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Retroperitoneal Laparoscopic Radical Nephrectomy for Renal Cell Carcinoma: A Report on 2 Initial Cases

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We report our experience with retroperitoneal laparoscopic radical nephrectomy in 2 patients with renal cell carcinoma. In this procedure, a working space in the retroperitoneum is created using the blunt balloon dissection technique. Carbon dioxide insufflation is performed, and 4 trocars are inserted into the retroperitoneal cavity through the lateral abdominal wall. The kidney is removed together with the perirenal fat and Gerota's fascia in a muscle-splitting fashion. Using this procedure, a right nephrectomy was performed in a 65-year-old man with a 2.4-cm tumor and in a 54-year-old woman with a 3.5-cm tumor. Operative time was 220 min and 195 min, respectively, and estimated blood loss was 10 mL and 115 mL, respectively. There were no major perioperative complications. Although a long-term follow-up is necessary to evaluate the efficacy of this procedure, it will probably become a standard treatment modality for localized renal cell carcinoma.

Key words: laparoscopy; nephrectomy; renal cell carcinoma

Recently, an increasing number of renal tumors have been detected incidentally in lower stages of growth due to the widespread use of ultrasonography and computed tomography (CT). Radical nephrectomy had previously been the standard treatment modality for localized renal cell carcinoma. In recent years though, laparoscopic nephrectomy has gained popularity in treating both benign and malignant renal diseases, and is usually performed via the transperitoneal or retroperitoneal approach.

We report on our experience using retroperitoneal laparoscopic radical nephrectomy in 2 patients with renal cell carcinoma.

Patient Reports

Case 1

A 65-year-old man with a left ureteral stone arrived at our hospital on May 11, 2001. He underwent shock wave lithotripsy on May 14 and June 4. During shock wave lithotripsy, a mass 2.4 cm in diameter was found incidentally in the right kidney by ultrasonography. CT revealed a tumor measuring 2.4 cm by 2.1 cm in the midportion of the right kidney, with no evidence of renal hilar lymphadenopathy or hepatic metastasis (Fig. 1). Chest CT and bone scintigraphy disproved the probability of metastatic disease. The patient was administered a laxative the day before surgery, and an enema the morning of the surgery. Compression stockings were applied to both legs and upper thighs.

On August 24, under satisfactory general anesthesia combined with epidural anesthesia, a nasogastric tube and an urethral catheter were inserted. The patient was placed in the flank position, with the kidney bridge elevated, and the operating table was bent to widen the space between the 12th rib and the iliac crest. A 1.5-cm incision was made just below the tip of the 12th rib for the 1st trocar port. The flank muscle

Abbreviation: CT, computed tomography

fibers were bluntly separated. The thoracolumbar fascia were gently pierced with a fingertip. A space for subsequent balloon dilator placement was created by gentle finger dissection of the retroperitoneum, anterior to the psoas muscle and posterior to Gerota's fascia. A working space in the retroperitoneum was created by a trocar-mounted balloon device (PDB; United States Surgical Inc., Norwalk, CT). The balloon was inflated with approximately 800 mL of air. The dilation process was monitored laparoscopically through the transparent balloon. Following the balloon deflation and removal, a second 12-mm trocar was placed 7 cm dorsal to the 1st trocar port under bimanual guidance. A 12-mm blunt tip trocar was placed at the 1st trocar port. Carbon dioxide insufflation was performed at a pressure of 8 mmHg to maintain the working space in the retroperitoneal cavity, and a 10-mm, 0-degree laparoscope was inserted via the 1st trocar. The peritoneum was dissected off of the anterior abdominal wall to enable 2 additional trocars to be placed. The 3rd and fourth 5-mm trocars were placed under laparoscopic vision (Fig. 2). Dissection and coagulation during the laparoscopic procedure were performed using the ultrasonically activated scalpel (Harmonic Scalpel; Ethicon Inc., Cincinnati, OH) via the 3rd trocar. At first, the lateroconal fascia was incised along the quadratus lumborum muscle, with exposure of the posterior lamina of Gerota's fascia. The kidney was retracted anterolaterally by the surgical assistant, who used a grasping forceps via the 4th trocar. The leading edge of the psoas muscle was traced cephalad and renal hilar pulsation could be seen. The renal artery was identified and dissected, secured with five 10.5-mm laparoscopic clips (Ligaclip ERCA; Ethicon Inc.), and transected with scissors, while 3 clips were left on the aorta side. The inferior vena cava and the renal vein were then identified and dissected. Its adrenal and gonadal branches were transected with the Harmonic Scalpel to prevent them from being damaged when the renal vein was dissected. The renal vein was mobilized, stapled and divided with a 35-mm laparoscopic stapler (Endocutter; Ethicon Inc.). The posterior aspect of the kidney was dissected upwards, and the anterior aspect of the kidney surrounded by Gerota's fascia was dissected free from the peritoneum. An incision was made in Gerota's fascia at the upper pole of the kidney, and the ipsilateral adrenal gland was spared. The lower

