Hand-assisted and standard laparoscopic radical nephrectomy after prior renal surgery

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GABR AH, ROBERTS WW, WOLF JS JR. Hand-assisted and standard laparoscopic radical nephrectomy after prior renal surgery. *Can J Urol* 2014;21(1):7141-7144.

Introduction: *With the increasing use of partial nephrectomy, cases of ipsilateral tumor recurrence will inevitably occur. We aimed to evaluate the efficacy and feasibility of laparoscopic radical nephrectomy (LRN) for a previously operated kidney, through a case-matched comparison with LRN in patients without prior renal surgery.*

Materials and methods: *Among 550 patients who underwent hand-assisted or standard LRN at our institution between August 1996 and January 2013, we identified patients who had prior laparoscopic or open surgical renal surgery. Each study patient was matched 1:2 with patients who had not had prior renal surgery. Matching was exact by surgical approach, gender, side of surgery, and American Society of Anesthesiologists score, and closest possible by age and body mass index.*

Results: *LRN was performed in 9 patients (6 hand-assisted and 3 standard) with prior open surgical or laparoscopic renal surgery. There were no conversions to open surgery. Primary surgeon tended to be to attending urologist more often than the trainee in the study compared to the control patients, an indication of increased technical difficulty. Additionally, there were four intraoperative injuries recorded in the study group (44%) and just one such event in the control group (5.6%) (p = 0.0297).*

Conclusions: *Although LRN after prior renal surgery is challenging, requiring the expertise of experienced surgeons and being associated with appreciable rate of intraoperative injuries, these cases can be completed laparoscopically (especially with the selective use of hand-assistance) and are associated with duration of hospitalization and postoperative complication rates similar to those in patients undergoing LRN without prior renal surgery.*

Key Words: laparoscopy, nephrectomy

Introduction

With the increasing use of partial nephrectomy, cases of ipsilateral tumor recurrence will inevitably occur. Although repeat attempts at nephron sparing treatment with ablation or partial nephrectomy may be warranted in some patients,[1,2] in others a radical nephrectomy may be the best course of action. Owing to its minimization of the duration and intensity of patient convalescence, the laparoscopic approach to radical nephrectomy is favored when technically possible. However, prior abdominal surgery can complicate transperitoneal laparoscopic surgery,[3] and a history of prior renal surgery is even more daunting, owing to scarring and obliterated tissue planes around the kidney.[4,5] Our group nonetheless has preferentially addressed the challenge of radical nephrectomy after prior renal surgery with laparoscopy.

Accepted for publication November 2013

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The results of laparoscopic radical nephrectomy following prior renal surgery have not been well-described in the literature, with only one prior report to our knowledge.[6] The aim of our study is to evaluate the efficacy and feasibility of laparoscopic radical nephrectomy for a previously operated kidney, through a case-matched comparison with the outcomes of laparoscopic radical nephrectomy in patients without prior renal surgery.

Materials and methods

From our IRB-approved prospectively derived database, we identified 550 patients who underwent laparoscopic (standard or hand-assisted) radical nephrectomy at our institution between August 1996 and January 2013. Among these, we identified patients who had a history of laparoscopic or open surgical renal surgery prior to the laparoscopic radical nephrectomy.

Demographic and operative data collected prospectively at the time of surgery included gender, age, side of surgery, American Society of Anesthesiologists (ASA) score, body mass index (BMI), radiographic mass size, surgical approach (standard or hand-assisted laparoscopy, identity of primary operator (trainee versus attending surgeon), estimated blood loss, conversion of surgical approach, operative time (skin incision to skin closure), and intraoperative complications.

Our techniques for transperitoneal standard and hand-assisted laparoscopic radical nephrectomy have been previously described.[7] Briefly, patients were positioned in a modified lateral position, at 45° from horizontal, with the table flat. Standard laparoscopic radical nephrectomy was performed using four or five ports. Hand-assisted laparoscopic radical nephrectomy was performed with a variety of hand-assistance devices. The incision for the device was made in the midline peri-umbilically, unless obesity prompted a paramedian location. Two or three ports were used.

Additional data were collected retrospectively, including complications and duration of hospital stay. Major postoperative complications were those requiring significant intervention or hospital readmission. Minor postoperative complications did not lead to such interventions. Any complication that happened within 30 days of surgery, and those directly related to the surgery beyond 30 days, were included.

