Laparoscopic Renal Surgery: Ramathibodi Hospital Experience

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Objective: *To report the authors' early experience of laparoscopic renal surgery for benign and malignant renal conditions.*

Material and Method: *Laparoscopic renal surgery was performed on 24 patients with benign and malignant renal conditions between July 2004 and February 2005. The patient characteristics and perioperative data including operative time, blood loss, analgesic requirement, complications, duration of postoperative drain removal, length of hospital stay, and duration to return to normal activity were all recorded.*

Results: *Laparoscopic simple nephrectomy was performed in 15 patients with nonfunctioning benign renal conditions. Three operations of hand-assisted laparoscopic radical nephrectomy and one of partial nephrectomy were performed for large and small renal cell carcinoma, respectively. Transitional cell carcinomas were managed by retroperitoneoscopic nephrectomy or hand-assisted approach in 3 cases. For a case of severe inflammatory renal condition, hand-assisted approach was used for treatment. Laparoscopic renal cyst decortication was performed in one case. In the laparoscopic simple nephrectomy group, the mean operative time was 126 $\pm$ 38.3 minutes. The median (range) estimated blood loss was 100 (50-500) mL, and one patient required conversion to open surgery because of renal vein injury.*

In three cases of hand-assisted laparoscopic radical nephrectomy, the operation time was 315, 325 and 150 minutes and the operative blood loss was 500, 1000 and 200 ml, respectively. In cases of hand-assisted laparoscopic partial nephrectomy, the operation time and the operative blood loss were 220 minutes and 350 ml, respectively. In three cases of transitional cell carcinoma, the operation time was 120, 140 and 150 minutes and the operative blood loss was 100, 150 and 150 ml. The surgical margins of all resected specimens for malignant tumors were negative and no major complication was recorded. Simple renal cyst decortication was successfully performed within 90 minutes of operation time and bleeding 50 ml. In cases of severe inflammatory renal condition performed by hand-assisted approach, the operative time was 250 minutes and the operative blood loss was 250 ml.

Conclusion: *Laparoscopic renal surgery is a safe and efficacious approach for resection of benign non-functioning kidneys and malignant renal tumors.*

Keywords: *Laparoscopic renal surgery, Partial nephrectomy, Nephroureterectomy, Radical nephrectomy, Renal cyst decortication*

J Med Assoc Thai 2005; 88 (12): 1825-32
Full text. e-Journal: *http://www.medassocthai.org/journal*

Since the initial report of laparoscopic nephrectomy by Clayman et al[1] in 1991, it has continued to grow in the management of both benign and malignant disease of the kidney over the past decade. At present, laparoscopic renal surgery has expanded beyond simple nephrectomy to include radical nephrectomy, nephroureterectomy and partial nephrectomy. The safety, efficacy, reduced morbidity, and rapid convalescence of these procedures have been described in several large

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series[2-4]. The long-term cancer control and techniques of laparoscopic radical nephrectomy, nephroureterectomy and partial nephrectomy for renal malignancy have also been published[5-7]. The authors performed the first successful laparoscopic nephrectomy in July 2004 and, after The authors gained more experience, laparoscopic renal surgery including hand-assisted approach has now become a routine procedure in our institute for suitable patients having benign or malignant diseases. Herein, the authors described our early experiences of laparoscopic renal surgery which was the first series report of laparoscopic renal disease management in our institute and Thailand.

Material and Method

Patients

From July 2004 to February 2005, 24 laparoscopic renal surgeries were performed on 10 male and 14 female patients with a mean age of 51.8 $\pm$ 12.7 years. The operation was classified as laparoscopic simple nephrectomy for benign renal conditions in 15 cases, hand-assisted laparoscopic radical nephrectomy for large renal cell carcinoma in 3 cases, hand-assisted laparoscopic partial nephrectomy for small renal cell carcinoma in 1 case, laparoscopic radical nephroureterectomy including hand-assisted technique for transitional cell carcinoma in 3 cases, hand-assisted laparoscopic simple nephrectomy for xanthogranulomatous pyelonephritis with nephrocutaneous fistula and failed flank exploration in 1 case, and laparoscopic simple cyst decortication in 1 case. All patients had no contraindications for laparoscopic surgery.