Fig. 1. Early-phase enhanced computed tomogram demonstrating a renal tumor in the right kidney (case 1).

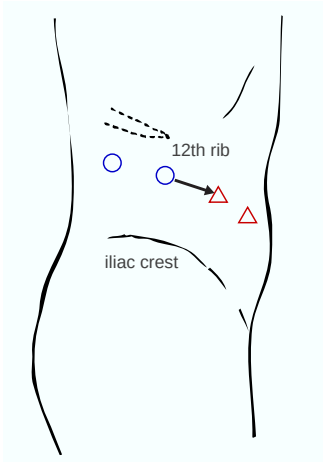

Fig. 2. Trocar placement for retroperitoneal laparoscopic radical nephrectomy. ○, 12-mm trocar; △, 5-mm trocar. The arrow indicates the line of skin incision to remove the specimen.

pole of the kidney was freed, and the ureter isolated during the procedure was secured with four 8.4-mm clips and transected. The specimen was entirely freed upon the completion of the circumferential mobilization. Insufflation was lowered to confirm proper hemostasis in the surgical bed. A 5-mm drainage tube was then inserted through the 4th trocar, and left in the surgical bed. The trocars were removed under laparoscopic vision. The specimen was removed in a muscle-splitting fashion through an additional skin incision, which was made between the 1st and 3rd trocar ports. All wounds were closed using a synthetic absorbable suture. Operative time was 220 min, and estimated blood loss was 10 mL. The specimen weighed 275 g (Fig. 3).

Pathological examination of the kidney revealed clear cell-type, grade-2 and stage-pT1a renal cell carcinoma. Postoperatively, the patient began oral intake on postoperative day 1. He required analgesia for 3 days. Although a subcutaneous emphysema occurred at the right flank abdominal wall, it disappeared on postoperative day 2. Since the patient wanted to receive adjuvant therapy, he was treated with a daily intramuscular administration of 3×10^6-IU/mL interferon-alpha for 2 weeks. He was discharged from the hospital on postoperative day 31.

Case 2

A 54-year-old woman visited our hospital with an asymptomatic gross hematuria on June 26, 2001. Urological examination including ultrasonography and abdominal CT, revealed a tumor measuring 3.5 cm by 3.5 cm in the lower pole of the right kidney, and no evidence of renal hilar lymphadenopathy or hepatic metastasis (Fig. 4). Chest CT and bone scintigraphy showed no signs of metastatic disease. Preoperative preparation was as described for case 1.

