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Partial nephrectomy in surgical management of renal neoplasms -National Cancer Institute experience

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ABSTRACT

Background: Nephron sparing surgery (NSS) is currently considered the best alternative in treatment of renal tumors <4 cm and its indication is expanding to selected cases of lesions up to 7 cm in size (whether open, laparoscopic or robotic) compared to radical nephrectomy, and the benefit of preserving renal function. Several studies have demonstrated the surgical and oncological safety of

NSS in terms of local recurrence, long-term cancer-specific survival and the overall survival, which is comparable to radical nephrectomy. *Patients and Methods*: This is a retrospective descriptive cohort study including 40 patients with renal masses treated with partial nephrectomy (PN) whether open or minimally invasive (laparoscopic or robotic). These cases were treated by surgical intervention between March 2015 and July 2018. The study was performed at National Cancer Institute (NCI) - Cairo University (CU). Tumor size, site and relation to renal pelvis and vascular pedicle were assessed by contrast enhanced computed tomography (CT) abdomen and pelvis. Warm ischemia time (WIT), estimated blood loss (EBL), operative time, postoperative pain, postoperative complications, and hospital stay were recorded. *Results:* Mean operative time was 187 minutes. Mean blood loss was 413 ml. Mean warm ischemia time was 22.3 min. Open partial nephrectomy (OPN) was converted to radical in 1 case. 1 laparoscopic partial nephrectomy (LPN) case was converted to open radical and 2 LPN cases were converted to open partial. 3 patients had positive margin after resection and 2 patients had close margin (0.1 cm). 18 patients experienced mild postoperative pain, while 13 had moderate pain and 3 had severe pain.6 cases had no pain postoperative. Mean hospital stay was 3.2 days. *Conclusion*: NSS is an accepted safe procedure that can be done open, laparoscopic and robotic which resulted in short hospital stay and preserved renal function but moderate blood loss and long operative time which can be reduced by improving learning curve of operating surgeons. We recommend adoption of NSS in any case with renal neoplasm indicated for partial nephrectomy.

Keywords: laparoscopic partial nephrectomy; robotic; operative time; warm ischemia time.

1. INTRODUCTION

Nephron sparing surgery (NSS) is currently considered the best alternative in treatment of renal tumors <4 cm and its indication is expanding to selected cases of lesions up to 7 cm in size (whether open, laparoscopic or robotic) compared to radical nephrectomy, and the benefit of preserving renal function. NSS has gained popularity after several studies that demonstrate higher incidence of chronic renal failure after radical nephrectomy (Huang et al., 2006) and the direct association between renal insufficiency and cardiovascular morbidity and mortality (Go et al., 2008).

As a result, partial nephrectomy is regarded as a common and appropriate treatment for patients with small renal tumors, even in patients with a normal contralateral kidney. Partial nephrectomy is technically more challenging than radical nephrectomy; therefore, it requires proper techniques. Despite various surgical techniques to prevent postoperative adverse events after nephron sparing surgery, most large series have reported 7.4% of persistent urine leak, 4.9% of dialysis, and 2.8% of acute and delayed bleeding (Uzzo and Novick, 2001). These relatively high complication rates of partial nephrectomy require secure renorrhaphy techniques to prevent adverse events. In fact, if the defect is too large to be repaired; OPN is also difficult to perform due to the excessive tensile force involved, which destroys the remaining renal parenchyma. The power of sliding the suture down on the renal parenchyma is limited in traditional methods of closing the parenchymal defect because of the "cheese slicing" effect of knot tying. To overcome this problem, several techniques have been developed to enhance coaptation strength using exogenous material such as felt pledgets and Hem-o-lok clips (Zincke and Ruckle, 1995)

2. PATIENTS AND METHODS

This was a retrospective descriptive study which included 40 patients presented to urology unit at National Cancer Institute (NCI); Cairo University (CU) with renal tumours (benign or malignant). The patients were treated with partial nephrectomy (28 open, 7 robotic and 5 laparoscopic) between March 2015 and July 2018. Inclusion criteria were patients aged up to 70 years with renal neoplasm (benign or malignant) without renal vein thrombosis, with tumor stage T1 or T2 N0 M0. Exclusion criteria were patients with T3 or T4 disease, medical comorbidities that preclude surgical management, refusing surgery in general or with extensive metastatic disease who can't tolerate technical challenges. Data were collected from hospital medical records, investigations' reports and pathology department records.

The study was carried out at urology unit of surgical department at NCI, CU. Patients were diagnosed by history taking and clinical examination in outpatient clinic and by investigations including laboratory tests (complete blood count, liver function tests, kidney function tests and coagulation profile) and radiological imaging such as CT chest, abdomen and pelvis for diagnosis of renal masses to identify relation of renal mass to renal pelvis and vascular pedicle to determine feasibility of partial nephrectomy. Some patients had MRI abdomen and some had PET CT scan. Tumour size was measured as the longest diameter of each tumor in any single plane of the preoperative imaging study. Histological sub typing and pathologic staging were performed according to the 7th edition of American Joint Committee guidelines and cellular grading was performed by the Fuhrman's grading system (Edge et al., 1982). After exposing the renal tumor with the overlying fat and surrounding normal parenchyma, renal artery alone was identified

and wrapped by nylon tapes, then controlled by a vascular bulldog to reduce bleeding and renal tissue turgor in all cases. Then, the renal tumor was resected with a 1 cm or adequate safety margin. Renorrhaphy included 2 layers; inner and outer.

