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Complete retroperitoneal laparoscopic nephroureterectomy with bladder cuff excision for upper tract urothelial carcinoma without patient repositioning: a single-center experience

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Abstract

Objective: This study was performed to evaluate the outcome of complete retroperitoneal laparoscopic nephroureterectomy with bladder cuff excision (RLNU-BCE), which is performed to treat urothelial carcinomas in the renal pelvis or in the ureter higher than the crossing of the common iliac artery without patient repositioning.

Methods: We retrospectively analyzed the clinical data of 48 patients with upper tract urothelial carcinoma who underwent complete RLNU-BCE in our institution from May 2017 to September 2019.

Results: RLNU-BCE was successfully performed in all 48 patients. The median operation time was 110 minutes [interquartile range (IQR), 100–130 minutes], and the median postoperative anesthesia recovery time was 10 minutes (IQR, 7–15 minutes). The median postoperative hospitalization period was 5 days (IQR, 4–6 days). Pathologic examination revealed that the margin of all resected specimens was negative. After a median follow-up of 13 months (IQR, 7–20 months), no local recurrence or distant metastasis was found. No complications occurred during follow-up.

Conclusion: Based on our experience with this technique, RLNU-BCE deserves application and promotion in clinical practice. Long-term comparative studies are required to confirm its superiority over other techniques.

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Introduction

Unlike the incidence of common urothelial carcinomas, the incidence of upper tract urothelial carcinoma (UTUC) has gradually been increasing in recent years, and it has now reached nearly 5% to 10%.[1,2] Nearly all patients have microscopic hematuria, and about one-third are treated for lumbar or abdominal pain. Clinical therapy is begun once a definite diagnosis has been obtained. Radical nephroureterectomy with ipsilateral bladder cuff excision (BCE) is currently considered the gold standard treatment of UTUC.[3] In addition, laparoscopic surgery, characterized by its safety, effectiveness, and minimal injury, has gradually replaced open surgery and is now widely applied in the clinical setting. With the advent of laparoscopic instruments and technologies, various strategies have been suggested for the treatment of UTUC, including retroperitoneal routes,[4,5] the transperitoneal route,[6] and single-site retroperitoneal laparoscopic nephroureterectomy (RLNU).[7,8] Nonetheless, all of these surgical techniques have a common problem: difficulty dealing with the vesicoureteral junction under laparoscopic conditions.[9] Previous studies have revealed that incomplete excision and defective vesicoureteral sutures are prone to trigger tumor cell implantation and dissemination.[10] During the past few years, several techniques have been proposed to optimize the BCE technique, including the open approach (either intravesical or extravesical excision), laparoscopic approach (standard excision, endoGIA, Ligasure), and endoscopic approach (transurethral resection with ureteral stripping). However, most of these strategies require changing the body position during the operation, which may increase the risk of implantation metastasis. Based on a summary of previous experiences and the anatomical characteristics of the upper urinary tract elucidated in recent years, RLNU with BCE (RLNU-BCE) without patient repositioning has been applied in our hospital with good clinical effects.

Materials and methods

Clinical data

Forty-eight patients were retrospectively enrolled in this study (27 men and 21 women) ranging in age from 41 to 82 years. Of the 48 patients, 30 had renal pelvis cancer and 18 had ureteral tumors higher than the crossing of the common iliac artery. The lesion was on the right side in 20 patients and on the left side in 28 patients. Sixteen patients visited the hospital for evaluation of painless gross hematuria, and upper urinary tract tumors were discovered during the physical examination in seven patients. Before surgery, computed tomography urography and magnetic resonance urography were used to determine the size and location of the tumor. Moreover, examination of the urine for tumor cells was adopted as an elementary pathological examination before the biopsy, and suspicious tumor cells were found by

urinalysis in 14 patients. Ureteroscopy was performed in 10 patients before surgery. Additionally, cystoscopy was performed to rule out bladder tumors in all patients before surgery. The patients' preoperative renal dynamics were evaluated to determine the function of the contralateral kidney.

