case of metastatic adenocarcinoma, there was male patient in 41–50 years age. There was one caseof squamous cell carcinoma (SCC), which were in females in age group 31–40 years. There were six cases of wilm's tumor, one in male of age group 0–5 years, two in 6–10 years and three cases in female of age group 0–5 years. Two case of cystic nephroma, one male belonged to 41–50 years age group and one female in 21–30 years age group. Two case of congenital mesoblastic nephroma was reported in one female and one in male. Who was in age group 0–5 years (Table 4). There was no significant difference of pattern of neoplastic in males and females (P>0.05).

In our study, that majority of the Renal tumor were presented in stage I (52.94%) followed by stage II (41.18%) and stage III (5.88%).

Table 4: Distribution of gender in neoplastic lesions.

Age	RCC	Wilm's tu	SCC (Well Differentiated)	Metastatic Adenocarcinoma	Cystic Nephroma	Congenital Mesoblastic Nephroma	Angiomyolipoma	Total	%
M	18	3	0	1	1	1	0	24	58.54
F	10	3	1	0	1	0	1	17	41.46
Total	28	6	1	1	2	1	1	41	

Table 5: Distribution of agein various histopathological variant of renal cell carcinoma.

Age	Clear cell type	Papillary	Chromophobe cell CA.	Collecting Duct CA.	Total	%
0–10	–	–	–	–	0	0
11–20	1	1	–	–	2	7.14
21–30	–	–	–	–	0	0
31–40	4	–	–	–	4	14.28
41–50	7	–	–	1	8	28.57
51–60	4	1	1	–	6	21.43
61–70	4	1	1	–	6	21.43
71–80	2	–	–	–	2	7.14
Total	22	3	2	1	28	–
%	78.57	10.71	7.14	3.57	–	–

Table 6: Distribution of gender in various histopathological variant of renal cell carcinoma.

Age	Clear cell type	Papillary	Chromophobe Cell CA.	Collecting Duct CA.	Total	%
M	14	2	1	1	18	64.28
F	8	1	1	0	10	35.71
Total	22	3	2	1	28	–

Table 7: Furhman nuclear grading of Renal cell carcinoma.

Fuhrman Nuclear Grade	No. of Cases	%
Grade–1	4	14.28
Grade–2	17	60.71
Grade–3	6	21.43
Grade–4	1	3.57

Table 8: Various studies comparing Furhman nuclear grading of Renal cell carcinoma.

Fuhrman nuclear grade	Aiman et al	Wang et al	Kumar et al	Shalakha et al	Present study
Grade-1	4 (16%)	6 (11.3%)	-	1 (16.67%)	4 (14.28%)
Grade-2	13 (52%)	34 (64.2%)	3 (30%)	4 (66.67%)	17 (60.71%)
Grade-3	6 (24%)	11 (20.8%)	4 (40%)	1 (16.66%)	6 (21.43%)
Grade-4	2 (8%)	2 (3.8%)	3 (30%)	-	1 (3.57%)

Total number of right and left neoplastic lesions was 10 and 16, respectively. Most of the right neoplastic lesions were in age groups 41–50 years (30%) and 61–70 years (30%). Majority of the left neoplastic lesions were in age groups 41–50 years (31.25%) and 51–60 years (18.75%). There was no significant difference in age in right and left neoplastic lesions (P=0.594).

Total number of right and left non-neoplastic lesions was 31 and 27, respectively. Most of the right non-neoplastic lesions were in age groups 21–30 years and 41–50 years. Majority of the left non-neoplastic lesions were in age groups 21–30 years and 31–40 years. There was no significant difference in age in right and left non-neoplastic lesions (P=0.484).

Discussion

In this study, out of the 111 nephrectomy specimens studied, 63.06% were non-neoplastic lesions and 36.94%were neoplastic lesions. Thus, in our study, non-neoplastic lesions comprised the majority of the cases. Some of the previous studies also showed similar predominance of non-neoplastic lesions. In study by Shaila et al., out of 106 nephrectomies 77.66% were non neoplastic and 22.64% were neoplastic lesions.[4] Similar observation were reported by study of Divyasree BN et al. in which non-neoplastic were 72.41% and neoplastic were 27.59% cases.[11]

In the nephrectomy specimens, 53.15% were of males and 46.85% of females, with male:female ratio 1.13:1. This ratio is in concordance with the study by El Malik et al. who reported 61% nephrectomies in males and 39% in females with M:F = 1.9:1.[12]

However, it is in slight variation with Aiman et al., where among nephrectomy specimens, 51.4% were of females and 48.5% of males, with M:F = 1:1.05.[9] Similar findings were found by Rafique where M:F ratio was 1:1.05.[13] Shaila et al[4]., also reported that among the nephrectomy cases 57.55% were female patients and 42.45% were male patients, which was similar to study of Divyasree BN et al. who observed 51.5% of female and 48.5% of males.[11]

In the present study, the most common indication for nephrectomy was chronic pyelonephritis (42.86%), followed by renal cell carcinoma (71.79%). Our findings are at par with findings of previous studies as chronic pyelonephritis is reported as the most common clinical indication in the studies by Shaila et al[4]., Aiman et al[9].,Popatet al[14]., Adamson et al[15].

