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BRIEF REPORT

I-Rue Lai
Meng-Kun Tsai
Shih-Chieh Chueh
Po-Huang Lee
Chun-Jean Lee

Handport-assisted laparoscopic living-donor nephrectomy; initial experience in Taiwan

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I.-Lai · M.-K. Tsai · P.-H. Lee (✉)
C.-J. Lee
Department of Surgery,
National Taiwan University Hospital,
7 Chun-san South Road, Taipei, Taiwan
E-mail: pohuang@ha.mc.ntu.edu.tw
Tel.: +886-2-23123456
Fax: +886-2-27717406

S.-C. Chueh
Department of Urology,
National Taiwan University Hospital,
Taipei, Taiwan

Abstract The feasibility of handport-assisted laparoscopic living-donor nephrectomy in Taiwan was assessed by comparison with conventional open nephrectomy. Six serial patients undergoing laparoscopic living-donor nephrectomy (LLDN) were compared with six patients undergoing open donor nephrectomy. Body-mass index (BMI), operating time, hospital stay, and short-term graft function were assessed in both groups of patients. Handport-assisted LLDN was successfully attempted in all six patients. Mean ischemic time was 4.5 min in the laparoscopic group. There was no major complication in either group. Short-term graft function was good in all patients, except for one case of chronic rejection with mild azotemia in the open group. The length of stay was significantly longer in the open group, but the operation time of the laparoscopic group was much longer than that of the open group. There was no difference in the resumption of diet and in the use of narcotic analgesics in addition to patient-controlled analgesia. LLDN is a technically demanding approach. With handport assistance, the surgeons could shorten their learning curve. While initial graft function rates are equal to those of the open method, cosmesis and hospital stay are improved by the laparoscopic approach. Longer follow-up and larger patient numbers are needed to confirm these initial results in Taiwan.

Keywords Hand-assisted · Laparoscopy · Nephrectomy

Introduction

In Taiwan, 25,000 patients undergo hemodialysis, and 1,600 undergo peritoneal dialysis each year. Of these, 4,000 are on the waiting list for renal transplantation [1]. However, in 1999 only 96 patients underwent renal transplantation, 84 receiving cadaveric- and 12 receiving living-donor grafts [2].

Because of the growing shortage of cadaveric kidneys, live donation is one potential means of obtaining more kidneys [3]. Moreover, live-donor renal transplantation yields significantly improved patient and graft survival [4].

The most common method of harvesting live-donor renal allografts is via a retroperitoneal flank incision. However, there are several disadvantages to this approach [5]. The relatively prolonged recovery period can have significant financial impact on the donor, and natural fear of pain and cosmetic concerns are associated with a long flank incision. Besides, the long-term morbidity associated with the retroperitoneal flank approach is not uncommon. Wound complications, pneumothorax, and chronic wound pain or incisional hernia may occur in 15%–20% of patients [6, 8].

Laparoscopic living-donor nephrectomy was first developed in 1995 by Ratner [14] and co-workers to decrease the morbidity of the open procedure and to stimulate individuals to donate their kidneys. The potential benefits of laparoscopic donor nephrectomy include decreased wound pain, shorter hospitalization,

better cosmesis, and a more rapid return to everyday life. Additionally, the accumulated benefits might increase the acceptance of donation and expand the pool of potential kidney donors. There are several reports from western countries on the success of laparoscopic living-donor nephrectomy (LLDN) for renal transplantation [7, 9, 10]. However, there are few reports on this approach from eastern countries.

Using our accumulated experience in laparoscopic surgery, we have performed LLDN on six donors since November 2000. The results of these are compared with those of donors who underwent the open approach in the previous year.

Patients and methods

Patient selection

LLDN (LLDN group) was performed in six patients at the surgical department of the National Taiwan University Hospital (NTUH) from January through May 2001. Laparoscopic donors were compared with six patients undergoing open donor nephrectomy (open group) at NTUH from January through December 2000. Early graft survival, intraoperative variables, and postoperative recovery are compared between the two groups. Laboratory investigation included the determination of human leukocyte antigen and a lymphocytotoxic crossmatch before the transplantation. Magnetic resonance angiography was performed to visualize the renal vascular and ureteral anatomy and to determine the presence of two functional kidneys.

Surgical technique

The patient was placed in the modified flank position. A pneumoperitoneum of 15 mmHg was established via a periumbilical incision. The kidney was approached via a transperitoneal access utilizing four port locations (Fig. 1). The umbilical port site was enlarged to 7 cm at the end of the procedure for handport placement and for removal of the graft. The left colon was reflected medially to expose Gerota's fascia. The hilum of the kidney was dissected to reveal the renal vein and its tributaries. The gonadal vein and suprarenal vein were clipped and divided. The ureter and gonadal vein were dissected together to the level of the pelvic brim and the bifurcation of the common iliac artery. To minimize the risk of ischemic necrosis of the ureter, we dissected the gonadal vein and the ureter as a unit, to preserve the adventitia and arterial plexus of the ureter. No ureteral complication developed in the patients in our series. During the dissection, the patient was given crystalloid along with mannitol and furosemide to maintain diuresis.

The periumbilical port site was enlarged to one 7-cm-long incision to allow the placement of the handport (Pneumo Sleeve device, Dexterity, Roswell, Ga., USA). With manual assistance by the surgeon, the kidney was freed from its surrounding attachment and adrenal gland. The renal artery was dissected from its root of the aorta from the posterior aspect of the kidney. The lumbar veins were clipped and divided. The renal artery was divided between clips, and the warm ischemia time began. An endoscopic gastrointestinal-anastomosis stapler was used subsequently to divide the renal vein. The graft was removed via the handport and placed in an ice bath, flushed, and prepared for transplantation. The wound was closed in a standard manner. The harvested graft was immersed immediately in ice-cold saline solution and transferred from the workbench to the renal perfusion bath.