Parameters of evaluation included T N M staging, operative factors (intraoperative complications, operative time, warm ischemia time, estimated blood loss and blood transfusion), postoperative factors (hospital stay, postoperative pain, postoperative complications as bleeding, wound infection and urine leak), oncologic safety of the procedure regarding safety margin. Postoperative pain was assessed by pain score (mild, moderate and severe). The early postoperative complications (within 30 days after surgery) were evaluated by central review of medical records for every case included and classified by using the Clavien-Dindo system such as urine leak, bleeding, port site hernia or incisional hernia (Clavien et al., 2009). Postoperative serum creatinine level was drawn from all patients at 1 month follow-up evaluation. Also, spiral CT abdomen and pelvis was performed at the 3 month follow-up evaluation to identify any delayed complications, loco-regional or distant recurrence.

The study was approved by the ethical committee of NCI. Clinical data were collected from hospital medical records and investigations' reports, recorded in a standard database form, evaluated and analyzed by the authors.

Statistical analysis

Data was analyzed using IBM SPSS advanced statistics (Statistical Package for Social Sciences), version 24 (SPSS Inc., Chicago, IL). Numerical data was described as median and range or mean and standard deviation as appropriate, while qualitative data was described as number and percentage. Chi-square (Fisher's exact) test was used to examine the relation between qualitative variables as appropriate.

3. RESULTS

The mean age was 40 ±9.6 years. 37 cases were diagnosed by CT, while 8 cases had MRI and 4 cases had PET CT scan. 23 cases had clear cell renal cell carcinoma, 6 cases had papillary renal cell carcinoma, 4 cases had chromophobe renal cell carcinoma, 5 cases had oncocytoma, 1 case had neuroendocrine carcinoma and 1 case had angiomyolipoma. 14 cases were grade 1 and 22 cases grade 2. Mean operative time was 187 minutes. Mean blood loss was 413 ml. Mean warm ischemia time was 22.3 min. 23 cases were pT1a, 12 cases were pT1b, 4 cases were pT2a and 1 case was pT2b. Open partial nephrectomy was converted to radical in 1 case (due to bleeding from left renal vein). LPN was converted to open radical in 1 case (due to bleeding from operative bed) (figure 1 & 2). 2 LPN cases were converted to open partial (due to technical difficulty). 17 cases were located in the upper zone while 19 cases were located in the lower zone, 3 cases were midzonal and 1 case was at isthmus of a horse shoe kidney. 3 patients had positive margin after resection and 2 patients had close margin (0.1 cm). 18 patients experienced mild postoperative pain, while 13 had moderate pain and 3 had severe pain. 6 cases had no pain postoperative. Mean hospital stay was 3.2 days as shown in Table 1. 2 years recurrence free survival was 100%.

Table 1 Parameters of evaluation of partial nephrectomy regarding pre, intra and postoperative factors

	Age (years)	abdominal and pelvic U/S size (cm)	CT abdomen and pelvis size (cm)	Warm ischemia time (min)	Operative time (min)	Blood loss	Pathology (PO) size (cm)	Hospital stay (days)
Number	40.0	12.0	38.0	39.0	40.0	40.0	40.0	40.0
Mean	46.7	5.3	4.8	22.3	178.1	413.4	4.9	3.2
Median	46.5	5.3	4.0	22.0	180.0	300.0	4.0	3.0
Std. Deviation	9.6	2.0	1.9	5.2	44.0	425.2	2.1	1.1
Minimum	23.0	2.9	2.0	10.0	80.0	50.0	2.0	2.0
Maximum	64.0	9.0	11.2	35.0	300.0	2500.0	12.0	7.0

Regarding postoperative complications, 1 patient developed urine leak postoperative which was treated by image guided aspiration. 1 robotic partial nephrectomy case developed port site hernia which was managed by mesh hernioplasty. All cases had normal serum creatinine drawn 1 month postoperative for follow up. Complications were classified according to Clavien-Dindo classification as shown in table 2.