Surgical techniques

All 48 RLNU-BCE operations were performed by one surgeon with rich experience in laparoscopy. After administration of general anesthesia, a catheter was inserted into the urethra and the patient was placed in the 90° lateral decubitus position (see Figure 1, in which UTUC on the left side is taken as an example). The assistant then stood on the contralateral side and routinely sterilized the surgical site. The surgeon stood on the lesion side of the patient and performed the surgery, while the camera assistant stood behind the patient's buttocks.

First, a small incision was made at the intersection of the line inferior to the lowest point of the 12th rib and the outer sacrospinous muscle, and the muscle was obtusely separated into the lumbodorsal fascia. The retroperitoneal space was then expanded and a self-made dilator was placed. About 400 mL of air was injected into the balloon dilator to expand the peritoneum. Trocars of corresponding sizes were then placed at ports A, B, and D (Figure 1). The laparoscope was introduced and pneumoperitoneum was established through port A, and the gas pressure was maintained at 12 mmHg. The trocars in ports B and C were used for surgical manipulation. The trocar in port D was used to assist the operation if necessary (Figure 1). After entering the retroperitoneum, the extraperitoneal fat was removed using an ultrasound scalpel to expose the peritoneal reflection. The psoas muscle and ureter were then exposed, and the distal ureter was ligated to the tumor with a Hem-o-lok clip to prevent the tumor from spreading (Figure 2(a)). The perineal fascia was cut to make a 5-cm-wide opening between

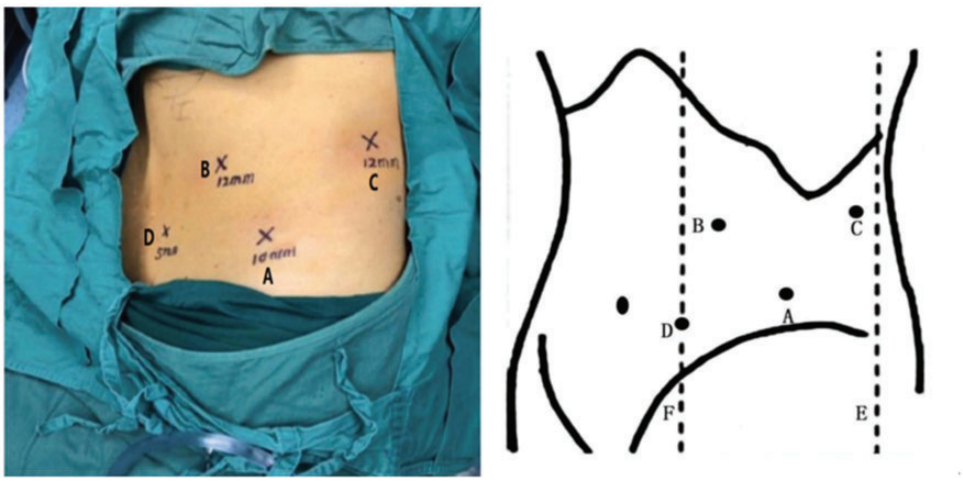

Figure 1. Port sites. Port A: Intersection of a longitudinal line 2 cm ventral to the mid-axillary line and a transverse line 3 cm superior to the iliac crest. Port B: Intersection of a longitudinal line 2 cm ventral to the anterior axillary line and a line extending from the 12th rib. Port C: Intersection of the line inferior to the lowest point of the 12th rib and the outer sacrospinous muscle. Port D: Intersection of the midclavicular line and a transverse line 3 cm inferior to the umbilicus. Line E: Posterior axillary line. Line F: Mid-axillary line.

the upper pole and the lower pole of the kidney. The back sides of the kidney were then freed along the surface of the psoas muscle toward the renal pedicle to a certain length until the renal artery was found. The renal artery was then clipped with three Hem-o-lok clips. The distal artery between two Hem-o-lok clips was cut with scissors to identify and release the renal vein, which was processed in a similar manner (Figure 2 (b), (c)). The kidney and perirenal fat on the lesion side were completely freed