Each patient who had prior renal surgery was matched 1:2 with patients who had not had prior renal surgery. Matching was exact by surgical approach, gender, side of surgery, and ASA score, and closest possible by age and BMI. Bivariate comparisons between the groups with and without prior abdominal surgery were performed with Fisher's exact test and chi-squared test as appropriate, using commercial software on a personal computer.

Results

Among the 550 patients, 9 (1.6%) had prior open surgical or laparoscopic renal surgery. They included 5 females and 4 males, with an average age of 56 years. The nephrectomy was on the left side in 5 patients and the right in 4 patients. Of the patients, 4 suffered from hypertension, 2 had a history of vascular diseases and 3 had no significant past medical history, such that the ASA score was 2 in 5 patients and 3 in 4 patients.

Previous renal surgery included partial nephrectomy for renal cancer in 6 patients (4 laparoscopic [3 standard, 1 hand-assisted] and 2 open surgical) and renal cyst excision in 3 patients (2 open surgical and 1 standard laparoscopic). Among the latter 3 patients, 2 had recurrence of prior incomplete resection of pathologically documented multilocular cystic nephromas, with maximal dimensions of the recurrent lesions prompting radical nephrectomy of 6.5 cm and 9.3 cm. The third patient had prior open surgical renal cyst resection that revealed renal cell carcinoma, with subsequent recurrence of a solid mass suspicious for renal cancer. In 8 of the 9 patients, the indication for operation was radiographic recurrence of renal cancer (6) or multilocular cystic nephroma (2). All 8 patients were given the option of both partial and radical nephrectomy, and all selected radical nephrectomy. In 1 patient, the indication was presence of renal cancer in a renal sinus and a focal positive margin in the partial nephrectomy specimen. This patient was advised to undergo close surveillance, but she desired radical nephrectomy for assurance of cure. Mass location was in the upper pole in 4 patients, mid-renal in 3 patients and lower pole in 2 patients.

The laparoscopic radical nephrectomy was performed with hand-assistance in 6 patients and standard laparoscopy in 3 patients. There were no conversions to open surgery, and no conversions from standard laparoscopy to hand-assisted laparoscopy. The primary surgeon was the attending urologist in 5 patients (56%) and a resident or fellow in 4 patients (44%).

Mean surgery time was 224 minutes (SD ± 78 minutes), with an average estimated blood loss of 450 mL (SD ± 458 mL). Intraoperative blood transfusion was required in 1 case, for a total of 3 units of packed

TABLE 1. **Preoperative demographics**

	Study (n = 9)	Control (n = 18)	p value
Age, years (mean ± SD)	56 ± 11	59 ± 8	0.4327
Body mass index (mean ± SD)	30.9 ± 6	31.1 ± 6.2	0.9397
Mass size, cm (mean ± SD)	4.1 ± 2.8	6.9 ± 3.1	0.0532

red blood cells. There were four intraoperative complications in 4 patients, including splenic (the patient requiring intraoperative blood transfusion), liver, colonic serosal and adrenal injuries. In the first three cases, laparoscopic repair was successful but the fourth injury necessitated adrenalectomy for persistent hemorrhage.

Median length of hospital stay was 2.4 days (SD ± 0.7). The course of hospital admission was unremarkable in all patients, with no complications during the initial postoperative stay. Of the patients, 1 had a post-discharge complication, that being ileus requiring readmission, which resolved with conservative management.

In all 8 of the patients with radiographic recurrence of renal cancer (6) or multilocular cystic nephroma (2), final pathology was confirmatory. In the patient with presence of renal cancer in a renal sinus and a focal positive margin in a partial nephrectomy specimen, no tumor was found in the radical nephrectomy specimen.

The control group included 18 patients, matched 2:1 with study patients, with exact matching by surgical approach, gender, side of surgery and ASA score, and as close as possible for age and BMI. Table 1 reveals the effective matching for the latter two characteristics, with age and BMI differing by only 5.4% and 0.6%, respectively. The renal masses tended to be slightly larger in the control group (6.9 cm, compared to 4.1 cm), although the difference did not reach statistical significance (p = 0.0532). Tables 2a and 2b demonstrate the comparisons of perioperative findings between the study and control groups. There were no differences between the groups in terms of operative time, estimated blood loss, duration of hospital stay, intraoperative blood transfusion or postoperative complications. Although the difference did not reach statistically significance, the primary surgeon tended to be to attending urologist more often than the trainee in the study compared to the control patients (56% versus 17%, respectively, p = 0.0721). Additionally, there was a significant difference regarding intraoperative injuries, with four events recorded in the study group (44%) and just one event in the control group (5.6%) (p = 0.0297).

