

HISTOMORPHOLOGICAL STUDY OF NEPHRECTOMY SPECIMENS IN A TERTIARY CARE HOSPITAL OF CHATTOGRAM: AN OBSERVATIONAL STUDY

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Abstract

Background: Now a-days nephrectomy is not an uncommon surgery practiced in urology. Not only the clinical suspicions are confirmed but also many unsuspecting lesions are brought to light by the histopathological study. Elective nephrectomy is done for both benign and malignant diseases of the kidney. On the other hand, trauma is the most common cause of emergency nephrectomy. To observe the demographic and histopathological aspects of nephrectomy specimens in a tertiary care hospital of Chattogram: Chittagong Medical College Hospital.

Materials and methods: This was an observational study of nephrectomy specimens received in the Department of pathology, Chittagong Medical College over a period of one year (January to December 2019). The studied parameters were: frequency, age, sex, laterality, clinical presentation, histological type and morphologic characteristics.

Results: There were 30 nephrectomy specimens of which 09 were non-neoplastic and 21 were neoplastic lesions. Among the neoplastic lesions, all the cases were malignant with no significant side and sex differences of patients. The most frequent (26.67%) age range was 0-10 year and renal cell carcinoma was the commonest (13 out of 21 cases, 61.90%) malignant tumor. Among the non-neoplastic lesions, chronic pyelonephritis was the

most frequent benign lesion (5 out of 9 cases, 55.56%).

Conclusion: In this study, there was a much higher rate of nephrectomy performed for malignant conditions of the kidney compared to other developing countries, where benign lesions are the main cause of nephrectomies.

Key words

Nephrectomy; Renal cell carcinoma; Wilm's tumor; Chronic pyelonephritis.

Introduction

Kidney, the blood-filtering organ may be involved by many benign or malignant diseases requiring histopathological evaluation. Renal biopsy and nephrectomy are useful procedure to understand the histomorphology of renal diseases. It helps in establishing the accurate diagnosis, identifying the exact pathology and deciding the appropriate management plan for patients suffering from different types of renal diseases^{1,2}. Nephrectomy is the surgical removal of irreversibly damaged, non-functioning kidneys involved by different benign pathological conditions like obstruction due to extensive renal stone disease, trauma, polycystic kidney disease, pyelonephritis etc as well as different malignant conditions of the kidney³. Detailed surgical histopathology of the resected specimen remains a valuable tool in prognostic stratification of the patients in addition to evaluate the applicability of the newly developed treatment modalities⁴. Renal Cell Carcinoma (RCC) in adults and wilms tumors in children are the commonest neoplastic and chronic pyelonephritis, the end stage of many infective and obstructive kidney lesions is the commonest non-neoplastic indications for nephrectomy⁵. Classification of RCC is based on correlative cytogenetic, genetic and histologic studies⁶. Fuhrman grading system for RCC uses nuclear grades based on nuclear size, irregularity of the nuclear membrane and nucleolar prominence. Fuhrman nuclear grading appears to

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be inappropriate for chromophobe RCC because it very frequently shows marked nuclear irregularities (Grade 3 nuclei) despite the overall excellent survivals⁷. Significant differences in the disease spectrum were found in different national and international studies⁴. The incidence and death rates of renal malignancy are very high in developed countries due to high rates of obesity, smoking and hypertension⁸. In children, renal malignancies are rare, accounting for 6% to 7% of all childhood tumors⁹. Here, we present the histomorphological characteristics of nephrectomy specimens received at the Department of Pathology, Chittagong Medical College, Chattogram. The purpose of this study is to describe the morphological spectrum and basic epidemiological data of renal diseases diagnosed at our institution.

