



Original Research Article

An audit of nephrectomy: A prospective study in a tertiary care hospital in Eastern India

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ARTICLE INFO

Article history:

Received 04-08-2021

Accepted 02-12-2021

Available online 28-11-2022

Keywords:

Audit

Nephrectomy

Benign

Malignant

Complication

ABSTRACT

Background: Nephrectomy means surgical removal of irreversibly damaged kidney by various disease processes, injury and congenital anomalies or en block removal of kidneys along with renal tumors.

Objective: Objective of the study is to gather information and analyze nephrectomies performed at in a tertiary care hospital of Eastern India.

Materials and Methods: A prospective observational study of nephrectomies performed during three years from April 2012 to March 2015 in a tertiary care hospital of Eastern India regarding their demographic study, clinical presentation, indications, postoperative complications and histopathological report.

Results: A total of 106 nephrectomies were performed during the study period. The male to female ratio was 1.3:1 (60:46). Left sided nephrectomies were more common than right side 1.3 :1 (60:46). The indications were renal malignancy in 57.5 % (61) cases others were benign conditions 42.5% (45) leading to non -functioning or poorly functioning kidneys. In the benign conditions, renal stone 22 (48.9%), neglected ureteropelvic junction obstruction 11(24.4%), chronic pyelonephritis 5 (11.1%), renal tuberculosis 4 (8.9%), polycystic kidney disease 2(4.4%), renal trauma 1(2.2%). Malignant diseases were more common in male and benign diseases were more common in females. Benign conditions were more common in younger age group than malignant conditions which were more common in older age group. Nephrectomies in malignant conditions had a higher rate of complications than benign conditions. One patient in malignant group died in immediate postoperative period and one patient of benign group died in early postoperative period (<7 days) with overall 30 days mortality rate was 1.89%.

Conclusion: In our study nephrectomies were performed more in malignant diseases than benign diseases. The mean age of patients undergoing nephrectomies for benign conditions were relatively younger than the mean age of patient undergoing nephrectomies with malignant tumours. There was a higher rate of post-operative complications in malignant tumours than benign diseases but there was no difference in overall mortality.

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1. Introduction

Kidney is one of the most vital organs in human body. It receives twenty percent of cardiac output of our body. These paired organs are required to maintain normal human

physiological functions of our body system. The primary organs for maintaining fluid and electrolyte balance are the kidneys. Apart from that another important role is in maintaining the acid-base balance. They secrete renin, erythropoietin and most active form of vitamin D, 1, 25-dihydroxycholecalciferol. By these ways it plays a vital role in controlling blood pressure, affects red

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blood cell production and affect calcium metabolism, in particularly calcium absorption. Like any other organ of human body, kidney may be involved in various pathological processes, and sometimes it needs removal from our body. Nephrectomy means surgical removal of irreversibly damaged kidney by various disease processes, injury and congenital anomalies or en block removal of kidneys along with renal tumors. Simple nephrectomy is indicated in benign diseases with nonfunctioning or very poorly functioning kidney due to neglected cases of stone disease, genitourinary tuberculosis, ureteropelvic junction obstruction, nephrocalcinosis, chronic pyelonephritis, polycystic kidney disease, vesicoureteric reflux, congenital dysplasia or severe traumatic injury in presence of contralateral normal kidney.¹ Radical nephrectomy is done in case of localized renal carcinoma where minimally invasive procedure like cryotherapy, radiofrequency ablation or nephron sparing surgery–partial nephrectomy are not feasible. Cytoreductive nephrectomy of the primary lesion may be done infrequently in case of metastatic disease for palliative purpose in patients with advanced stages. The indications are severe pain, hematuria, constitutional symptoms, and a lot of paraneoplastic symptoms like hypercalcemia, erythrocytosis, secondary thrombocytosis, or hypertension. Utmost importance to be given to preserve kidney because many of the nephrectomies patients may ultimately leads to chronic renal failure. Partial nephrectomy, also mentioned as kidney-sparing surgery or nephron-sparing surgery is the preferred approach that involves complete resection of a tumor with a negative margin, with preservation of maximum renal parenchyma that are functioning. In today's practice, nephron-sparing surgery is feasible with the advancement of renal imaging, improved experience of renovascular surgery, advanced techniques for preventing renal damage due to ischaemia and increased numbers of incidentally detected low-stage renal tumor. Greater appreciation of the deleterious effects of chronic kidney disease (CKD) and good long-term survival is achieved in patients undergoing this from of treatment. It is now standard of care for the management of clinical T1 (tumor up to 7 cm in greatest dimension and confined to kidney) specially T1a (tumor up to 4 cm in greatest dimension and confined to kidney) renal masses in the presence of a normal contralateral kidney. A functioning renal remnant of at least 20% of one kidney is necessary to avoid end-stage renal failure. In addition to malignant disease, partial nephrectomy can also be used for localized disease of the kidney. The indications of partial nephrectomy include parenchymal atrophy in hydronephrosis or atrophic pyelonephritis in a duplicated renal segment; calyceal diverticulum complicated by either infections, stones, or both; calculus disease with obstruction involving the lower pole calyx or segmental parenchymal disease

