

Outcomes of Laparoscopic Partial Nephrectomy for small renal masses.

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Abstract

Background: Due to the increased use of imaging modalities in daily medical practices, more and more small renal masses are detected. For these SRMs, nephron sparing procedures are more commonly opted rather than radical nephrectomy for the sake of preservation of renal function and proven similar oncological outcomes. This surgery has evolved from open, laparoscopic to Robot-assisted approaches. This article summarizes our institutional experience of laparoscopic partial nephrectomy.

Materials and Methods: Patients with small renal masses who underwent laparoscopic partial nephrectomy at B.P. Koirala Memorial Cancer Hospital from January 2023 to June 2024 were retrospectively retrieved. Altogether 23 case notes fulfilled the criteria for analysis. All the demographic, preoperative, intraoperative, postoperative data were collected from the notes and plotted. All the issues within 30 days of surgery were defined as early complications. Clavein-Dindo Classification used for analysis. SPSS 25 software was used.

Results: Twenty three patients underwent partial nephrectomy with laparoscopic method. All were done trans-peritoneally. Average age of patient was 50.96 ± 12.8 years with range of 33-76. Male were 14 and 9 were females. Average hospital stay was 8 days. The majority of patients after PN recovered well. Nonetheless, 8 developed postoperative complications. GI complications were 8.7%, infections related 13%, Wound related 8.7% and others. Two patients (8.3%) were required to undergo reoperation and nephrectomy for haematuria.

Conclusion: Laparoscopic partial nephrectomy is a surgery with steep learning curve. As it requires advanced laparoscopic suturing skills, complications in early period was common. After maturity the complications are as par to open PN.

Keywords: Laparoscopic partial nephrectomy, Small renal masses, Postoperative complication, Renal cell carcinoma

Introduction:

Renal cell carcinoma (RCC) accounts for 2-3% of all malignant neoplasm with the incidence of 65000 new cases per year and 13000 die of the disease.¹ Patient rarely present with the classic

triad symptoms of lumbar region pain, hematuria and a palpable mass² due to the increased use of abdominal imaging and RCC is diagnosed as a incidental finding in imaging done for other reasons.³ RCC has been

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classified into clear cell, papillary, chromophobe and others. Due to the current era of increased abdominal imaging for different medical reasons, renal masses are diagnosed in small sizes and named as small renal mass (SRM). Classically, SRM is defined as contrast enhancing solid or cystic renal lesion that is < 4 cm in largest diameter which will be consistent with clinical stage T1aRCC.⁴ Incidentally detected SRM (pT1a) has relatively favorable outcome with 5 year CSS of 95-100%. About 2% of SRMs develop metastasis and has poor prognosis with 5 year CSS of 5-10%.⁵ The current management options available for small renal masses includes active surveillance, ablative techniques like radiofrequency, thermal, cyrotherapy etc and surgical technique of PN. Standard of care of the current time for SRM is masses is partial nephrectomy whenever possible.¹ other indications of partial nephrectomy include solid/complex cystic lesion (Bosniac 3/4), in anatomically functioning 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.⁷

Non-feasibility of partial nephrectomy are likely when only less than 20% of renal parenchyma can be preserved after surgery, warm ischemia time exceeding 30 mins and cold ischemia time exceeding 45 minutes, diffuse encasement of renal pedicle or collecting system by tumor, thrombus in major renal veins, adjacent organ invasion or regional lymphadenopathy. The principles of partial nephrectomy

is to preserve as much normal renal parenchyma as possible along with negative surgical margins, which my translate into similar oncological outcome as of nephrectomy.⁸ There are different techniques of partial nephrectomy: enucleation, enucleo-resection, wedge resection, segmental nephrectomy, transverse resection and polar resection. There have been developments in approach to partial nephrectomy from open, laparoscopic to robot assisted techniques. There are methodological objectifying ways to expect the difficulty during surgery by looking into cross-sectional imagings. This complexity has been evaluated using various scoring system like C-Index, RENAL and PADUA nephrometry score.⁹

The complications specific to partial nephrectomy are postoperative bleeding, urinary leakage, adjacent organ injury, some may develop renal insufficiency and hyperfiltration injury, formation of pseudoaneurysm, even positive surgical margins and local surgical site recurrence.¹⁰ Laparoscopic partial nephrectomy can have similar complications as of open PN, and also requires advanced laparoscopic suturing skills which interferes with the ischemia time. Benefits are small scar, early mobility and short hospital stay and early return to work.