In the present study, 4 (5.71%) cases of xanthogranulomatous pyelonephritis were seen. Shaila et al[4]., observed two cases (1.88%) cases, Popatet al[14]. observed two cases (2.5%), El Malik et al[11]., six cases (1.1%), Aiman et al[9]., eight (5.7%) cases, and D'Costa et al[16]. found 10% cases of xantho granulomatous pyelonephritis in their studies.

Most of the cases of xanthogranulomatous pyelonephritis were in age group 21–30 years, one case in age group 31–40 years, and one case in 41–50 years. In study by Aiman et al., most of the patients, i.e., 62.5% belonged to the age group of 41–60 years, followed by 25% in the age group of 21–40 years.[9] Popat et al[14]., reported that all cases were in the age group of 20–40 years. In study by Ranadive et al., the age of cases in the range of 20–60 years.[17]

Among 41 neoplastic lesions of kidney in our study, the most common neoplasm encountered was renal cell carcinoma 28 cases (71.79%). Comparable findings were reported by Shaila et al[4]., Aiman et al[9]., Rafique et al[13].

In the RCC, most of the cases were in in fifth to seventh decades of life. Similar findings were observed by Shailaet al[4]. and Mahesh et al[18].

We found 4 cases of Wilm's tumor in the age group of 0–5 years and 2 cases in 6–10 years, which is correlating with the study of Shaila et al[4]., who reported five cases of Wilm's tumor in the age group of 2 to 6 years. Argani et al. also reported similar findings.[19]

Primary squamous cell carcinoma and angiomyolipoma of the kidney is a very rare entity. In our study, there was one case of squamous cell carcinoma and one case of angiomyolipoma. In the study by Aiman et al., only one case of squamous cell carcinoma was noted in a 33-year-old man and one case of angiomyolipoma in a 50 years female.[9] Reported by Li et al[20]., the incidence of renal SCC among malignant renal tumors is in the range of 0.5–0.8% and Blacheret al.[21] also reported similar findings.

In our study, histological types of RCCs were 22 (78.57%) cases of clear cell type, 3 cases (10.71%) were papillary variants, and two cases (7.14%) were chromophobe variant. This observation is similar to the observation noted by Aiman et al., where among all histological types of RCCs, seven (58.3%) cases were of clear cell type, four cases (33.33%) were papillary variants, and one case (8.3%) was chromophobe variant.[9] Similar findings were found by Mahesh et al[18].

Furhman nuclear grading revealed 17 (60.71%) cases showing Grade 2 nuclear features and 6 (21.43%) cases Grade 3 nuclear features followed by 4 (14.28%) cases Grade 1 and 1 (3.57%) cases Grade–4 nuclear features. This is similar to the findings of Wang et[22] al who observed, 34 (64.2%) cases showed Grade 2, 11 (20.8%) cases Grade 3, 6 (11.3%) cases Grade 1 and 2 (3.8%) cases Grade 4 nuclear features and Aiman et al observed, 13 (52%) cases showed Grade 2, 6 (24%) cases Grade 3, 4 (16%) cases Grade 1 and 2 (8%) cases Grade 4 nuclear features. Popet et al who observed that all cases of conventional renal cell carcinoma showed Grade 2 and Grade 3 nuclear features. Shalakh et al[23] revealed 4 (66.67%) cases showing Grade 2 nuclear features and 1 (16.67 %) cases Grade 1 nuclear features followed by 1 (16.66%) cases Grade 3 nuclear fetures. Kumar et al[24] revealed 4 (40%) cases showed Grade 3, 3 (30%) cases Grade 2 and 3 (30%) cases Grade 4 nuclear features. Table 8 Sowing various Authors comparing the pesentage of Furhman nuclear grading.

One case (2.44%) of squamous cell carcinoma, the patient was a 40 year female presenting with pain and lump in right lumber region. Radiological diagnosis was nephrolithiasis and clinical diagnosis was non functioning kidney. Grossly nephrectomy specimens was enlarged, tumor which was almost involving entire kidney with necrosis and haemorrhages. Well differentiated squamous cell carcinoma was confirmed on histopathology examination.

One case (2.44%) of angiomyolipoma was seen in our study. The patient was a 55 year female presenting with pain and lump in left lumber region. Aiman et al reported one case (0.07%) of angiomyolipoma and popat et al reported two cases 2.5%) falling in the age group of 40–60 years. In a study done by Shaila et al and Kumar et al, 1.87% and 14.28 % with female predominance.

Two cases (4.88%) of congenital mesoblastic nephroma was seen in our study. The patient was a 15 days female child and 1 month male child presenting with lump in lumber region.

Two cases (4.88%) of cystic nephroma was seen in our study.

In our study, that majority of the Renal tumor were presented in stage I followed by stage II and stage III, Similar finding presented by Kumar et al[23] and Wang et al[24].

Conclusion

On histopathology of nephrectomy specimens, a wide range of lesions are encountered. Squamous cell carcinoma and angiomyolipoma in adult and mesoblastic nephroma in children are rare finding in our study. Some neoplasm misdiagnosed as non neoplastic like cystic nephroma, clinically presented as multicystic kidney. Many lesions can be clinically and radiologically misdiagnosed, so every nephrectomy specimen should be subjected to a detailed histopathological examination. This can ensure proper management. In renal cell carcinoma, nuclear grade and staging of tumor are necessary for therapeutic purpose and prognosis.

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