with impairment of the drainage system; renovascular hypertension due to segmental parenchymal damage or renal artery disease with noncorrectable branch; traumatic injury with irreversible damage to a portion of the kidney; and resection of a benign kidney tumour such as an angiomyolipoma or oncocytoma (Maatman et al, 1984). Cryotherapy and radiofrequency ablation (RFA) are other modes of treatment for small renal masses. The strategies of local energy application with therapeutic intent directed at focal destruction with minimal injury to the surrounding normal kidney tissue and reduced morbidity. Cryotherapy is the most studied method indicated for the treatment of small renal masses by probe ablation. The biological principle of cryotherapy is destruction of tissue by repeated rapid freeze and thaw cycles down to temperatures below -20°C (preferably below -40°C). The two most commonly used freezing agents are liquid argon and liquid nitrogen. Radiofrequency ablation (RFA) involves coagulation of tumours by directly applying temperatures of $50\text{--}100^{\circ}\text{C}$ throughout the tumor via needle electrodes. For both the techniques indications are similar and are presently confined to serious comorbidity and/or patients with advanced age who are unsuitable to withstand surgical treatment, impairment of renal function, multiple bilateral tumors as in von Hippel-Lindau disease, and renal tumors arising in a solitary kidney. Present guidelines for cryotherapy do not include treatment of tumors more than 3cm in size and for radiofrequency ablation not more than 5cm. Laparoscopic nephrectomy was first described in 1991,² is currently considered the gold standard for radical nephrectomy.³ Not only malignant tumors, most of the benign conditions, including nonfunctioning kidneys, chronic infections like chronic pyelonephritis (contracted granular kidney), renal tuberculosis, symptomatic polycystic kidney diseases all are removed laparoscopically without much difficulties. Previously, large tumor size was considered a contraindication for laparoscopic nephrectomy, but with the development of newer imaging techniques, surgical tools and expertise of surgeon, tumor size becomes less important. Laparoscopic radical nephrectomy including renal vein thrombus is feasible. Only relative contraindications are profound perirenal inflammation, bulky lymphadenopathy, large venous thrombus, and tumor involvement of adjacent organs. It is well established that laparoscopic nephrectomy offers equivalent oncological outcomes and improved postoperative outcomes compared to open nephrectomy.⁴ Minimally invasive procedures are associated with less complications, early recovery and short hospital stay.^{4,5} Laparoscopic partial nephrectomy is associated with longer warm ischaemic times and more urologic complications like postoperative haemorrhage and urinary leak. There are geographical variations of indications for nephrectomy as some urological disease processes are more prevalent in some regions of some

countries.⁶ In contrast to developed countries in developing countries benign diseases are more common than malignant disease for which nephrectomies are indicated.