In this study, we cross-sectionally audited our results in that stipulated time frame. This will be helpful in identifying the room for improvement.

Materials and methods:

All the case notes of patients who underwent laparoscopic partial

nephrectomy for SRM during the period of January 2023 to June 2024 were retrieved from medical record section for this study.

The demographic variables like age, gender, body mass index (BMI), history of smoking, history of alcohol use, duration of symptoms, co-morbid conditions were tabulated. The findings of cross-sectional imaging, preoperative blood reports were also tabulated. Intraoperative positioning, port placement, requirement of extra port, time duration of anesthesia, time duration of surgery, finding in surgery, site and size of tumor, time duration of ischemia, method of resection and renorrhaphy, blood loss were also tabulated. In post operative period; stay in HDU, need of use of special drugs for organ support, blood transfusion rate are also tabulated. Any occurred complications were classified and tabulated as per Clavein-Dindo classification.

Data Analysis: All data were expressed as mean, standard deviation or frequency and percentages. All the data are analyzed using SPSS 27 software.

Surgical Procedure:

Laparoscopic partial nephrectomy were performed at the discretion of operating surgeon in whom to perform. The complexity score of less were taken as initial cases and gradually moving towards the complex. Operations were performed under GA, on lateral position, 3 to 4 ports are made on one side of body, mostly done in transperitoneal approach, kidney was mobilized to visualize the tumor and to score the margins. Pedicular dissection was performed to see the

renal artery, and selective artery only clamping was done in majority of times. Tumor was resected with scissors and the tumor bed closure performed in 1 or 2 layers using barbed sutures with haemolock bolstering in renal surface. Proper observation of kidney and suture lines were performed after un-clamping of renal artery. Further suturing was not required. Wound site was further inspected on reduced pressure of pneumoperitoneum. The tumor was kept in custom made retrieval bag and removed by elongating one of the ports. A drain was kept. Ports were closed. Patients were kept in HDU for a day or more depending on the clinical recovery. The progress was noted, any complications were also noted. In this study, these complications were converted into CD classification.¹³

The explanations of CD classification is as follows. Surgical site infection which did not require any intervention were classified as grade I. Patients with postoperatively pneumonia, pyelonephritis, paralytic Ileus and those requiring parenteral nutritional support and blood transfusion were classified as grade II. Patients with bowel obstruction with or without peritonitis, dehiscence of wound, hematoma, hemoperitoneum who needed 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 grade IVA while those with multiorgan

dysfunction as grade IVB. Mortality of the patient was considered as grade V.

Results:

Among 23 patients, 14(61%) patients were male and 9(39%) were female. The mean age was 51 ± 12 years (range 33-76 years). Habit wise, 5 (22%) patients were smokers, 6 (26%) patients had history of alcohol consumption. Comorbidity wise, 7 (30%) patients were hypertensive, 2 (8.7%) patients had diabetes and 2(8.7%) had hypothyroidism under medication. Only 3 (13%) patients were symptomatic on presentation, 2 had lumbar pain and 1 had hematuria. Rest of the 21 (87%) patients were incidentally detected on ultrasound, which was done for some other reasons. Right kidney tumors were in 17 (74%) patients, and left kidney tumors were in 6 (26%) patients. Blood transfusion was required in 1 (4%) patient to optimize preoperatively.

Out of 23 patients, 19 patients underwent laparoscopic partial nephrectomy. Two patients were converted to open partial nephrectomy, one patient had open nephrectomy. Lap nephrectomy was performed in one case where the renal mass was not visible in laparoscopy. Location wise, 5(22%) patients had tumor in upper pole, 11(48%) patients in mid pole and 7(30%) in lower pole. The size of the tumor as measured in CECT was 15 - 57 mm.

Mean operative time was 179 ± 57 minutes (range 95-310 minutes) and mean blood loss was 303 ml (range 50ml to 2000 ml). Mean warm ischemia time was 20 ± 6.9 minutes

(11.5 to 40 minutes) in 20 patients and cold ischemia time in 1 patient was 32 minutes. One patient had transient rise in creatinine in postoperative period which later returned to normal in few days. Two (8.6%) patients had a collecting system opened during surgery, which was stented and repaired. HDU stay was 1 day for 18 patients, 2 days for 4 patients and 3 days for 1 patient.