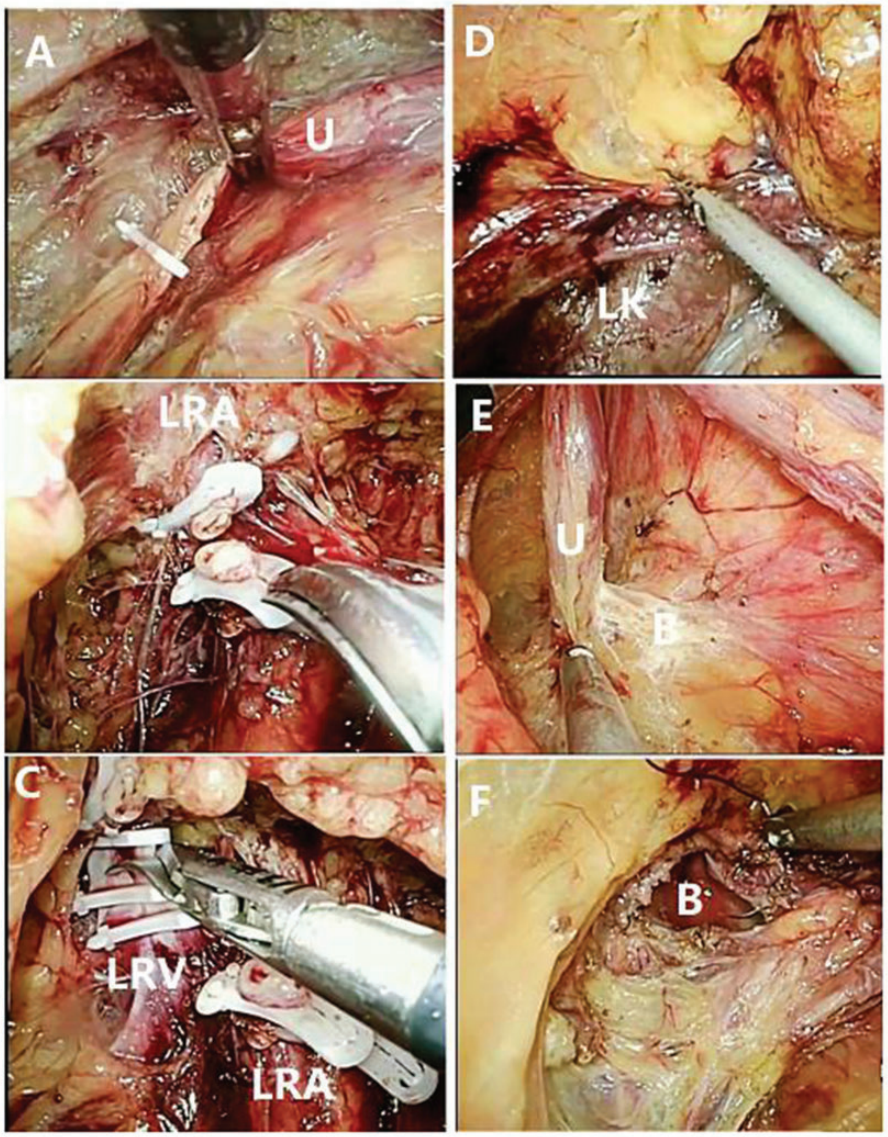

Figure 2. Representative images of the surgical procedures. (a) Clamping of the ureter with a Hem-o-lok clip. (b, c) Cutting of the renal artery and vein. (d) Dissociation of the kidney. (e) Pulling the ureter to expose the bladder. (f) Complete suturing of the bladder. LRA, left renal artery; LRV, left renal vein; U, ureter; B, bladder; LK, left kidney.

(Figure 2(d)), and the adrenal glands were retained. The ureter was then released to the pelvis (Figure 2(e)).