2. Aims and Objectives

Aims and Objective of this study is to obtain information and analyze nephrectomies from different aspects performed in a tertiary care hospital in Eastern India. Aim of this study is also to gather information regarding indications, clinical presentation, postoperative complications, histopathological report and demographic profile of the patients. Purpose of this study is to develop surgical skills regarding various surgical approaches without causing any untoward effects to the patients. Finally after analyzing all the data, apply judicious use of our knowledge to prevent loss of kidney function / or kidney and to formulate and plan future implement of any disease control programme.

3. Materials and Methods

After obtaining consent from the Institutional Ethical Board, all the medical and surgical records obtained from the patients who underwent nephrectomies from April 2012 to March 2015 in a tertiary care institute in Eastern India were analyzed. The study design was a prospective, observational one. All the data extracted includes age, sex, religion, affected side, clinical presentation, preoperative investigations, and indications for nephrectomy, surgical approach, postoperative complications and histopathological reports. The indications for nephrectomy were divided into benign and malignant diseases.

3.1. Statistical analysis

After compilation of all the collected data, analysis was done using Statistical Package for Social Sciences (SPSS), version 22 (IBM, Chicago, USA). As the study design was a prospective, observational one, categorical variables are expressed as number of patients and percentage of patients with age wise distribution (mean age of presentation of nephrectomy for benign and malignant lesion), sex predilection (male female ratio of malignant lesion), clinical presentations, indications, histologic subtypes and complications.

4. Results

In our study period of three years (April 2012 to March 2015) total 106 nephrectomies performed. Sixty (56.6%) patients were male and 46(43.4%) were female (Figure 1). Age of the patients ranged from 5 years to 76 years (Mean age 45.6 years) (Figure 2 and 3). Out of 106 patients 75 patients were Hindus and 26 patients were Muslims (Figure 4). Patients for nephrectomies presented

with different types of clinical symptomatology (Figure 5). Majority of the patients 79.2% (84 patients) presented with the complaints of abdominal pain followed by fever 20.8% (22 patients), haematuria 13.2% (14 patients), renal lump 11.3% (12 patients), renal angle tenderness 8.5% (9 patients), family history of stone 7.5% (8 patients), history of previous surgery 14.2 % (15 patients), weakness and weight loss 9.4 % (10 patients) and incidental 10.4% (11 patients).

Out of total 106 patients with nephrectomies, 61(57.5%) were performed for malignant conditions and 45(42.5%) patients for benign diseases. Among the benign conditions for nephrectomies 22(48.9%) had non or poorly functioning kidneys due to stone related aetiology and other benign conditions are neglected ureteropelvic junction obstruction 11(24.4%), chronic pyelonephritis 5(11.1%), renal tuberculosis 4(8.9%), polycystic kidney disease 2(4.4%), renal trauma 1(2.2%).

Out of 39.6% (42 patient) of patients who had comorbidities , the incidence of comorbidities as follows : Hypertension 42.9% (18 patients), obesity 11.9% (5 patients), diabetes mellitus 26.2%(11 patients), pulmonary tuberculosis 7.1%(3 patients), hypertension with diabetes mellitus 11.9 % (5 patients). Risk factors were present 26.4% (28 patients). Out of them 60.7%(17 patients) smokers and 39.3% (11 patients) had exposure of both smoking and alcohol. Urine culture showed, mostly sterile 73.6% (78 patients) while 17.9% (19 patients) showed *Escherichia coli* growth and 4.7% (5 patients) showed *Proteus* species only 3.8% (4 patients) showed growth of *Klebsiella*. Blood biochemistry showed derangement of serum urea and creatinine 4.7% (5 patients) and 7.5% (8 patients) of cases and alteration of serum sodium and potassium 18.9% (20 patients) and 11.3% (12 patients) respectively.