Parameters		n	%
Total no. of patients		23	50%
Gender	Male	14	61%
	Female	9	39%
Smoking	Yes	5	22%
	No	18	78%
Alcohol use	Yes	6	26%
	No	17	74%
Hypertension		7	30.4%
Diabetes		2	8.7%
Hypothyroidism		2	8.7%
Symptomatic		3	13%
	Pain	2	8.7%
	Hematuria	1	4%
Incidentals		21	87%
Side	Right	17	74%
	Left	6	26%
Site	Upper pole	5	21.7%
	Mid pole	11	47.8%
	Lower pole	7	30.4%

Patients were allowed to eat and drink as they progressed. Drains were usually removed in 72 hours.

Complications were seen in 11 (49%) patients during postoperative period. 9 (39%) patients had low hemoglobin requiring blood transfusion, 2 (8.6%) had urinary tract infection which was managed with iv antibiotics, 3(13%) had SSI and managed on bedside. In

those 2 patients, where DJ stents were inserted during surgery, one had hematuria requiring clots evacuation in postoperative period. Three (13%) other patients also had hematuria, of which one was better with conservative management, another one required clot evacuation and subsequently got better. The another bleeding patient kept on bleeding despite repeated evacuation of clots from the bladder, had severe fall in blood pressure and haemoglobin. Suspecting a formation of pseudoaneurysm, nephrectomy was performed in 10th day. Few patients 1(4.3%) had paralytic ileus, which resolved in itself. Few patients with fever 4 (17.3%) and one patient with diarrhoea were symptomatically treated. Another patient with haematuria underwent emergency nephrectomy along with chest tube insertion for pleural effusion.

sn	approach of surgery	frequency	percentage
1	LPN	19	82.6%
2	LPN converted to open PN	2	8.7%
3	LPN converted to LRN	1	4.3%
4	LPN converted RN	1	4.3%

When translated to the Clavien Dindo classification from the list of the issues patients had and tabulated those in Table 3.

Mean duration of hospital stay was 8 ± 6 days (range 4-27 days) with 3 patients 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).

On histopathology report, out of 23 patients, 15 (65.2%) patients had clear cell renal cell carcinoma with ISUP grade 1 in 12 patient and grade 2 in 3 patients. Four (17.3%) patients had papillary renal cell carcinoma and 4 (17.3%) had angiomyolipoma. No sarcomatoid or rhabdoid differentiation and lympho-vascular or perineural invasion was seen in any patients. No tumor necrosis was seen in any patients. Surgical margins were negative in all patients. Closest resected margin was reported in the range of 1- 6 mm (mean 2.6 mm). According to size, 18 patients (78%) had pT1a and 5(22%) had pT1b.

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

Discussion:

Laparoscopic partial nephrectomy is a technically demanding operation as it requires intracorporeal suturing in precise and timely manner. PN in itself has relatively high morbidity than radical nephrectomy. In our study, in deed, we are in the steep of our learning curve. We observed an overall complication rate of 49%, categorically grade I in 8.6%, grade II in 26% and grade III in 13%.

AP Ramani et al. concluded in his study of 200 patients, the complications of laparoscopic partial nephrectomy that 33% had one complications in which 5.5% were peroperative, 12% postoperative 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%.¹²

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%.¹³

BM Benway et al., concluded in the comparative study between robot assisted and laparoscopic approach that operative time was 189 vs 174 minutes, pelvicalyceal breach was 47 vs 54%, positive margin rate was 3.9% vs 1%, intraoperative blood loss was 155 vs 196 ml, hospital stay was 2.4 vs 2.7 days, warm ischemia time was 19.7 vs 28.4 mins and postoperative complications were 8.6% vs 10.2%.¹⁴

Aboumarzouk OM et al. concluded in his study about robot assisted and laparoscopic approach that there was no difference in operative time ($p=0.58$), estimated blood loss ($p=0.76$) and conversion rates ($p=0.84$). RPN had less warm ischemia time than LPN ($p=0.0008$). There was no difference in hospital stay ($p=0.37$), complications ($p=0.86$) or positive margins ($p=0.93$).¹⁵

Conclusion:

Laparoscopic partial nephrectomy has been the standard of care for small renal masses. With meticulous learning of laparoscopic suturing skills, and with increase in experience of surgical team, the results are better.

