

Study of complications in partial nephrectomies in 1 year period at tertiary care cancer hospital.

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Abstract

Background: Incidental diagnosis of small renal masses are increasing now a days due to increased use of imaging by ultrasound or cross sectional investigations done for other reason or routine screening. This has led to evolution in management of small renal masses and changes in treatment modalities directed towards nephron sparing procedures. Partial nephrectomy has evolved from open, laparoscopic to Robotic-assisted procedures. There have been studies on laparoscopic partial nephrectomy but no studies have been done in our country and no comparison between open and laparoscopic approach.

Materials and Methods: Cases who underwent partial nephrectomy from January 2021 to June 2024 were retrospectively analyzed. Altogether 46 patients underwent partial nephrectomy in open or laparoscopic surgery. The demographic data, pre-operative, per-operative and post-operative parameters were collected and tabulated. The early complications were defined as the complications that occurred during hospital stay or within 30 days of surgery. These were noted and classified according to Clavein-Dindo Classification. Data collected analyzed using SPSS 25 software.

Results: We observed an overall complication rate of 49% vs 56% in laparoscopic group vs open group; In contrary, 13% vs 4.3% patients experienced high grade complications. The mortality rate was 0%.

Conclusion: Laparoscopic partial nephrectomy had a steep learning curve. With maturity, the complications rates are not more than that of open surgery.

Keywords: Partial nephrectomy, Small renal masses, Renal cell carcinoma, Clavein-dindo classification

Introduction:

Renal Cell Carcinoma (RCC) accounts for 2-3% of all malignant neoplasm with the incidence of 65000 new cases per year and 13000 dying of the

disease.¹ The classic triad of symptoms of RCC are lumbar region pain, hematuria and a palpable flank mass.² Due to the increased use of abdominal imaging, patients are rarely presented

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with these symptoms now-a-days and an incidental finding in imaging done for other reasons is more common.³ RCC has been classified into clear cell, papillary, chromophobe and others. Small renal mass (SRM) is defined as an incidentally detected contrast enhancing solid or cystic lesion that is < 4 cm consistent with clinical stage T1a RCC.⁴ Incidentally detected SRM is favorable with 5 year CSS of 95-100%.⁵ The different treatment modalities for SRM include active surveillance, microinvasive nephron sparing approaches such as cryoablation, radiofrequency thermal ablation and minimally invasive partial nephrectomy and the classical radical nephrectomy.⁵

The standard treatment modality for SRM of this time is partial nephrectomy.¹ Other indications of partial nephrectomy include tumors in solitary kidney, bilateral tumors, known familial RCC, preexisting CKD or proteinuria, young patients, multifocal masses, and in patients with comorbidities likely to impact renal function in future solid/ complex cystic lesion (Bosniak 3/4) in anatomically functioning solitary kidney.⁶ The principles of partial nephrectomy are to preserve the normal renal parenchyma and to achieve negative surgical margins without compromising the oncological outcome.⁷

The contraindications of partial nephrectomy are technical issues like less than 20% of renal parenchyma can be preserved, warm ischemia time more than 20-30 mins and cold ischemia time more than 45 minutes and cancer related issues like diffuse encasement of renal pedicle or

collecting system by tumor, thrombus in major renal veins, adjacent organ invasion or regional lymphadenopathy.⁸

There has been development of various scoring systems for defining the complexity of small renal masses like C-Index, RENAL and PADUA Nephrometry score.⁹ With different techniques of partial nephrectomy according to the location and complexity: enucleation, enucleo-resection, wedge resection, segmental nephrectomy, transverse resection and polar resection are suggested methods. Due to increased diagnosis of SRM and definitive benefit of nephron sparing approaches, there has been inclination towards this surgery. Initially started with open surgery; laparoscopic to robot assisted surgeries are widely practiced procedures. The known early complications of partial nephrectomy are peri-operative hemorrhage, injury to adjacent organs, urinoma, urinary fistula, renal insufficiency due to acute renal failure and hyperfiltration injury. Late complications are formation of pseudoaneurysm, hypertension, positive surgical margins and local surgical site recurrence.¹⁰ Laparoscopic partial nephrectomy has benefits of cosmetic scar, decreased analgesics requirement and shorter duration of hospital stay than open approach with slightly more operative time duration due to learning curve in early period.