When the surgical wound no longer exhibited active bleeding, the patient was placed in the 70° oblique position with the lesion side up by rotating the operating table (elevating the foot side and lowering the head). The trocars in ports A and D were used as the operation channels, while the lens entered through port B. The surgeon shifted the operation to the head-to-foot direction, while the assistant stood beside the patient's head. The ureter was lifted to the inner segment of the bladder wall. The bladder detrusor was freed around the ureter and cut apart before the ureter was pulled to the cephalic side, the bladder detrusor was sutured with a 3-0 absorbable barbed wire, and the bladder was pulled (Figure 2(f)). The ureter and a 1.5- to 2.0-cm-thick segment of the bladder wall around the ureteral opening were removed, and the bladder was sutured.

Finally, saline was injected into the bladder through a catheter to check for the presence or absence of urine leakage. The kidney was placed in a specimen bag with a diameter of 130 mm, and the saline irrigation area was sterilized. The pneumoperitoneum pressure was lowered to 5 mmHg to check for active bleeding on the wound surface. A 6-cm (5- to 7-cm)-wide oblique incision was made 5 cm above the inguinal region. After pulling out the trocar, the muscles of each layer were bluntly separated into the retroperitoneal cavity. The surgical specimens were removed, and a 20-Fr porous drainage tube was separately placed in the retroperitoneal and pelvic cavities. The incision in the abdominal wall was sutured, stapled, or adhered.

Ethics

All patients provided informed consent before the treatment. All procedures in this study were performed in accordance with the principles of the Research Ethics Committee of the Affiliated Yantai Yuhuangding Hospital of Qingdao University and with the 2013 Helsinki Declaration and its amendments.

Results

All 48 patients underwent complete laparoscopic surgery, and no procedures were converted to open surgery. The median operation time was 110 minutes [interquartile range (IQR), 100–130 minutes], and the median intraoperative bleeding volume was 60 mL (IQR, 20–110 mL). The median recovery time of postoperative intestinal function was 5.5 hours (IQR, 5.0–6.5 hours). Additionally, no peritoneal or abdominal organ injury occurred during the surgery.

After surgery, the patients were subjected to a fluid diet. The drainage tube was then removed 2 to 3 days after surgery when the drainage volume had decreased and no intestinal obstruction appeared. The median postoperative hospital stay was 5 days (IQR, 4–6 days), and the histopathological examination showed urothelial carcinoma in 48 specimens. Notably, most tumors were T2 stage tumors (Table 1). All patients underwent intravesical instillation therapy beginning 2 weeks after surgery (once a week for four to eight treatments and once a month thereafter; 1 year in total).

Based on the latest European Association of Urology guidelines, cystoscopy or urinary cell exfoliation was performed every 3 months for the first year and once annually thereafter. Additionally, computed tomography urography was performed at 6-month intervals for 2 years after surgery and once a year thereafter. A previous study revealed that the median time to bladder tumor and other metastases was 8.7 months (IQR, 6.0–

Table 1. Clinical and pathologic characteristics of the study population.

Parameter	
Age, years	61.5 (41.5–82.5)
Sex	
Male	27 (56)
Female	21 (44)
Side	
Right	20 (42)
Left	28 (58)
Body mass index, kg/m^2	23.6 (20.4–26.8)
Tumor location	
Pelvis	30 (62)
Ureter	18 (38)
Tumor stage	
T_1	17 (35)
T_2	29 (61)
T_3	2 (4)
Operation time, minutes	110 (100–130)
Intraoperative blood loss, mL	60 (20–110)
Anesthesia recovery time, minutes	10 (7–15)
Intestinal function recovery time, hours	5.5 (5.0–6.5)
Hospital stay, days	5 (4–6)
Follow-up, months	13 (7–20)

Data are presented as median (interquartile range) or n (%).

18.5 months) after RLNU-BCE.[11] None of the 48 patients in our study had developed tumor recurrence after 13 months (IQR, 7–20 months) of follow-up. The patients were still continuing follow-up at the time of this writing.