Materials and methods

This study included all the total or partial nephrectomy specimens received during January 2019 to December 2019 at Department of Pathology, Chittagong Medical College, Chattogram for histopathological examination. Total 30 patients, who have given informed written consent to participate in this study were the study subject. All the renal biopsy specimens and patients who were unwilling to give consent were excluded from this study. All the nephrectomy specimens were sent from Department of Urology, Chittagong Medical College, received in 10% formalin, tissues of 4-5 μ m thickness were processed accordingly, embedded in paraffin sections and stained with Haematoxylin and Eosin (H & E) stain followed by light microscopy. All the clinical data were recorded in a pre- designed data sheet. The clinical data of the patients included age, sex, clinical features, all pathological and biochemical investigation records, all imaging studies and gross & histopathologic examination reports of the specimens. Prior to the commencement of the study, the research protocol was approved by the proper authority.

Results

Out of 30 specimens 16 (53.33%) cases were right sided and 14 (46.67%) were left sided nephrectomies. The male-female ratio was equal and age ranges from one year to seventy years. The largest age group was 0–10 years (08 cases, 26.66%), among them 07 cases were malignant.

Patients operated for benign conditions were younger (Mean age 33 years) than those with malignant tumors (Mean age 54.74 years). The age distribution is shown in Figure I.

There were 9 non-neoplastic (30%) and 21 (70%) neoplastic lesions, of them all the neoplastic lesions were malignant. No benign neoplasm was diagnosed in the mentioned time frame. Sex and side distribution of the affected patients are shown in Table-I.

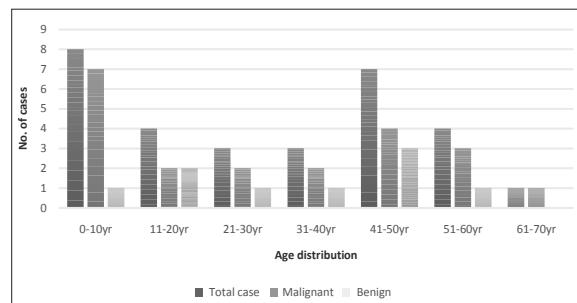


Fig 1 : Age distribution (n=30).

Table I : Indications of nephrectomy with sex and side distribution (n=30).

Causes	Number of cases	Sex distribution		Side distribution	
		Male	Female	Right	Left
I. Benign conditions	09	4	5	5	4
A. Chronic pyelonephritis	05	3	2	3	2
B. Granulomatous inflammation	02		2		2
C. Granulomatous inflammation with pyelonephritis	01		1	1	
D. Multicystic renal dysplasia	01	1		1	
II. Malignant conditions	21	11	10	11	10
A. Renal cell carcinoma	13	6	7	7	6
B. Wilms' tumor	06	4	2	4	2
C. Transitional cell carcinoma of renal pelvis	01		1		1
D. Squamous cell carcinoma	01	1			1

Table II: Histological characteristics of renal cell carcinoma (n=13).

Subtypes	Number of cases	Sex distribution	
		Male	Female
Clear Cell carcinoma	05(38.46%)	4	1
papillary carcinoma	05(38.46%)	1	4
Sarcomatoid variant	02(15.38%)	1	1
Chromophobe variant	01(7.7%)		1
Fuhrman grade			
G-I	00	0	0
G-II	06 (46.15%)	3	3
G-III	05 (38.46%)	2	3
G-IV	02 (15.38%)	1	1

Table III. Clinical presentations of the affected patients.

Clinical presentation	Histological diagnosis						
	Pyelo-Nephritis (n=5)	Granulomatous inflammation (n=3)	Multicystic Renal dysplasia (n=1)	RCC (n=13)	Wilm's Tumor (n=6)	TCC of renal pelvis (n=1)	SCC (n=1)
Pyuria	5	1			2	1	
Abdominal pain	5					1	
Fever	4						
Flank pain		3		4			
Abdominal lump			1	12	6		1
Hematuria			1	7		1	1
Dysuria		3					