Surgical techniques

The bowel was prepared by using polythene glycol. A third generation cephalosporin (Ceftriaxone) was administered on induction of general anaesthesia. The patient was placed in the standard full flank position with the operating side up. The standard three ports retroperitoneal approach was adopted in benign nonfunctioning renal conditions and cyst decortication. For creation of the retroperitoneal space, the authors used two fingers of number 8 glove tied over each other and fixed on the end of an 18F red rubber catheter. The dilator was placed under digital control and inflated to 500 mL with normal saline solution. The inflated balloon was left for a few minutes to achieve hemostasis before being deflated and removed. The renal pedicles were controlled by using 3 and 2 hem-o-lok for the proximal and distal side, respectively. The kidney was mobilized and the ureter was followed, ligated and cut as long as possible. Then, the kidney and ureter were entrapped in a specimen bag and removed intact through lower quadrant incision. In case of renal cyst decortication, the cyst was identified first. Then, the cyst wall was cut and electrical cautery was used for the bleeding point.

Hand-assisted transperitoneal approach was conducted for malignant or severe inflammatory renal conditions. For the right side and the left side, hand port device and laparoscopic ports were placed as Fig. 1A and 1B, respectively. The kidney was removed through hand port incision after completing the operation. A drain was routinely used. The kidney within the surrounding Gerota's fascia was removed all at once in cases of malignancy.

For right hand-assisted laparoscopic partial nephrectomy, the perinephric fat was cleared except for that overlying the tumor and the examined kidney. The duodenum was mobilized, the renal hilum was dissected and the renal artery was temporarily clamped with a bulldog vascular clamp. Mannitol was given approximately 30 minutes before vascular clamping. The renal vein was surrounded by vascular loop without occlusion. Then, the kidney was cooled with ice slush through the hand port device. After 10 minutes of waiting to achieve protective hypothermic temperatures (15 C), the renal capsule was scored 5 mm from the tumor and an endoscope scissor without cautery was used for tumor resection. Hemostasis was achieved with 3-0 absorbable sutures, followed by placement of perinephric fat and bandage of surgicel. The renal parenchyma defect was closed with 2-0 absorbable intracorporeal laparoscopic sutures. In cases of nephroureterectomy, the cuff of the ureter was dissected off the bladder by a standard intravesical technique and the specimen was removed via the lower abdominal wound. Most of the patients were discharged the next day after drain removal.

Data collection

Patient characteristics and pathological data, operative details, analgesic requirement (morphine sulphate equivalent), complications, length of hospital stay, and time to return to normal activity were recorded prospectively.

Results

The patient characteristics and operative data of laparoscopic simple nephrectomy for benign nonfunctioning renal conditions are shown in Table 1. The mean operative time was 126 $\pm$ 38.3 minutes. The