Table 2 Intraoperative and postoperative complications regarding partial nephrectomy

Clavien-Dindo classification	Frequency	Percent
IIIa	1	2.5
IIIb	5	12.5
No	34	85.0
Total	40	100.0

Figure 1 Open partial nephrectomy specimen

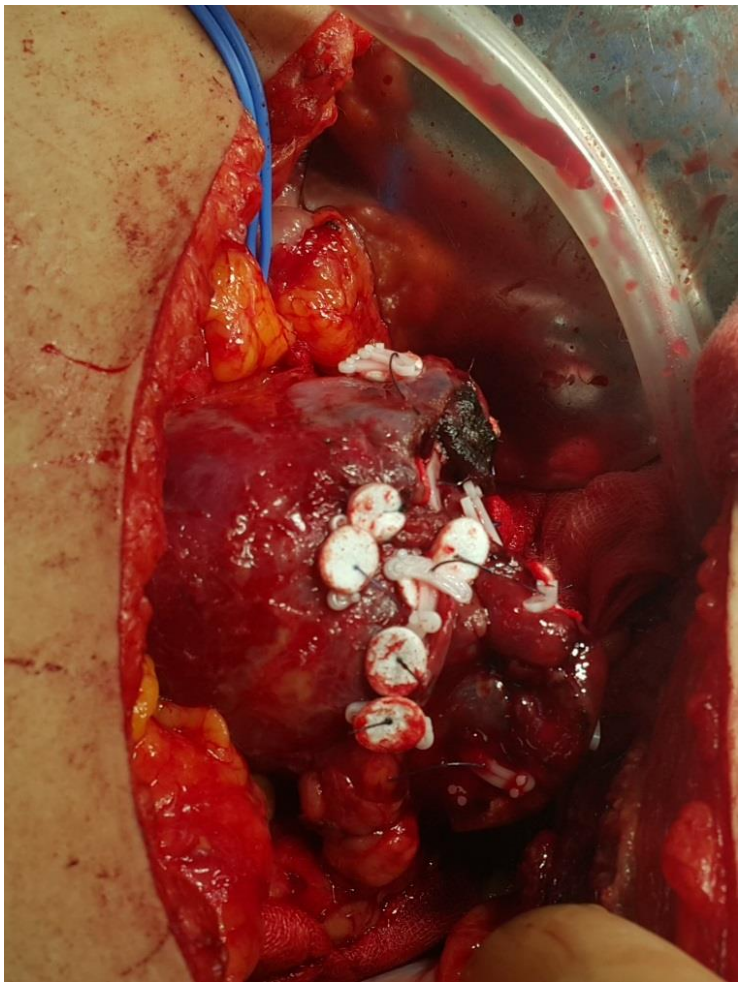

Figure 2 Renorrhaphy after right partial nephrectomy

4. DISCUSSION

Another study including 96 partial nephrectomy patients (54 open, 15 laparoscopic and 27 robotic) showed that open partial nephrectomy (OPN) had advantages in operative time and ischemia time, at the expense of increased blood loss, which was, in part, due to differences in operative technique (Lucas et al., 2012). Our study showed advantages in WIT and hospital stay but with prolomged operative time and moderate blood loss. A separate large series of OPN reported a shorter operative time (155±59 min), but similar ischemia time (20.1 ± 10.9 min) and blood loss (median = 350 mL). A higher (15.3%) transfusion rate was reported (Patard et al., 2007). There are several studies that compare laparoscopic partial nephrectomy (LPN) to OPN. The largest comparison (771 LPN versus 1,028 OPN) shows reduced WIT for OPN versus LPN (30.7 min versus 20.1 min respectively), positive margins (2.85% LPN versus 1.6% OPN), and blood loss was similar for OPN and LPN (300 mL versus 376 mL) with a 5% transfusion rate for both groups (Gill et al., 2007).

Volpe et al. meta-analysis included a systematic review which comprises a total of 96 works, with the objective of showing renal function predictive factors after the surgical resection of kidney tumors using LPN. They conclude that a better post-operative renal function is associated with a clamping time below 25 minutes (Alcázar et al., 2008). Our study showed that mean WIT was 22.3 min which resulted in normal creatinine level postoperative in all patients. Martin et al. underwent a similar study, in which they reviewed 94 works in order to determine the factors linked to a higher renal insufficiency after a LPN. The prolonged ischemic time was one of these factors. In this study, they state that if the ischemic time is longer than 25 minutes, approximately every extra minute increases the risk of the kidney suffering renal function disease by about 5–6% (Martín et al., 2018).

5. CONCLUSION

NSS is an accepted safe procedure that can be done open, laparoscopic and robotic which resulted in short hospital stay and preserved renal function but moderate blood loss and longer operative time which can be reduced by improving learning curve of operating surgeons. We recommend adoption of NSS in any case with renal neoplasm indicated for partial nephrectomy.

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Author Contributions

Both authors contributed in the study design, data collection, data analysis and manuscript writing.

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Conflict of Interest

The authors declare that there are no conflicts of interests.

Ethical approval

The study was approved by the ethical committee of NCI. Clinical data were collected from hospital medical records and investigations' reports, recorded in a standard database form, evaluated and analyzed by the authors.

Data and materials availability

All data associated with this study are present in the paper and/or the Supplementary Materials.

Data and materials availability

All data associated with this study are present in the paper.

Peer-review

External peer-review was done through double-blind method.

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