Conflicts of Interest

None

References

1. Agochukwu N, Shuch B. Clinical management of renal cell carcinoma with venous tumor thrombus. *World Journal of Urology*. 2014 Jun;32:581-9.
2. Gharabaghi MA. *Clinical Spectrum of Patients with Renal Cell Carcinoma. Emerging research and treatments in renal cell carcinoma*. Rijeka: InTech. 2012 Feb 3:229-44.
3. Bradley AJ, Maskell GF, Mannava A, Pollard A, Welsh T. Routes to diagnosis and missed opportunities in the detection of renal cancer. *Clinical Radiology*. 2021 Feb 1;76(2):129-34.
4. Kang SK, Huang WC, Pandharipande PV, Chandarana H. Solid renal masses: what the numbers tell us. *American Journal of Roentgenology*. 2014 Jun;202(6):1196-206.
5. Wilcox Vanden Berg RN, Basourakos SP, LaRussa S, McClure TD. Management of the small renal mass:

- a 2020 update. *Current Oncology Reports*. 2020 Jul;22:1-9.
6. Ginzburg S, Tomaszewski JJ, Kutikov A. Focal ablation therapy for renal cancer in the era of active surveillance and minimally invasive partial nephrectomy. *Nature reviews Urology*. 2017 Nov;14(11):669-82.
 7. Prins FM, Kerkmeijer LG, Pronk AA, Vonken EJ, Meijer RP, Bex A, Barendrecht MM. Renal cell carcinoma: alternative nephron-sparing treatment options for small renal masses, a systematic review. *Journal of endourology*. 2017 Oct 1;31(10):963-75.
 8. Klatte T, Ficarra V, Gratzke C, Kaouk J, Kutikov A, Macchi V, Mottrie A, Porpiglia F, Porter J, Rogers CG, Russo P. A literature review of renal surgical anatomy and surgical strategies for partial nephrectomy. *European urology*. 2015 Dec 1;68(6):980-92.
 9. Okhunov Z, Rais-Bahrami S, George AK, Waingankar N, Duty B, Montag S, Rosen L, Sunday S, Vira MA, Kavoussi LR. The comparison of three renal tumor scoring systems: C-Index, PADUA, and RENAL nephrometry scores. *Journal of endourology*. 2011 Dec 1;25(12):1921-4.
 10. Polascik TJ, Pound CR, Meng MV, Partin AW, Fray F. Partial nephrectomy: technique complications and pathological findings. *The Journal of urology*. 1995 Oct 1;154(4):1312-8.
 11. Capitanio U, Bensalah K, Bex A, Bootjian SA, Bray F, Coleman J, Gore JL, Sun M, Wood C, Russo P. Epidemiology of renal cell carcinoma. *European urology*. 2019 Jan 1;75(1):74-84.
 12. Ramani AP, Desai MM, Steinberg AP, Ng CS, Abreu SC, Kaouk JH, Finelli A, Novick AC, Gill IS. Complications of laparoscopic partial nephrectomy in 200 cases. *The Journal of urology*. 2005 Jan;173(1):42-7.
 13. Stephenson AJ, Hakimi AA, Snyder ME, Russo P. Complications of radical and partial nephrectomy in a large contemporary cohort. *The Journal of urology*. 2004 Jan;171(1):130-4.
 14. Benway BM, Bhayani SB, Rogers CG, Dulabon LM, Patel MN, Lipkin M, Wang AJ, Stifelman MD. Robot assisted partial nephrectomy versus laparoscopic partial nephrectomy for renal tumors: a multi-institutional analysis of perioperative outcomes. *The Journal of urology*. 2009 Sep;182(3):866-73.
 15. Aboumarzouk OM, Stein RJ, Eyraud R, Haber GP, Chlosta PL, Somani BK, Kaouk JH. Robotic versus laparoscopic partial nephrectomy: a systematic review and meta-analysis. *European urology*. 2012 Dec 1;62(6):1023-33.