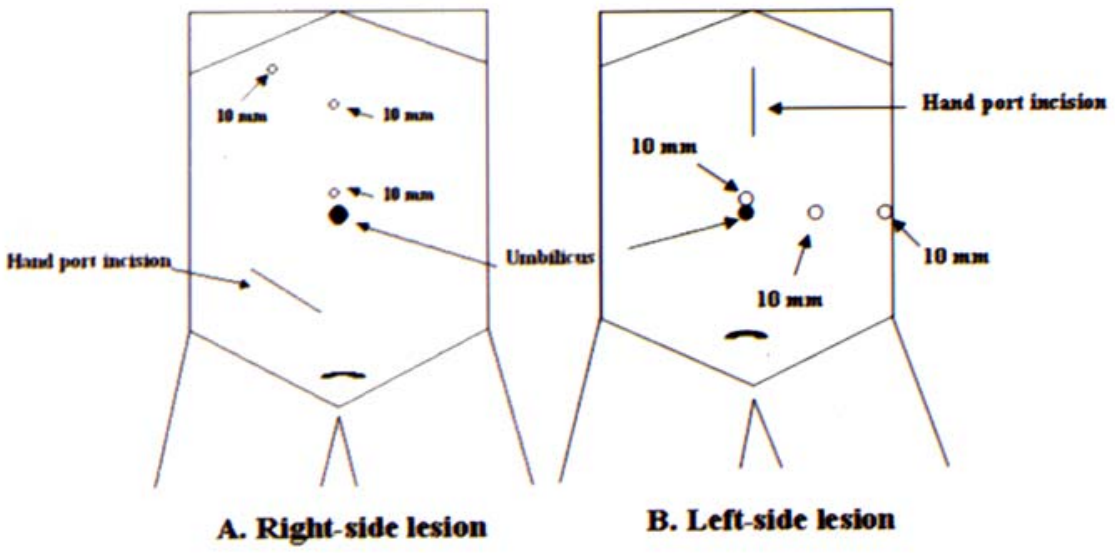

Fig. 1 A picture showing incision for hand port device and three 10 mm laparoscopic ports. A) right-sided lesion, B) left-sided lesion

median (range) estimated blood loss was 100 (50-500) mL. The pathological diagnosis of resected specimens was obstructing stone in 9 cases, PUJ obstruction in 1 case, ureteral stricture in 4 cases and dysplastic kidney in 1 case.

Table 1. Patient characteristics and operative results of laparoscopic simple nephrectomy for non-functioning benign renal conditions

	Laparoscopic simple nephrectomy (n = 15)
Mean age (years) ± SD	53.9 ± 12.9
Male:Female	5:10
Side (Right:Left)	9:6
Mean operative time (min) ± SD	126 ± 38.3
Median (range) blood loss (ml)	100 (50-500)
Median (range) analgesic requirement (mg of morphine)	8 (0-18)
Mean postoperative drain removal (days) ± SD	2.3 ± 0.8
Mean duration of hospital stay (days) ± SD	4.3 ± 0.8
Mean duration of return to normal activities (weeks) ± SD	2.8 ± 1.1
Complications	
• Right renal vein injury converted to open surgery	1
• Pneumoscrotum	2
• Low grade fever	1
• Delirium	1

In this group, 4 patients had previous abdominal surgery. The operation was converted to open surgery in one case due to right renal vein injury which was classified as a major complication. Minor complications included fever (1 case), pneumoscrotum (2 cases) and delirium (1 case). All of the minor complications were improved by symptomatic management within one week.

For renal cell carcinoma, hand-assisted laparoscopic technique was used for radical nephrectomy and partial nephrectomy. The patient characteristics and operative data are described in Table 2. The operative time and operative blood loss ranged from 150 to 325 minutes and from 200 to 1000 mL, respectively. The data of laparoscopic radical nephroureterectomy including hand-assisted technique for transitional cell carcinoma are shown in Table 3. In malignancy cases, there was one minor complication (prolonged ileus) in the patient who underwent partial nephrectomy, and the clinical condition was improved by conservative treatment within one week. Surgical margins of the specimens from malignant renal tumors (renal cell carcinoma and transitional cell carcinoma) were all negative. There was no port-site, local, or systemic metastasis occurring in the presented patients that had undergone laparoscopic radical nephrectomy or nephroureterectomy at this time.

Table 2. Patient characteristics and operative results of hand-assisted laparoscopic radical and partial nephrectomy for renal cell carcinoma

	Radical Nephrectomy			Partial Nephrectomy
	Case 1 mass 10 cm	Case 2 mass 17 cm	Case 3 mass 7 cm	Case 1 peripheral mass 3.5 cm
Age (years)/ Side	48/Right	52/Right	47/Right	45/Right
Sex	Male	Male	Female	Female
Operative time (min)	315	325	150	220
Blood loss (ml)	500	1000	200	350
Analgesic requirement (mg) of morphine	6	16	8	8
Postoperative drain removal (days)	3	8	3	4
Duration of hospital stay (days)	5	10	6	6
Duration of return to normal activities (weeks)	4	3	3	2
Complications	-	-	-	Prolonged ileus

Table 3. Patient characteristics and operative results of laparoscopic nephroureterectomy for transitional cell carcimnoma

	Pure laparoscopy for nephrectomy		Hand-assisted approach for nephrectomy
	Case 1	Case 2	Case 3
Age (years)/ Side	27/Left	75/Left	45/Right
Sex	Male	Female	Female
Operative time (min)	140	150	120
Blood loss (ml)	150	150	100
Analgesic requirement (mg) of morphine	6	9	8
Postoperative drain removal (days)	2	3	2
Duration of hospital stay (days)	4	5	4
Duration of return to normal activities (weeks)	2	4	3
Complications	-	-	-