TABLE 2a. **Preoperative demographics**

	Study (n = 9)	Control (n = 18)	p value
Surgery time, minutes (mean ± SD)	224 ± 78	191 ± 46	0.3959
Estimated blood loss, mL (mean ± SD)	450 ± 458	299 ± 314	0.4321
Length of hospital stay, days (mean ± SD)	2.4 ± 0.7	2.3 ± 1.2	0.3408

TABLE 2b. **Perioperative characteristics, categorical data**

	Study (n = 9)	Control (n = 18)	p value
Primary surgeon (n)			
Trainee	4	15	0.0721
Attending	5	3	
Intraoperative injury (n)			
Present	4	1	0.0297
Absent	5	17	
Intraoperative blood transfusion (n)			
Present	1	0	0.3333
Absent	8	18	
Postoperative complication (n)			
Present	1	4	0.6361
Absent	8	18	

Discussion

Renal cell carcinoma is the third most common tumor of the genitourinary tract, accounting for more than 13,000 annual deaths in United States.[8] The current trend is to deal with small renal masses with nephron sparing surgery, supported by clinical practice guidelines from both the American Urological Association and European Association of Urology.[9,10] This strategy, however, is associated with a risk (albeit small) of tumor recurrence in the previously operated renal unit. Applying another partial nephrectomy is technically challenging, as repeat renal exposure and attempts at renal preservation may be associated with higher perioperative complications and local tumor recurrence rates.[4,11]

Although we have performed repeat partial nephrectomy in selected patients, and indeed our institutional bias towards partial over radical nephrectomy has been documented,[12] this situation is often addressed with radical nephrectomy. We prefer the laparoscopic approach when feasible, owing to its minimization of duration and intensity of patient convalescence. Our retrospective review reveals use of the hand-assisted rather than standard laparoscopic technique in 67% of the study cases, not surprisingly given our institutional bias to use this approach in the setting of anticipated difficult surgery.[7] This rate of hand-assistance use is greater than the use of hand-assistance in our overall laparoscopic radical nephrectomy cohort, which is 53%.

Although not significantly different, the operative time in our study group appeared slightly longer than in the control group, which could be explained by the expected adhesions and disturbed anatomy when operating on a previously operated kidney. Same results have been reported in other studies.[3,6,11,13] Similarly, in our teaching center the trainee is the primary surgeon in most laparoscopic radical nephrectomies (83% of control cases) but with these challenging repeat surgical procedures the attending surgeon was the primary surgeon in 56% of the study group patients.

Other studies have described an increase in conversion rate in the re-operative setting, but without significant difference in patient morbidity and rate of complications.[3,14-16] Likely owing in large part to our liberal use of hand-assistance, we had no conversions of approach in our study patients. Other techniques that we have found helpful in this setting are more aggressive bowel mobilization to ensure a wide field of exposure, en-bloc staple ligation of the hilum, and alternative approaches to the renal hilum such as posterior or superior. Regarding complications, the best comparison with our current study is the recently reported work of Boris et al.[6] These authors reported on minimally invasive partial nephrectomy (laparoscopic and robotic), laparoscopic radiofrequency ablation and laparoscopic radical nephrectomy on previously operated kidneys. They found that the fewest complications occurred with laparoscopic radical nephrectomy (none in their series) in contrast to minimally invasive partial nephrectomy which was associated with the highest blood loss and rate of conversion. Our intraoperative injury rate was 44%, however, this was not correlated with conversion of the technique or development of other serious manifestations except for necessitation of adrenalectomy in one patient. These patients ultimately did well, with duration of hospitalization and postoperative complication rates showing no difference from case-matched controls.

Conclusions

In summary, our findings suggest that laparoscopic radical nephrectomy after prior renal surgery is challenging – more often requiring attending rather than the trainee as the primary surgeon, frequently requiring hand-assistance, and more often being associated with intraoperative complications – but that ultimately such procedures are successful and associated with duration of hospitalization and postoperative complication rates similar that noted in patients undergoing laparoscopic radical nephrectomy without prior renal surgery. □

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