On August 24, retroperitoneal laparoscopic radical nephrectomy was performed under general and epidural anesthesia. Operative procedure was almost the same as described for case 1. Two renal veins directly enter the right

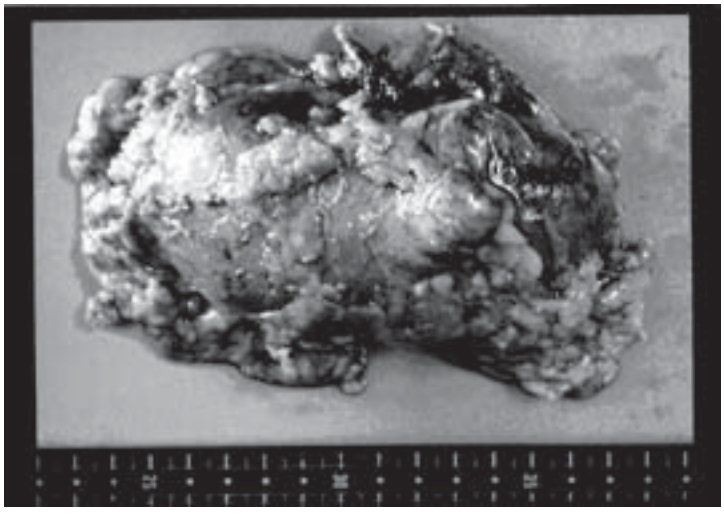

Fig. 3. Macroscopic appearance of the specimen (case 1).

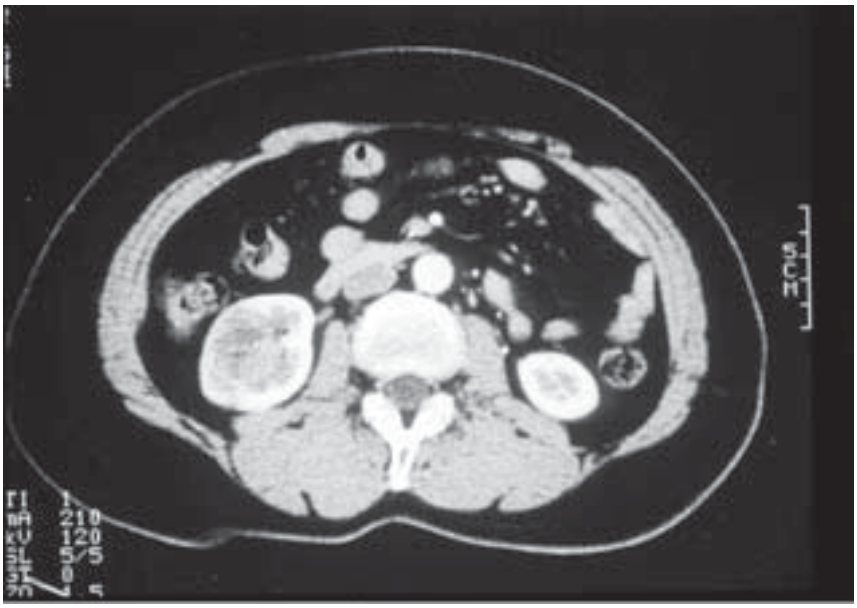

Fig. 4. Contrast-enhanced computed tomogram showing a renal tumor in the right kidney (case 2).

lateral aspect of the inferior vena cava. A smaller vein was clipped and transected, and a bigger one was divided with the Endocutter.

Operative time was 195 min. Estimated blood loss was 115 mL. The specimen weighed 200 g (Fig. 5). Pathological examination of the kidney revealed chromophobe cell-type, grade-2 and stage-pT1a renal cell carcinoma. There were no postoperative complications. The patient began oral intake on postoperative day 1. She required analgesia for 2 days. She was discharged from the hospital on postoperative day 17, since she was anxious about an early hospital discharge despite our advice.