Left side hand-assisted laparoscopic simple nephrectomy was performed successfully for a case of xanthogranulomatous pyelonephritis with nephrocutaneous fistula which had failed from previous flank exploration for the purpose of nephrectomy. The operative time was 250 minutes and the operative blood loss was 250 ml. The patient received only 12 mg of intravenous morphine, drain was removed within 2 days post operation and the patient was discharged from the hospital on the 4th postoperative day. The patient returned to normal activity in 2 weeks after surgery.

A case of simple renal cyst decortication was performed successfully within 90 minutes of operation time, bleeding 50 ml and the patient used only 8 mg of intravenous morphine. The patient did well thereafter.

Discussion

Since the introduction of laparoscopic nephrectomy in 1991[1], this procedure has been proved to be a standard approach for nephrectomy. The procedure offers the advantages of decreased operative blood loss, reduced postoperative pain, more rapid short and long-term convalescence and improved cosmesis[2-4]. These issues are important for geriatric patients who may undergo major urological surgery[8].

Although it was financially more expensive during the learning curve, with increased surgeon experience and efficiency, laparoscopic radical nephrectomy and nephroureterectomy are less expensive than open surgery techniques[9]. In the present series, laparoscopic nephrectomy was initially used to treat benign

nonfunctioning renal diseases; however, the indication was subsequently extended to renal malignancy. Training in a skilled laboratory, practicing with animal models, and attending overseas training courses with live demonstrations by experienced surgeons have proved to be invaluable experiences[10]. The authors commenced the initial case under the supervision of a highly experienced laparoscopic urologist and this approach could reduce the steep learning curve of the procedure.

Laparoscopic simple nephrectomy accomplishes the objectives of its traditional open surgery without exposing patients to additional risks or complications[11]. Most laparoscopic surgeons are familiar with the transperitoneal route because it is the standard technique used during the laparoscopic training[10]. The transperitoneal approach allows a wider working space, a better view and more clearly anatomical landmarks compared with the retroperitoneal approach[12]. However, the authors preferred to perform through the retroperitoneal route. Retroperitoneal approach has several advantages over the transperitoneal approach such as no need to mobilize the colon, low risk of visceral organ injury and patients who have had previous open abdominal surgery or peritonitis can be operated on[13,14]. In addition, in cases of highly suspicious contamination such as infected hydronephrosis these do not interfere with the peritoneal cavity. One of the most important benefits of the retroperitoneal approach is that the renal artery can be controlled first and then the renal vein. This technique can reduce blood supply and size of the kidney. The renal vein usually decreases in size when the renal artery is clamped, therefore, the control of renal pedicle is much easier by this approach. The main disadvantage of this approach is the limited working space. However, after adoption of Gaur's balloon dissection technique[15] and having gained more experience, the authors rarely encountered difficulty of working area limitation and the operative time was much improved. The authors have performed simple nephrectomy successfully by laparoscopy in all of the presented series except one which has been converted to an open surgery because of uncontrolled renal vein injury. This case was early in the authors' experience and had severe inflammation of the kidney associated with stone. However, the patient did well thereafter. Although the present series was small, the overall results such as operation time, operative blood loss, length of hospital stay and complications were comparable with those in larger series that have been described previously[2,3,10].

Laparoscopic radical nephrectomy is now the standard treatment modality for patients with T 1-3a renal cell carcinoma[16]. It can also be performed by hand-assisted laparoscopic approach. The authors preferred to use hand-assisted technique in malignancy cases. The advantages of hand-assisted laparoscopic radical nephrectomy over standard laparoscopy are decreased operative time (especially early in surgeon experience), no need for specimen morcellation, and direct manual control of the operative field[17]. Moreover, it also provides postoperative convalescence and post operative pain similar to those of standard laparoscopic nephrectomy[17]. In the present series, tumor size was large (8, 17 and 7 cm) and also had high vascular supply. A disadvantage of standard laparoscopy for cancer cases is that when the specimen is morcellated, staging information is not available[17]. This problem can be avoided by enlarging a port site at the end of the operation to enable whole large specimen removal. However, it is believed that if one is going to make a large incision, it is much better to make it at the beginning of the procedure and to use it for hand assistance throughout the case. Although the number of the presented patients was small, the operative time and operative blood loss were comparable with those in larger previously described series[17,18]. These may confirm that a urologist with minimal laparoscopic experience can perform hand-assisted laparoscopy safely and efficiently[18]. The disadvantage of hand-assisted approach was high cost of the device (500 dollars). Nevertheless, the authors could reduce the cost of the device by reusing it.