In this study, we retrospectively analyzed and compared the Open and Laparoscopic partial nephrectomy in terms of different variables as we consecutively treated the patients.

This audit will be helpful to identify the potential complications and their management which in subsequent time improve the outcome of surgery in the future.

Materials and methods:

All patients of SRM who underwent partial nephrectomy during the period from January 2021 to June 2024 were included in the study. All their clinical data were tabulated and analyzed. The consents were preoperative consents. These patients were divided in two groups according to the approach of surgery: open versus laparoscopic. Patients who were operated by laparoscopic approach were labeled as group A and open approach were labeled as group B.

The different variables like age, gender, body mass index (BMI), smoking history, history of alcohol intake, duration of symptoms, co-morbid conditions, history of significant weight loss, tumor stage, histological subtype, preoperative hydronephrosis, pre-operative hemoglobin, preoperative transfusion, creatinine and albumin, and use of pre-operative medications were reviewed. CECT Abdomen/Pelvis was the major investigation for delineation of tumor in kidney.

Intraoperative parameters like duration of surgery, blood transfusion, warm or cold ischemia time, estimated blood loss and operative findings were reviewed and recorded in both groups. Postoperative parameters like ICU stay, use of inotropes, length of hospital stay were recorded in both groups. The postoperative complications seen in both groups

were reviewed and were enlisted and classified according to Clavein-Dindo Classification.

All data were expressed as mean, standard deviation or frequency and percentages. Univariate analysis was done, using student's independent t-test for continuous variables and chi-square test for categorical variables. Comparison between both groups will be done using SPSS 27.

For all statistical tests, p-value < 0.05 was considered statistically significant.

Operative Procedure:

The selection of surgical approach was operating surgeon's discretion as per complexity of renal masses. In open surgical procedures, the standard flank incision and retroperitoneal approach was the preferred approach. In laparoscopic group, preferred approach was transperitoneal approach, 3-4 ports. The meticulous renal dissection was performed to locate the tumor as well as the renal pedicles. Usually surgeries were performed in warm conditions and selective arterial clamping, and preferably selective clamping was performed. Tumors were sharply dissected with scissors, making sure not cutting into tumor. The collecting system if opened were repaired with 3/0 absorbable sutures, if not internal and external renorrhaphy were performed. In laparoscopic cases, 2/0 barbed sutures were used for repair. The time of clamp in out time were noted and documented. Wounds were closed in usual fashion.

Definition of early complication:

Early complications were defined as any complications occurred during

hospitalization or within 30 days of surgery.¹⁰ Postoperative complications during the hospital stay or 30 days were reviewed and recorded and classified according to Clavein-Dindo classification.¹¹

Table 1: Clavein-Dindo Classification

Grade	Definition
I	Any deviation from the normal postoperative course without the need for pharmacological treatment, or surgical, endoscopic, and radiological interventions. Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgesics, diuretics and electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside
II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications, or requiring blood transfusion or total parenteral nutrition
III	Requiring surgical, endoscopic, or radiological intervention
IIIa	Intervention not under general anesthesia
IIIb	Intervention under general anesthesia
IV	Life-threatening complication (including central nervous system complications) requiring intensive care unit (ICU) management
IVa	Single organ dysfunction (including dialysis)
IVb	Multiorgan dysfunction
V	Death of a patient

Surgical site infection not requiring any intervention were classified as Grade I. Patients who developed postoperative pneumonia, pyelonephritis, paralytic ileus and those who required parenteral

nutritional support and blood transfusion were classified as Grade II. Patients with bowel obstruction with or without peritonitis, dehiscence of wound, hemoperitoneum, hematuria who underwent surgery under general or spinal anesthesia were classified as Grade IIIB while those who did not require general/spinal anesthesia taken as Grade IIIA. Patient with septic shock or single organ dysfunction who needed inotropic support were taken as IVA while those with multiorgan dysfunction as Grade IVB. Mortality of the patient was considered as Grade V.