Discussion

With the rapid development of medical technology and the continuous improvement of laparoscopic instruments, radical nephroureterectomy for treatment of UTUC has changed from open surgery to minimally invasive laparoscopic techniques during the past few decades. Since the first report of successful laparoscopic nephroureterectomy by Clayman in 1991, minimally invasive surgery has been more extensively used than open surgery in the field of urology.[12–14] Notably, laparoscopic nephroureterectomy is very beneficial for most patients because it significantly reduces the risk of excessive intraoperative blood loss, shortens the hospital stay, accelerates recovery, and reduces the incidence of complications.[15–17] Although urological minimally invasive surgery has significantly matured, complete laparoscopic surgery for renal pelvic carcinoma or ureteral cancer remains challenging.[18,19] Specifically, the difficulty in the operation lies in the management of the lower segment of the ureter and the opening part of the ureteral bladder.[20,21] For instance, separating the lower segment of the ureter easily causes bleeding, and it is difficult to suture the bladder because of the influence of the angled space.[22] Laparoscopic renal and ureteral surgeries, in which only an incision in the abdomen is required to open the ureter and bladder, thus remain the most prevalently used strategies. Nonetheless, the patient's body position requires repeated adjustment and the towels should be disinfected during the surgery, making the procedure complicated and resulting in a relatively long operation time with interference of the intra-abdominal viscera. Moreover, the surgeon requires additional assistance. The ruptured bladder cannot be closed after laparoscopic nephroureterectomy with transurethral resection, thus increasing the risk of urine extravasation, tumor cell overflow, and a long postoperative catheterization time.[23,24] Based on several existing studies, surgeons have removed the distal ureters and bladder cuffs using laparoscopy and large Hem-o-lok clips or intravascular staples.[25,26] Although the laparoscopic strategy partially prevents local implantation of tumor cells, the site of resection cannot be precisely located, and staplers or large Hem-o-lok clips may easily promote stone

formation.[27,28] Complete laparoscopic nephrectomy may be performed by a transperitoneal or retroperitoneal approach. The retroperitoneal approach allows for a large degree of blunt separation within the perirenal fascia.[11] It has a shorter operative time than the transperitoneal approach, which is primarily characterized by sharp separation. Additionally, the retroperitoneal approach allows the surgeon to enter the operating field more quickly with less damage to the isolated abdominal organs and tissues, thereby significantly reducing the risk of postoperative bleeding, infection, and other complications.[29] However, the approach via the abdominal cavity is invasive to a certain extent, with a long operation time, high stress level, and high level of inflammation in the body.[30] Furthermore, acute separation can increase the possibility of serious damage to the body. The technique proposed in the present report has the following advantages. (1) The complete retroperitoneal laparoscopic operation causes less trauma and interference to the abdominal organs, hence facilitating faster recovery of patients. (2) The distal ureter and bladder sleeve are precisely resected under a clear operative field. (3) The operation is simplified and accelerated because a change in body position and sheet disinfection are not required. (4) The surrounding bladder wall and sleeve mucosa can be clipped before resection of the distal ureter, which is stitched together with the bladder under microscopy after resection of the distal ureter and bladder sleeve. Thus, complete RLNU-BCE performed without patient repositioning is effective for the treatment of UTUC.

Notably, lymph node dissection was not routinely performed in our center because the curative role of lymph node dissection for UTUC remains controversial.[31,32] Although some previous articles have described better oncological outcomes when lymph node dissection is performed,[33,34] more clinical data and research are still needed to prove the role of lymph node dissection in patients with UTUC.

Conclusion

Our preliminary experience of complete RLNU-BCE in 48 patients has shown that the operation is a safe, effective, and feasible minimally invasive method with satisfactory short-term outcomes. This paper only presents a summary of our clinical experience, and our study did not include comparison with other surgical methods. Therefore, long-term comparative studies are required to effectively assess the superiority of this modified approach.

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Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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