Among the benign conditions (n=9), majority cases (5 cases) were chronic pyelonephritis; due to renal calculus or neglected pelvi-ureteric junction obstruction. They presented with pyuria, abdominal pain and/or fever and three of them underwent radioisotope renography, showing less than 15% relative function of the involved kidney. In other cases, on IVU, non-functioning kidney was diagnosed due to non-excretion of contrast agent by the involved kidney. Granulomatous pyelonephritis patients were (3 cases) presented with dysuria, flank pain and previous history of tuberculosis (Clinically proven). A 20 yrs-old girl had history of genito-urinary tuberculosis and rupture of urinary bladder. A one year three months-old male baby presenting with a ballotable kidney lump on right flank and recurrent vomiting, underwent USG of the abdomen showed multiple cystic lesions almost replacing the entire right renal parenchyma. The baby underwent right-sided simple nephrectomy and diagnosed as Multi Cystic Dysplastic Kidney Disease (MCDKD). Renal cell carcinoma cases came with lump in abdomen, weakness and gross hematuria. In Wilms' tumor, most cases are presented as mass in abdomen.

None of the affected patients had abnormal serum creatinine, as the opposite kidney was functioning well. Indications of nephrectomies are summarized at table I.

Renal Neoplasia on Nephrectomy Specimen:

Out of 30 nephrectomy specimens, 21 cases were malignant neoplasm, no benign neoplasm was identified in this study. Of the malignant neoplasms RCC was the commonest (61.9%) one, with M: F ratio of 6: 7. These included each of

clear cell carcinoma 05 (38.46%) & papillary carcinoma 05 (38.46%) cases, sarcomatoid carcinoma 02 (15.38%) cases and chromophobe carcinoma 01 (7.7%) case (Table II). Wilm's tumor was seen in 6 cases (28.5%) accounted for the commonest paediatric neoplastic lesion with an average age of 3.2 years. Transitional cell carcinoma of renal pelvis and squamous cell carcinoma were found as single case each. Table IV shows morphologic characteristics of malignant neoplasm.

Table IV : Morphologic characteristics of malignant cases (n=21).

Variables	Number	Percentage
A. Tumor size (in cm)	<5cm	05 23.9%
	5-10cm	08 38.1%
	>10cm	08 38.1%
B. Capsular invasion	Present	08 38.1%
	Not present	13 61.9%
C. Renal vein invasion	Present	03 14.3%
	Not present	04 19.04%
	Could not be assessed	14 66.67%
D. Pelvis involvement	Present	03 14.3%
	Not present	03 14.3%
	Could not be assessed	15 71.4%

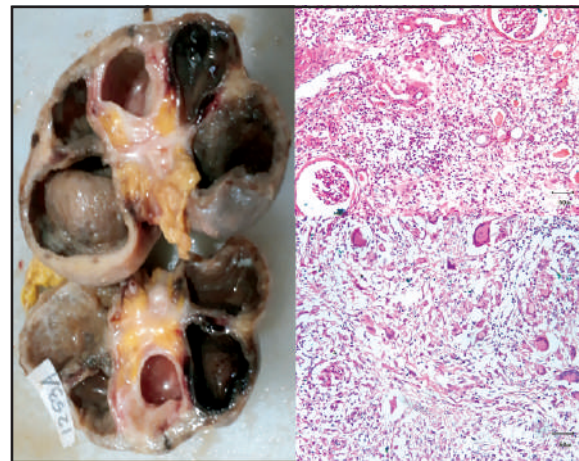


Fig 1: Case of chronic pyelonephritis with granulomatous inflammation. The cut section (Left) of nephrectomy specimen reveals cystic spaces due to irregular scarring and severe loss of papillae. The photomicrograph shows chronic interstitial inflammation and fibrosis along with thyroidization of tubules (Right upper). And formation of many Langhans type giant cells (Right lower).

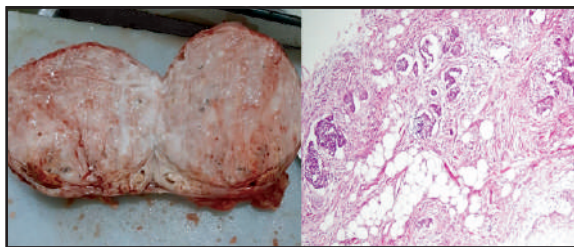


Fig 2 : Wilms Tumor: Grossly, homogeneous solid growth involving whole kidney. Low power microscopic view showing a combination of stromal, blastemal and immature tubular formations.