Results:

Total of 51 case notes were retrieved who underwent partial nephrectomy during the period. Only 46 case notes were complete so as to retrieve the required data, so only these cases were analyzed. By chance, 23 had laparoscopic surgery (Group A) and 23 patients had open partial nephrectomy (Group B). Mean age in laparoscopic was 50.96 ± 12.8 years with range 33-76 years and in open group mean age was 52.39 ± 15.7 with range 25-78 years. The majority of tumors were incidental tumors.

In 23 laparoscopically attempted patient, patients, 19 patients underwent laparoscopic partial nephrectomy, 1 patient had lap nephrectomy for invisibility of tumor, 2 patients were converted open partial nephrectomy and one had open nephrectomy. The more complex tumor on CECT abdomen and pelvis and with complex renal vessels were more likely to be converted to open partial or radical nephrectomy. In 23 patients, where

partial nephrectomy were attempted, 1 had nephrectomy and 22 PN.

		Group A (Lap)		Group B (Open)	
		n	%	n	%
No of patients		23	50%	23	50%
Gender	Male	14	61%	16	69%
	Female	9	39%	7	30%
History of Smoking	Yes	5	22%	8	34%
	No	18	78%	15	65%
History of alcohol use	Yes	6	26%	9	39%
	No	17	74%	14	61%
Hypertension		7	30%	9	39%
Diabetes		2	8%	3	13%
Hypothyroid		2	8%	3	13%
Symptoms		3	13%	4	17%
	Pain	2	8%	2	8%
	Hematuria	1	4%	2	8%
Incidentally discovered		21	87%	19	82%
Side	Right	17	74%	15	65%
	Left	6	26%	8	34%
Site	Upper pole	5	21%	4	17%
	Mid pole	11	47%	12	52%
	Lower pole	7	30%	7	30%
Collecting system breached		2	8%	3	13%
Preoperative transfusion		1	4%	2	8%

The size of the tumor in maximum diameter in CECT was 32 mm \pm 10.62 with range of 15 mm to 47 mm in laparoscopic vs 44 \pm 8.9 mm with range of 29-58 mm in open group. Mean operative time was 179 \pm 57 minutes (range 95-310 minutes) vs 159 \pm 38 minutes (range 90-245 minutes) and mean blood loss was 303 \pm 409 ml (range 50ml to 2000 ml) vs 367 \pm 107 ml (range 150-600ml) in laparoscopy and open group respectively. Mean ischemia time was 20.43 \pm 6.97 mins (range 11.5 to 40 mins) vs 16.78 \pm 1.95 mins (range 14-22 mins) in laparoscopy and open group respectively.

Parameters	Surgical Approach	n	mean	SD	p
Size of tumour in mm	Group A (lap)	23	32.8261	10.62438	0.634
	Group B (open)	23	44.0870	8.94891	
Duration of surgery	Group A (lap)	23	179.2174	57.37433	0.021
	Group B (open)	23	158.7957	39.86390	
Blood loss	Group A (lap)	23	303.48	409.818	0.053
	Group B (open)	23	367.39	107.247	
Ischemia time in min	Group A (lap)	23	20.43	6.978	0.004
	Group B (open)	23	16.78	1.953	
ICU stay in days	Group A (lap)	23	1.26	.541	0.641
	Group B (open)	23	1.22	.518	
Hospital stay in days	Group A (lap)	23	8.09	6.201	0.053
	Group B (open)	23	7.91	3.029	

Parameters		Group A (lap)		Group B (open)	
		n	%	n	%
Pathological stage	pT1a	18	78	11	48
	pT1b	5	22	12	52
Histological type	Clear cell RCC	15	65	15	65
	ISUP Grade 1	12		10	
	ISUP Grade 2	3		5	
	Papillary	4	17	5	21
	ISUP Grade 1	3		3	
	ISUP Grade 2	1		2	
	Angiomyolipoma	4	17	3	13