In the malignant group, 88.5% (54 patients) had clear cell carcinoma, 6.6% (4 patients) had transitional cell carcinoma and 4.9% (3 patients) had chromophobe renal carcinoma. Malignant renal tumours were common in males than females (36 males vs 25 females, ratio 1.4:1). In malignant group, no side predilection was noticed, but in cases of benign tumours, incidence of lesions was on the right side mostly (53%). The mean age of patients presented with benign conditions for nephrectomy was 36.5 years (range 5-75 years) while that for malignant disease was 52.3 years (range 7-76 years).

Majority of malignant tumours were removed by radical nephrectomy via trans-abdominal route. Retroperitoneal approach was used for simple nephrectomy in all benign conditions. Partial nephrectomies were done in 5.7% (6 cases). Open procedures were done 84.9% (90 patients) and laparoscopic nephrectomies were done in 15.1% (16 patients). Post-operative complications occurred in 11.3% (12 cases). Complications were more common in

malignant group (13.1% vs 8.9%). Wound infections were more common in benign group and significant bleeding, atelectasis, pulmonary infections were more common in malignant group. Two patients one from each group died in post-operative period with overall mortality of 1.89%.

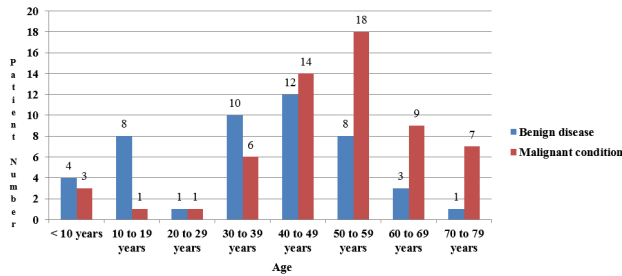


Fig. 1: Age wise distribution of benign and malignant diseases needed nephrectomies

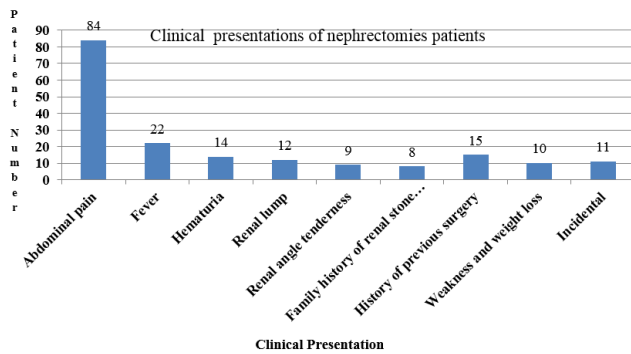


Fig. 2: Clinical presentations of nephrectomies patients

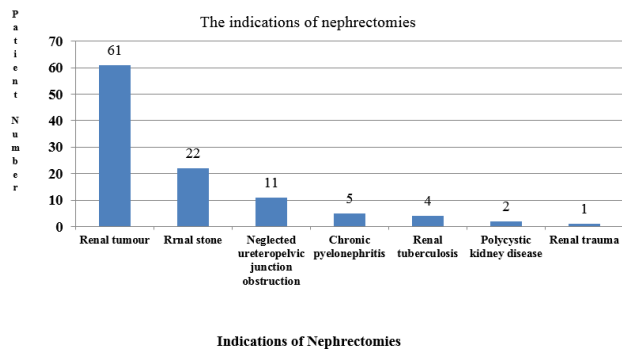


Fig. 3: The indications of nephrectomies

5. Discussion

Indications of nephrectomy vary in relation to age, race, sex, socioeconomic condition, ethnic group and geographical variation. In Norway and Nigeria nephrectomies performed for malignant conditions were