Discussion

Radical nephrectomy is the standard treatment for localized renal cell carcinoma, and was first described by Robson (1963). This procedure includes early ligation of the renal artery and vein before manipulating the renal tumor, en

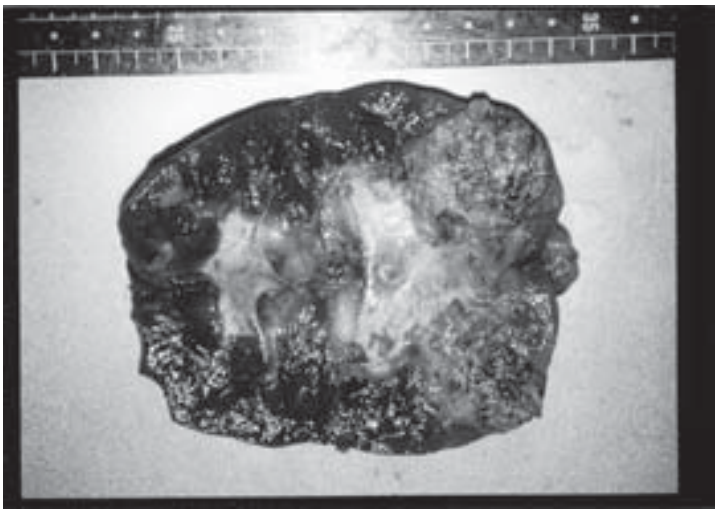

Fig. 5. Cut surface of the specimen (case 2).

bloc removal of the kidney and ipsilateral adrenal gland together with the perinephric fatty tissue and Gerota's fascia, and dissection of the lymph nodes.

Since the initial report of laparoscopic nephrectomy by Clayman et al. (1991), laparoscopic nephrectomy has become accepted as a minimally invasive procedure for benign, and, more recently, for malignant renal disease.

The benefits for patients undergoing a laparoscopic nephrectomy rather than an open nephrectomy include a briefer postoperative course with reduced pain and analgesic requirements, earlier oral intake and mobilization, a shorter hospital stay and convalescence, and better cosmetic results (Rassweiler et al., 1998; Abbou et al., 1999; Hemal et al., 1999; Fornara et al., 2001).

Laparoscopic radical nephrectomy is mostly done via the transperitoneal approach because of a larger working space and well-recognized anatomic landmarks. Gaur (1992) reported the creation of an adequate working space in the retroperitoneum using the blunt balloon dissection technique. This led to an increased interest in the retroperitoneal approach for laparoscopic nephrectomy. Since the kidney is a retroperitoneal organ, the retroperitoneal approach provides several potential advantages. In this approach, the renal hilum is initially exposed, allowing for early control of the renal vessels. The risk of intraperitoneal organ injury is very low compared to the transperitoneal approach.

In laparoscopic radical nephrectomy, specimen removal can be performed 2 different ways; intact removal performed by extending the incision at 1 of the port sites, or morcellation after the specimen has been placed in an entrapment sac. Intact removal of the specimen with or without an entrapment sac requires extension of the incision (Gill et al., 2000; Cicco et al., 2001). A larger incision, even in a longitudinal muscle-splitting fashion (Savage and Gill, 2001), may reduce the advantages of laparoscopic surgery. Morcellation can be performed with a high-speed electrical tissue morcellator (Kavoussi et al., 1993) or mechanical clamp and forceps (Ono et al., 2001). However, this maneuver introduces the risk of seeding of the tumor cell at the port sites, and dissemination into the working space. In addition, precise evaluation of the surgical margins, which is dependent on pathological examination of the intact specimen, may be difficult because of tissue morcellation.

In our department, simultaneous adrenalectomy during open radical nephrectomy is not routinely performed, except for large, upper pole tumors (Kadowaki and Miyagawa, 2001). Paul et al. (2001) reported a total of 866 consecutive patients who underwent nephrectomy and ipsilateral adrenalectomy with a solitary adrenal metastasis of only 6 (0.6%). They suggested that if the maximum tumor size measured by CT is less than 8 cm, and when a staging examination does not show organ or lymph node metastases, adrenalectomy is not necessary.

In this series, we did not perform regional lymph node dissection. Although regional lymph node dissection provides for more precise staging of the disease, its therapeutic value remains controversial. Minervini et al. (2001) suggested that there is no clinical benefit in terms of overall outcome in undertaking regional lymph node dissection in the absence of enlarged nodes detected before or during surgery. At present, our policy is to restrict retroperitoneal laparoscopic radical nephrectomy to tumors less than 7 cm, and neither regional lymph node dissection nor ipsilateral adrenalectomy is performed during the procedure.