On histopathology report, out of 23 patients, 15(65.2%) vs 15(65.2%) patients had clear cell renal cell carcinoma with ISUP grade 1 in 12 patients and grade 2 in 3 patients vs ISUP grade 1 in 10 patients and grade 2 in 5 patients in laparoscopic and open group. Four patients (17.3%) had papillary RCC with ISUP grade 1 in 3 and ISUP grade 2 in 1 patients of laparoscopic group vs 5 (21.7%) had papillary RCC with ISUP grade 1 in 3 and ISUP grade 2 in 2 patients. 4

(17.4%) vs 3 (13%) had angiomyolipoma in laparoscopic and open group respectively. No sarcomatoid or rhabdoid differentiation and lympho-vascular or perineural invasion or tumor necrosis was seen in any patients of both groups. The margins were negative in all patients with margin negative from closest resected margin of range 1- 6 mm (mean 2.6mm). According to size, 18 patients (78%) had pT1a and 5 (22%) had pT1b vs 11 (47.8%) had pT1a and 12 (52.2%) had pT1b in laparoscopic and open group respectively.

Complications were seen on 11 (49%) vs 13 (56%) in group A and group B patients during postoperative period among which 9 (39%) vs 11 (49%) patients had low hemoglobin requiring blood transfusion. 2 (8.7%) had urinary tract infection which was managed with iv antibiotics in both groups. 3 (13%) vs 6 (26%) had wound infection and managed on bedside, 2 (8.7%) vs 3% (13%) patients had collecting system breeched requiring DJ stent in laparoscopic and open group respectively out of which one patient in laparoscopic developed hematuria and clots evacuation along with DJ removal was done and one patient in open group had UTI along with hematuria which was managed with early DJ stent removal and iv antibiotics. 3 (13%) in laparoscopic group had macroscopic hematuria out of which 1 was conservatively managed, 1 was managed with clots evacuation and third patient was managed with clots evacuation and emergency nephrectomy while only 1(4.3%) in open group had hematuria which was managed with DJ removal

and antibiotics. 1(4.3%) patient in laparoscopic group has paralytic ileus which was conservatively managed. 4 (17.3%) patients of laparoscopic group had fever, 1 (4.3%) patient had diarrhea which was conservatively managed and 1 (4.3%) patient had hemoperitoneum and went into shock and emergency nephrectomy was done along with chest tube intubation for pleural effusion while 7 patients in open group (30.4%) had fever out of which 6 (26%) had wound infection 1 (4.3%) had UTI and 1 (4.3%) had respiratory tract infection. Only one patient in laparoscopic group had rise in creatinine level postoperatively which later returned to normal limits after managing with iv hydration and iv antibiotics. 2 (8.7%) patients in laparoscopic group vs 1 (4.3%) in open group required emergency nephrectomy during postoperative period.

In terms of Clavien Dindo classification, 2 (8.7%) vs 1(4.3%) patients had Grade I complications like diarrhea and vomiting. Grade II problems were seen in 7 (30.4%) vs 11 (47.8%) patients. 2 (8.7%) vs 1(4.3%) patients had Grade IIIB complications with one patient underwent emergency nephrectomy and one patient cystoscopy and clots evacuation in laparoscopic group the one in open group underwent emergency nephrectomy. 1 (4.3%) had Grade IVA complications with deranged creatinine and hematuria and the patient underwent clot evacuation and nephrectomy.