Fig. 1 Patient and port positions. The patient was placed in the right-flank position. The periumbilical port was extended to insert the handport

Results

Patient demographics were not significantly different between the open and the LLDN groups. There was no significant difference in body-mass index (BMI) between groups. No right kidney LLDN was carried out because of the shortness of the right renal vein. Warm ischemia time was recorded only for the LLDN group. LLDN was successfully attempted in six patients. Graft function was maintained in all six recipients of the LLDN group. Chronic graft rejection occurred in one recipient of an open-group kidney, but the urine output and renal function was adequate without dialysis support. The intraoperative variables and short-term outcomes are shown in (Table 1). There was no significant difference in the resumption of diet. With the use of patient-controlled anesthesia, very few narcotics were needed for pain relief in both groups. The length of stay was significantly longer for the open group (8.5 vs 6.2 days). However, the operation time was longer in the LLDN group. The early and 1-month follow-up serum creatinine levels of the donors were the same in the LLDN- and the open groups. One patient in the laparoscopic group needed a perioperative blood transfusion for a minor vascular injury to the lumbar vein; the bleeding from this injury was controlled. There was no associated morbidity or graft dysfunction in this patient. There were no major perioperative complications in either group.

Discussion

The initial experience of LLDN in Taiwan is satisfactory. All six cases were successfully treated with the laparoscopic method. No major complication occurred,

Table 1 Patient demographics and operation data. The data are expressed as mean (range); Student's *t*-test was applied

Characteristic	Open	LLDN	*P*
Age (years)	50.3 (40–62)	45.2 (37–55)	0.311
Gender (M:F)	4:2	3:3	–
BMI	26.7 (22.3–37.2)	25.6 (20.5–31.1)	0.700
Operation time (min)	180.5 (166–200)	312 (235–473)	0.004*
Warm ischemia time (min)	–	4.5 (3–8)	–
Length of stay (days)	8.5 (6–11)	6.2 (4–8)	0.048*
Serum creatinine on POD 30			
Donor (mg/dl)	1.3 (0.9–1.6)	1.2 (0.9–1.3)	0.087
Recipient (mg/dl)	1.63 (0.8–3.5)	1.03 (0.8–1.3)	0.174

*Significant difference between the groups

and the short-term functions of renal grafts were well maintained. Compared with the open method, the LLDN could shorten hospitalization time and improve cosmetics. More importantly, we hope the new method will increase the number of live-donor kidney donations.

LLDN nephrectomy was reported first by Ratner et al. in 1995 [14]. In the initial laparoscopic closed approach, the surgeons have to make a utility laparotomy to remove the graft at the end of the procedure. To assist the procedure from the beginning, preserve the advantages of laparoscopic surgery, and minimize wasted effort, it is reasonable to allow the surgeon to insert one hand via the utility laparotomy without losing pneumoperitoneum. In a pilot study, hand-assisted laparoscopic colon resection was found to be more efficient than closed laparoscopic colectomy [12]. Hand-assisted laparoscopic surgery (HALS) is suitable for living-donor nephrectomy as it allows tactile feedback, hand–eye coordination, gentle traction on tissue, and removal of the graft via the incision originally made to permit insertion of a device designed to allow manual access to the abdomen. Besides, HALS is believed to shorten warm ischemia time [11, 13] and extend vessel length at the division of the renal vein and artery [17]. A warm ischemia time of 10 min or longer was associated with elevated mean serum creatinine levels on postoperative day 7 [16]. In our results, the warm ischemia time was limited to 5 min with the assistance of the handport, and the serum creatinine levels were all within normal limits 1 month after surgery.

Location of the handport

The periumbilical incision was used for several reasons [15]. Cosmetic results are better because half the length of the incision can be placed in the recess of the umbilicus; it is technically easier; it is more comfortable for right-handed surgeons to insert their left hand from this location.

However, the hand-assisted device also has its drawbacks. It limits the liberal placement of the camera port. To allow adequate dissection of the ureter and gonadal vein, we have to shift the camera from a lower to an upper port for visualization and change the direction of dissection to avoid working under the mirror image. If the pneumosleeve was put in place at the beginning of procedure, the periumbilical port could not be used for the camera port. Moreover, hand preference of the surgeon might limit the placement of the pneumosleeve. For left nephrectomy, right-handed surgeons could use their left hand to work via the periumbilical handport, and it would be a little awkward for the left-handed surgeons if the handport position was not adjusted. In the patients in our series, we inserted the pneumosleeve after the ureter and gonadal vein dissections were completed and we could finish the operation without the need of changing camera position. In this way, we felt comfortable handling the vessels and saved much dissection time.

With more experience and method modification, the operating time for the laparoscopic group could be as short as that of the open group, according to previous reports [9, 10]. However, the operating time for the LLDN group was still much longer than that for the open group in our study. This means that we still have a lot to do to shorten the learning curve.

In summary, the initial graft survival and functional rate of LLDN and the open approach are both similar, and longer follow-up is necessary to confirm these observations. Handport-assisted LLDN is a safe but technically demanding method for harvesting renal grafts. To optimize donor safety, the surgeon should perform this technique with caution, reserving it as the last resort of laparoscopic renal surgery. An experienced and cooperative laparoscopic team is always required to perform this procedure. With the modification and the help of the handport, we will gradually shorten our learning curve and hope this new method can increase the donor pool in Taiwan.

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