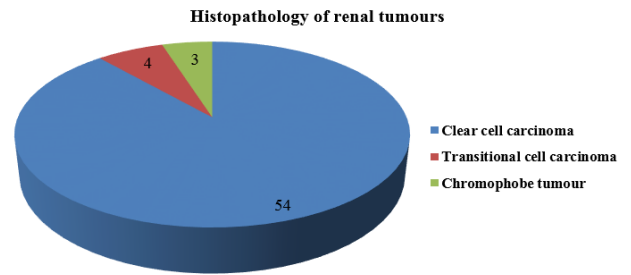


Fig. 4: Histopathology reports

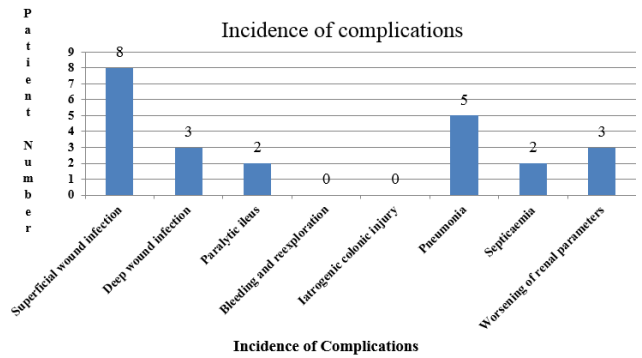


Fig. 5: Incidence of postoperative complications

68% and 67% respectively.^{7,8} Beisland et al and Kubba et al from Norway and UK reported respectively that there was a paradigm shift for the indications of nephrectomy in their countries over the last few decades. They noticed that more nephrectomies now being performed for malignant indications.^{7,9} On the other hand, in a case series, among 423 consecutive nephrectomies from Jordan, 70 % were performed for benign conditions.¹⁰ Datta et al published analysis of 88 nephrectomies in a rural tertiary centre of India that showed 62.5% of nephrectomies were for benign conditions.¹¹

Nephrectomies are of various types: simple, partial and radical nephrectomies.¹² In simple nephrectomy, removal of the kidney within the Gerota fascia is employed to manage nonmalignant diseases of the kidney. Indications for simple nephrectomy include durable nonfunction or poor function of a kidney due to obstruction, infection, trauma, stones, nephrocalcinosis, vesicoureteral reflux, polycystic kidney, or congenital dysplasia. Nephrectomy is undertaken when reconstructive procedures have failed or are contraindicated due to poor function of the renal unit, advanced age, or significant comorbidity. Simple nephrectomy of a functional kidney may be employed to relieve intractable symptoms or associated problems, such as bleeding, pain, hypertension, or persistent infection. Simple nephrectomy is an accepted treatment for renovascular hypertension that is refractory to other organ sparing therapies. In

partial nephrectomy, only diseased or infected portion of the kidney is removed. Spiral CT with 3-dimensional reconstruction, and or CT angiography or MR angiography is useful before nephron sparing surgery. Intraoperative ultrasonography can be also used as adjunct to frozen section biopsy to confirm the extent and number of tumor in the kidney at the time of performing a nephron sparing surgery. In radical nephrectomy en-bloc removal of the kidney outside the Gerota fascia together with the ipsilateral adrenal gland as well as complete regional lymphadenectomy from crus of the diaphragm to the aortic bifurcation is done. But ipsilateral adrenal gland is not always removed during radical nephrectomy. It is specially removed when abnormality in adrenal gland is detected in imaging or not visualized due to large size of renal mass, large upper pole tumor more than 7 cm in greatest dimension and venous thrombus to the level of adrenal vein. In our studies a total of 106 nephrectomies were performed during the study period. The male to female ratio was 1.3:1 (60:46). Left sided nephrectomies were more common than right side 1.3:1 (60:46). The indications were renal malignancy in 57.5 % (61) cases others were benign conditions 42.5% (45) leading to non-functioning or poorly functioning kidneys. In the benign conditions, renal stone 22(48.9%), neglected ureteropelvic junction obstruction 11(24.4%), chronic pyelonephritis 5(11.1%), renal tuberculosis 4(8.9%), polycystic kidney disease 2(4.4%), renal trauma 1(2.2%).