	Group A (Lap)		Group B (Open)	
	n (%)	CD	N (%)	CD
Gastrointestinal	3 (13)		1(4.3)	
Vomiting	3(13)	I	1(4.3)	I
Paralytic Ileus	1(4.3)	II	0	0
Infectious	4(17)			
UTI	2 (8)	I	2(8.7)	I
Pneumonia	2 (8)	II	1(4)	II
Sepsis	1(4)	IVA	0	
Wound	3 (13)		6(26)	
Surgical Site	3 (13)	I	6(26)	I
Infection				
Wound Dehiscence	0	0	0	0
Renal	1 (4)		0	
Renal Failure	1 (4)	IVA	0	0
Respiratory	1(4)		0	
Respiratory Distress (chest tube)	1(4)	IIIA	0	0
Blood Transfusion	9(39)	II	11(49)	II
Total Parenteral Nutrition	0	0	0	0
Hematuria requiring clots evacuation	2(8.7)	IIIa	0	0
Emergency Nephrectomy	2(8.7)	IIIb	1(4.3)	IIIb
Mortality	0	0	0	0

Mean duration of hospital stay for laparoscopic and open group was 8 ± 6.2 days (range 4-27 days) vs 7.9 ± 3 days (range 4-20 days) with 3 patients in laparoscopic group staying for a longer duration of 17, 25 and 27 days and mean duration of hospital stay of remaining 20 patients was 5.8 ± 1 days (range 4-8 days) in laparoscopic group.

Discussion:

Partial nephrectomy is a surgical procedure associated with relatively high morbidity than radical nephrectomy in urology. In our study, we observed an overall complication rate of 49% vs 56% in laparoscopic group vs open group with approximately 13% vs 4.3% patients experienced high grade complications when Clavien-Dindo grade 3 and higher are considered high grade, 30.4% vs 47.8% had grade 2 and 8.7% vs 4.3% had grade I complications in

laparoscopic and open group respectively.

Gill IS et al in his comparative study between laparoscopic and open partial nephrectomy that median surgical time was 3 vs 3.9 hours ($p < 0.001$), blood loss was 125 vs 250 ml ($p < 0.001$) and mean warm ischemia time was 27.8 vs 17.5 minutes ($p < 0.001$). Three patients in the laparoscopic group had a positive surgical margin compared to none in the open groups (3% vs 0%, $p = 0.1$). Laparoscopic NSS was associated with a higher rate of major intraoperative complications (5% vs 0%, $p = 0.02$).¹² Ting-ting Li concluded in his comparative study between laparoscopic and open approach that operative time was 121 ± 10 vs 135 ± 12 ($p < 0.05$), warm ischemia time was 15.2 ± 4.3 vs 23 ± 5.2 , intraoperative blood loss was 125.2 ± 45.5 vs 162.3 ± 30.6 , postoperative hospital stay was 12.8 ± 1.5 vs 10.2 ± 2.1 , postoperative drainage was 236.7 ± 10.56 vs 250.6 ± 15.13 , Postoperative intestinal function recovery time (H) was 20.3 ± 4.5 vs 18.5 ± 3.5 .¹³

AP Ramani et al, concluded in his study of laparoscopic partial nephrectomy of 200 patients that 33% had one complications in which 5.5% were per-operative, 12% post-operative and 15.5% delayed. Hemorrhage (9.5%) occurred in 3.5% preoperative and 2% postoperative and it was delayed in 4%. Urine leakage occurred in 4.5% out of which 3% required DJ stenting, 1% required CT guided drainage and 0.5% required no treatment. Elective laparoscopic nephrectomy was done in 0.5%.¹⁴ AJ Stephenson et al, concluded in his study that partial nephrectomy had

more complications than radical nephrectomy (9% vs 3%) and re intervention rate was 2.5% vs 0.6%.¹⁵

Conclusion:

Partial nephrectomy has been the standard of care for treatment of small renal masses and due to incidental finding of small renal masses on routine ultrasound screening for other complaints, renal masses are being diagnosed in an early stage. Partial nephrectomy can be performed as a nephron sparing procedure. Laparoscopic approach had better outcome in terms of hospital stay, cosmetic scar, less analgesics requirement and comparable outcomes in terms of post-operative complications and oncological outcome on comparison with open partial nephrectomy. Due to increased diagnosis of small renal masses and, more surgeons are being trained to overcome learning curve, complications are decreasing as well.

Conflicts of Interest

None

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