There are few reports concerning the long-term disease-free outcome of laparoscopic radical nephrectomy (Cadeddu et al., 1998; Ono et al., 2001). Ono et al. (2001) evaluated the efficacy of laparoscopic radical nephrectomy. One-hundred and three patients who had renal tumors less than 5 cm in diameter underwent laparoscopic radical nephrectomy. During a median follow-up period of 29 months (range 3 to 95 months), the seeding of port sites did not occur in any of the patients. Metastatic disease developed in 3 patients, and local recurrence in 1 patient. The 5-year disease-free and patient survival rates were 95.1% and 95.0%, respectively. These rates were comparable to those in patients who underwent open surgery.

Table 1. Results of retroperitoneal laparoscopic versus open radical nephrectomy

Patient number	Age	Sex	Side	Operative time (min)	Estimated blood loss (mL)		Tumor size (cm)	Pathological diagnosis (stage/grade)†	Analgesia (day)	Postoperative oral intake (day)		Hospital stay (day)
Retroperitoneal laparoscopic radical nephrectomy												
1	65	M	Rt	220	10		2.4	pT1a/G2	3	1		31
2	54	F	Rt	195	115		3.5	pT1a/G2	2	1		17
Mean	59.5			207.5	62.5		2.95		2.5	1		24
Open radical nephrectomy												
1	63	M	Lt	220	235		3	pT1a/G2	17	4		27
2	59	F	Lt	185	110		4.5	pT1b/G2	4	2		33
3	73	F	Rt	185	260		3	pT1a/G2	7	3		18
4	43	M	Rt	142	90		2	pT1a/G2	9	5		31
5	62	M	Lt	235	530		3.3	pT1a/G2	2	8		24
6	71	M	Lt	180	220		2.9	pT1a/G2	3	4		16
7	59	M	Rt	205	385		3.5	pT1a/G2	3	3		56
8	47	F	Rt	210	250	*	3.6	pT1a/G2	2	2	*	14
9	39	M	Rt	180	190		3	pT1a/G2	3	4		17
10	77	F	Rt	305	145		4.5	pT1b/G2	5	5		11
11	72	M	Rt	200	220		4.4	pT1b/G2	1	2		16
12	63	F	Rt	285	220		4	pT1b/G2	4	3		34
13	51	F	Rt	180	680		6	pT1b/G2	3	3		35
14	66	F	Lt	260	1150		3	pT1a/G2	4	2		32
15	83	M	Lt	160	440		3	pT1a/G1	5	2		16
16	57	M	Lt	235	500		2.3	pT3a/G2	4	3		33
Mean	61.6			210.4	351.6		3.5		4.8	3.4		25.8

F, female; Lt, left; M, male; Rt, right.
* $P < 0.05$ compared by the Mann-Whitney test.
† According to the general rule for clinical and pathological studies on renal cell carcinoma (Japanese Urological Association, The Japanese Society of Pathology and Japanese Radiological Society, 1999).

Outcome data were retrospectively compared between groups of patients treated between March 1998 and August 2001 at our department clinic of Tottori University Hospital: the 2 initial patients undergoing laparoscopic radical nephrectomy versus 16 patients with localized disease undergoing open radical nephrectomy (Table 1). Mean tumor size was 2.95 cm in the laparoscopic group and 3.50 cm in the open group ($P = 0.52$). Outcome analysis revealed that both groups were comparable in regard to operative time (207.5 min versus 210.4 min). However, the laparoscopic group showed lower blood loss ($P < 0.05$) and earlier postoperative oral intake ($P < 0.05$).

Although a long-term follow-up is necessary to evaluate the efficacy of this procedure, it will probably become a standard treatment modality for localized renal cell carcinoma.

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