The safety and efficacy of laparoscopic radical nephroureterectomy for the treatment of upper tract transitional cell carcinoma have been confirmed by a large multicenter study involving 116 patients[19], and the cancer-specific 2-year survival data were encouraging. A previous author[20] had a different opinion regarding control of the lower ureter and bladder cuff. The bladder cuff can be removed by laparoscopically, endoscopically or open surgery. It is believed that endoscope manipulation of the transmural portion of the ureter is imprudent in view of the possible leakage to the extraperitoneal space[21]. The authors still believe that the bladder cuff should be removed by a standard open technique through the lower abdominal incision for the betterment of cancer control principle.

Several authors have reported that the hand-assisted laparoscopic partial nephrectomy (HALPN) has proved to be feasible and reproducible[22,23]. Potential advantages include the ability to perform complex

deep resections, repair the collecting system with sutures, manipulate the kidney orientation for superior resection angles, and immediately extract and confirm margin status. Moreover, hypothermia provides an unhurried resection, delicate margin assessment and longer period of reconstruction[24].

Although this management was the first experience in our institute, the operative blood loss and the operation time were comparable with those in one of the largest series report[25]. The authors had no transfusion or major complication. However, the patient had persistent ileus necessitating readmission for intravenous fluid for 1 week but did well thereafter.

The authors have performed hand-assisted laparoscopic simple nephrectomy in xanthogranulomatous pyelonephritis (XGP) with nephrocutaneous fistula after failed flank exploration which was the severe inflammatory renal condition. In the past, Bercowsky et al[26] reported that open nephrectomy has more benefits than laparoscopic surgery in these inflammatory conditions. However, Tan et al[27] have reported the feasibility and the advantage of hand-assisted laparoscopic approach for inflammatory renal conditions. To the authors' knowledge, this is the first case of XGP with nephrocutaneous fistula and previous flank exploration, which was managed successfully by hand-assisted laparoscopic nephrectomy. Although the authors spent a long operation time because of severe adhesion, there was no increase in morbidity to the patient. The patient also had all the advantages of laparoscopic surgery over open surgery such as less postoperative pain, less operative blood loss and shorter recovery period.

Laparoscopic renal cyst decortication is feasible, safe and immediately effective. However, this type of intervention is rarely required[11]. The least invasive treatment option for a simple cyst is cyst aspiration and sclerosis. Nevertheless, laparoscopic management is reserved for patients who continue to suffer symptoms when less invasive procedure fails[11]. The present results revealed that laparoscopic treatment had also provided all benefits of minimally invasive surgery.

Conclusion

From the authors' early experience, laparoscopic renal surgery is a safe and efficacious approach for resection of benign non-functioning kidneys and malignant renal tumors. The advantages of laparoscopy over open surgery are decreased operative blood loss, reduced postoperative pain, more rapid short and long-term convalescence and improved cosmesis. Although the long-term cancer control in the present series is still inconclusive, the authors encourage this minimally invasive approach to be the standard management for renal diseases in our community.

Acknowledgements

The authors wish to thank Professor Amnuay Thithapandha for his help and advice concerning the preparation of this manuscript. We also thank our residents (Urology and Anesthesiology) and all the nurses in our minimally invasive urology unit for their assistance during the operations.