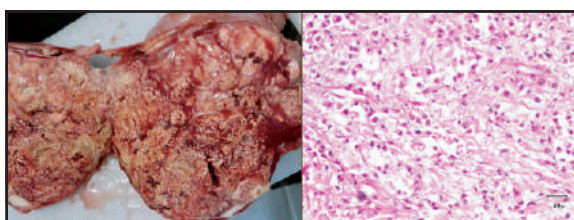


Fig 3 : Gross appearance of renal cell carcinoma, almost entirely necrotic. Microscopic view showing optically clear cytoplasm and sharply outlined cell membrane (Clear cell variant).

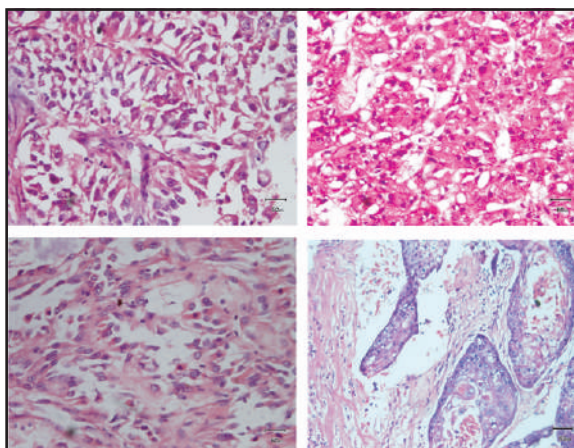


Fig 4: Microscopic view: Renal cell carcinoma- Papillary variant (Left & up) Chromophobe (Right & up) Sarcomatoid (Left & down) and Squamous cell carcinoma (Right & down).

Discussion

Geographic variation is obvious regarding the indications for nephrectomy. The socioeconomic condition and availability of health care facility is the main factor behind it. Despite changes in the investigation and the introduction of minimal invasive techniques in urology, renal preserving surgeries and development of better medical facilities,

the overall number of nephrectomies performed has remained constant over a 31-year period in a large European center. Here the highest indication and pathological cause of nephrectomies were chronic pyelonephritis, which showed a decline from 33.6 cases per year to 27.6 cases per year during a period of 20 years. Again, with advancement of years, malignant diseases of the kidney had become the more frequent causes for nephrectomy¹⁰. Philips et al reported in a series of 121 laparoscopic nephrectomy cases where 69 (57%) cases were done for benign diseases and 52 (43%) cases for malignant causes¹¹.

A retrospective study was done on 431 nephrectomies performed at Princess Basma Teaching Hospital in Jordan over a period of 10 years, where benign disease led to surgery in 298 cases, of which 161 were secondary to infection related conditions and malignancy resulted removal of 125 kidneys. Patients of benign diseases were younger (Mean age 38.4 years) than those with malignant tumors (Mean age 46.7 years)¹². 76.6% benign and 23.4% malignant etiology in nephrectomies were recorded in a center of Pakistan. Here benign causes include renal stone (53.3%) chronic pyelonephritis (20%) neglected ureteropelvic junction obstruction (16%) renal tuberculosis (7.6%) and iatrogenic (2.5%). Malignant tumors were more common in males while benign conditions in female patients. Patients with benign conditions were much younger (Mean age 32 years) than patients in malignant group (Mean age 52.8 years)¹³.

Reports from Nigeria and Norway showed malignant conditions were the prime indications for nephrectomies^{14,15}. Eke and Echem reported 67.6% renal malignancy with male/female ratio of 1:1.09 in nephrectomy patient¹⁴. Beisland et al have also reported an increase in the number of nephrectomies being performed for malignant conditions in Norway. Malignant tumor was the indication for nephrectomy in 437 cases (67.7%) whereas 209 kidneys (32.3%) were removed due to benign conditions. There were slightly more males with malignant tumor, but significantly more females with a benign infectious pathology. Significantly more malignant tumors were situated on the left side ($p = 0.0004$). No side difference was found in the benign groups. Mean age for patients with benign and malignant conditions were 51.8 and 65.4 years respectively¹⁵.