Malignant diseases were more common in male and benign diseases were more common in females. Renal cell carcinoma is a disease primarily involving the elderly populations, with typical presentations in the sixth and seventh decades of life.¹² There was a slightly male preponderance with a male to female ratio is 3:2.¹³ Known risk factors for renal cell carcinoma are hypertension, obesity and male gender.¹⁴ Besides that cigarette smoking, occupational exposure to chemicals, chromosomal aberration, and tumor suppressor genes have been implicated for development of renal cell carcinoma. Incidence of typical histological type of renal cell carcinoma accounts for 70-80% of renal carcinoma while percentage of other histologic subtypes are less frequent.¹⁵ A study conducted by Popat et al, found that 70% of malignant lesions were accounted for by renal cell carcinomas.¹⁶ Among the many observations in this study, the patients presented with renal cell carcinoma, the mean age noticed was 52.3 years and male female ratio was 1.4:1. Subtype of clear cell carcinoma accounted for 88.5% of all renal carcinoma. About 11(10.4%) patient tumors were incidentally discovered. Due to retroperitoneal location of kidneys, many renal masses remain asymptomatic and nonpalpable until they are advanced. With the advent of newer imaging techniques, now a day more than 50% of renal tumor was detected incidentally. The classically

described triad of gross hematuria, flank pain and palpable abdominal mass is now rarely noticed. In this present study, the incidence of malignant tumours occur at a much younger age group in comparison to that of the western countries where it commonly affects the elderly populations and the usual age of presentations is an advanced stage at the time of diagnosis.

Benign conditions were more common in younger age group than malignant conditions which were more common in older age group. Beisland et al observed that among the 209 nephrectomies performed for benign conditions over 20 years at two Norwegian hospitals, five (2.4%) tuberculous kidneys were removed. In another study from Jordan, the incidence of tuberculosis was accounted for nine (3%) among nephrectomies performed for benign lesions. In Western countries, whereas patients with renal tuberculosis are uncommon, but in the developing countries as many as 15-20% of tuberculous patients are diagnosed with Mycobacterium tuberculosis in their urine. In India among the important public health problems, tuberculosis still remains a major one and our study also reveals that there is significant higher incidence of renal tuberculosis compared to that of the other countries.

In our study it is noticed that nephrectomies in malignant conditions had a higher rate of complications than benign conditions (13.1% vs 8.9%). Various authors have reported about 3% reoperation rate after nephrectomy though we have not required reoperation in any case.^{6,9} Requirement of blood transfusion in our study is 8.5% (9 cases). A restrictive transfusion strategy is usually preferred as there is strong evidence supporting that perioperative blood transfusion is associated with higher incidence of morbidity and mortality after radical nephrectomy.¹⁷ In a study from the UK, stated about the outcomes after nephrectomy, described a Clavien-Dindo high grade (grade III or greater) complication rate of 3.9%.¹⁸ Reported mortality rate (<30 days) for nephrectomy ranged between 0.53% to 1.27%.¹⁹ In our study one patient in malignant group died in immediate postoperative period and one patient of benign group died in early postoperative period (<7 days) with overall 30 days mortality rate was 1.89%.

6. Conclusion

In our study nephrectomies were performed more in malignant diseases than benign diseases. The mean age of patients undergoing nephrectomies for benign conditions were relatively younger than the mean age of patient undergoing nephrectomies with malignant tumours. In comparison to western countries malignant tumours affects relatively younger age group in our study. There was a higher rate of post-operative complications in malignant tumours than benign diseases but there was no difference in overall mortality. Early case detection and initiation of proper management by implementation of screening

programme, health education and allocation of resources are necessary to reduce the rate of nephrectomy for preventable conditions like renal stone disease, tuberculosis. This study also helps in evaluation of demography and risk factors of various types of renal disorder for which nephrectomies are performed and to develop surgical skills for various types of surgical approaches in nephrectomies without causing any untoward effects to the patients.

7. Source of Funding

No financial support was received for the work within this manuscript.

8. Conflict of Interest

The authors declare they have no conflict of interest.

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Cite this article: Mondal PP, Haldar P, Ray A, Bera MK. An audit of nephrectomy: A prospective study in a tertiary care hospital in Eastern India. *Panacea J Med Sci* 2022;12(3):508-513.