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การผ่าตัดไตผ่านกล้อง: ประสบการณ์ในโรงพยาบาลรามาธิบดี

กิตติณัฐ กิจวิกัย, สุเทพ พัชรตระกูล, เจริญ ลีนานุพันธุ์, วชิร คชการ, สุชาติ ไชยเมืองราช

วัตถุประสงค์: *เพื่อรายงานผลการผ่าตัดไตโดยใช้วิธีการผ่าตัดผ่านกล้องในโรคที่ไตเสื่อมการทำงาน และมะเร็งของไต*

วัสดุและวิธีการ: *ตั้งแต่เดือนกรกฎาคม พ.ศ. 2547 จนถึงเดือน กุมภาพันธ์ พ.ศ. 2548 ผู้ป่วยจำนวน 24 ราย ได้รับการผ่าตัดไตผ่านกล้อง โดยมีการบันทึกลักษณะของผู้ป่วย ผลของการผ่าตัด ภาวะแทรกซ้อน ตลอดจนระยะเวลาที่ผู้ป่วยรักษาตัวในโรงพยาบาลและพักฟื้น*

ผลการศึกษา: *ผู้ป่วยจำนวน 15 ราย ได้รับการผ่าตัดไตออกในกรณีที่ไตสูญเสียการทำงาน และไม่ได้เป็นมะเร็ง โดยที่ค่าเฉลี่ยระยะเวลาการผ่าตัดอยู่ที่ 126 $\pm$ 38.3 นาที ค่าเฉลี่ยการสูญเสียโลหิต 100 มิลลิลิตร ยาแก้ปวดใช้โดยเฉลี่ย 8 มิลลิกรัมของมอร์ฟีน ค่าเฉลี่ยของการอยู่โรงพยาบาล 4.3 $\pm$ 0.8 วัน โดยในกลุ่มนี้มีภาวะแทรกซ้อนที่จำเป็นต้องเปลี่ยนมาทำผ่าตัดแบบเปิด 1 ราย เนื่องจากเส้นเลือดดำของไตฉีกขาด*

ผู้ป่วยจำนวน 3 รายเป็นมะเร็งเนื้อไตได้รับการผ่าตัดไตแบบเรดิคัลโดยใช้มือช่วย ระยะเวลาการผ่าตัดคือ 315, 325 และ 150 นาที ปริมาณการสูญเสียโลหิต 500, 1,000 และ 200 มิลลิลิตร ยาแก้ปวดใช้มอร์ฟีน 6, 16 และ 8 มิลลิกรัมมอร์ฟีน ตามลำดับ และมี 1 รายได้รับการผ่าตัดเนื้อไตออกบางส่วนผ่านกล้อง โดยที่ระยะเวลาผ่าตัดอยู่ที่ 220 นาที สูญเสียโลหิต 350 มิลลิลิตร ใช้มอร์ฟีน 8 มิลลิกรัม

ในผู้ป่วยมะเร็งเยื่อบุผิวของกรวยไต ได้รับการผ่าตัดผ่านกล้อง 3 ราย ระยะเวลาที่ใช้ผ่าตัดคือ 120, 140 และ 150 นาที สูญเสียโลหิต 100, 150 และ 150 มิลลิลิตร ใช้มอร์ฟีนแก้ปวด 8, 6 และ 9 มิลลิกรัม ตามลำดับผู้ป่วยกลุ่มมะเร็งไม่มีภาวะแทรกซ้อนที่เป็นอันตรายจากการผ่าตัด และตัดเนื้องอกได้หมดทุกราย

ผู้ป่วยจำนวน 1 ราย มีภาวะที่ไตอักเสบรุนแรงและเคยผ่านการผ่าตัดเปิดแต่ไม่สำเร็จมาก่อน ได้รับการตัดไตออกโดยผ่านกล้องและใช้มือช่วย สำเร็จ โดยมีระยะเวลาการผ่าตัดคือ 250 นาที เสียโลหิต 250 มิลลิลิตร

ผู้ป่วย 1 รายเป็นซีสต์ก้อนใหญ่ที่ไต รักษาโดยการผ่าตัดผ่านกล้องใช้เวลา 90 นาที เสียโลหิต 50 มิลลิลิตร และใช้มอร์ฟีน 8 มิลลิกรัมโดยที่ไม่พบภาวะแทรกซ้อน

สรุป: *การผ่าตัดไตผ่านกล้องปลอดภัยและมีประสิทธิภาพ และใช้ได้ทั้งที่ไตที่สูญเสียการทำงาน รวมถึงมะเร็งของไต*