In our study, 30 nephrectomies were available during the period of one year. Majority (70%) of cases were performed for malignant conditions. Among malignant tumors, renal cell carcinoma in adults and Wilm's tumor in children were the commonest tumor encountered in the nephrectomy specimens. A recent data from India showed the same result¹⁶. Patients of benign diseases were younger (Mean age 33 years) than those with malignant tumors (Mean age 54.74 years), which is quite similar to most of the studies. No difference was found in sex distribution and laterality of affected kidney among benign and malignant conditions. The most common affected age group in our study is 0-10 years, of them 6 cases out of 8 are Wilm's tumors. These data is similar to Lowe et al¹⁷.

In the present study, patients with Wilm's tumor presented with mass lesion in abdomen and hematuria, this corresponds with Malkanet al⁹. The size of malignant tumors was variable; the macroscopic size of tumor between 5 to 10cm and > 10cm were 38.1% each, while Baylan et al found that the median pathological tumor size was 3.5 cm and the size of pathological tumors ranged between 1.3 cm and 8 cm¹⁸. Chronic pyelonephritis and renal tuberculosis were the common benign conditions of our study. Thyroidization of tubules and interstitial inflammation & fibrosis were common microscopic finding among chronic pyelonephritis cases. One case was associated with granulomatous inflammation. The microscopic findings of our study were mostly similar to those observed by Divyashree et al and Jain et al. No traumatic lesion or benign tumor was diagnosed during the study period^{19,20}.

A case series from Pakistan showed 30 radical nephrectomy specimens for RCC included 21 (70%) clear cell renal cell carcinoma, 03 (10%) clear cell papillary renal cell carcinoma, 02 (6.6%) papillary renal cell carcinoma and 04 (13.33%) hybrid tumors²¹. In this study we diagnosed 13 cases of renal cell carcinoma, which include each of the papillary carcinoma & clear cell carcinoma 5 cases (38.46%) sarcomatoid carcinoma 2 cases (15.38%) and chromophobe carcinoma 1 case (7.7%). Age of patients with RCC ranges from 9 years to 70 years, with a mean age of 36.54 years and female to male ratio is 7:6. Among 13 RCC cases, 46.15%, 38.46% & 15.38% cases were graded as Fuhrman grade II, grade III & grade IV respectively. Like ours Baylan et al found Fuhrman grade II RCC as the most frequent grade (56/99 cases, 60.2%)¹⁸.

Limitation

The most important limitation of our study was small number of nephrectomy specimens, which do not reflect the actual scenario of our sample population. Again, lack of Immuno Histo Chemistry (IHC) facility in our institution also suffered us a few diagnostic difficulties, which was overcome by using strict morphological criteria. Similar limitations also noted in some of other studies in some other developing countries.

Conclusion

Although benign conditions are the leading cause of nephrectomy in the developing world and in developed countries most of the nephrectomies are performed for malignant diseases. In this study malignancy was the most common pathology. Neoplastic lesions were more common than non-neoplastic lesions of the kidney. Renal cell carcinoma was the commonest neoplastic lesion encountered followed by Wilms' tumour. Chronic pyelonephritis was the commonest non-neoplastic lesion in this series followed by renal tuberculosis. There is wide diversity and overlapping features in renal diseases that needs a thorough evaluation of morphological study for planning therapy and proper post-operative management.

Recommendations

Large scale studies with long term follow-up may provide a more reliable consensus regarding renal diseases in this region. Further studies including IHC and molecular profile of tumor are recommended to identify genetic defects.

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Contribution of authors

SB - Conception, acquisition of data, manuscript writing & final approval.

AS - Acquisition of data, data analysis, manuscript writing & final approval.

SUA - Design, data analysis, critical revision & final approval.

MZR - Interpretation of data, critical revision & final approval.

Disclosure

All the authors declared no competing interests.

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