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CASE REPORT

Robotic distal ureterectomy with psoas hitch and ureteroneocystostomy: Surgical technique and outcomes

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Abstract Use of the da Vinci® surgical robotic system has expanded to numerous upper and lower urinary tract procedures. We describe our surgical technique and perioperative outcome of robotic distal ureterectomy with psoas hitch and ureteroneocystostomy for distal ureteral pathologies. Eight patients with a median age of 69.5 years old underwent robotic distal ureterectomy with psoas hitch and ureteroneocystostomy between April 2009 and August 2014. The entirety of all cases was performed robotically by a single surgeon at a tertiary academic medical center. Median operative time was 285 min (range: 210–360 min), estimated blood loss was 50 mL (range: 50–75 mL) and median length of hospital stay was 2.5 days (range: 1–6 days). There was one post-operative complication, a readmission for dehydration (Clavien I). It suggests that robotic distal ureterectomy with psoas hitch and ureteroneocystostomy is a safe and effective minimally invasive alternative for patients with distal ureteral pathology.

1. Introduction

Laparoscopic ureterectomy was first described by Chadhoke and colleagues in 1993 [1]. More recently robotic surgery has expanded to address lower urinary tract procedures including ureteral pathologies following the success of robotic prostatectomy and partial nephrectomy [2–5]. Herein, we present our institutional experience and description of robotic distal ureterectomy with psoas hitch and ureteroneocystostomy for distal ureteral pathology.

2. Patients and methods

Following institutional review board approval, a retrospective chart review was performed at a large tertiary care academic institution to identify patients who underwent robotic distal ureterectomy for the treatment of

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distal ureteral pathology including urothelial carcinoma or benign stricture disease from April 2009 to August 2014. All patients underwent appropriate diagnostic imaging and evaluation including history and physical examination, cystoscopy, routine serum chemistries and cross sectional imaging with CT or MRI. Patients were offered all reasonable options depending on their underlying pathology to include surveillance, endoscopic, open, laparoscopic and robotic management with their attendant risks and benefits. The entirety of all procedures was performed robotically by a single surgeon at a tertiary academic medical center.

3. Technique

3.1. Preoperative preparation

The patient is given one bottle of magnesium citrate the day prior to surgery and diet is limited to clears. A broad-spectrum antibiotic such as cefazolin is administered intravenously within 30 min of incision. Sequential compression stockings are placed on the lower extremities. After the induction of anesthesia, an orogastric tube is placed.

3.2. Patient positioning and port placement

Patient positioning is similar to that for robotic prostatectomy. The patient is positioned supine and the arms are tucked to the sides. The patient legs are adducted and slightly flexed. The patient is secured to the operating table using 3 inch cloth tape over the chest. An 18 Fr urethral catheter is placed at the beginning of the case. A Veress needles is used to create pneumoperitoneum. A 12-mm trocar is placed at or slightly above the level of the umbilicus. The patient is then placed in steep Trendelenburg. Two 8-mm trocars are placed lateral to the rectus muscle on either side near the anterior axillary line and just below the level of the umbilicus. An additional 8-mm trocar is placed two to three finger breadths above the iliac crest on the left to accommodate the fourth robotic arm. For the assistant, a 12-mm trocar is placed in the right lower quadrant.

3.3. Exposure of ureter

Maryland bipolar forceps and curved monopolar scissors are used for the left and robotic arms respectively. The fourth arm contains a Prograsp forceps. A 30-degree down lens was used throughout the dissection. The posterior peritoneum is incised at the level of the iliac vessels above the ureter of interest. Once identified, the ureter is dissected distally towards the posterior bladder to the level of the ureterovesical junction. Division of the ipsilateral vas deferens in a male patient or suspensory/broad, round and infundibulopelvic ligaments in a female patient may aid in identification and exposure of the distal ureter. Importantly, necessary division of the ipsilateral medial umbilical ligament allows for the bladder to be rotated medially, thus improving exposure and visualization of the ureterovesical

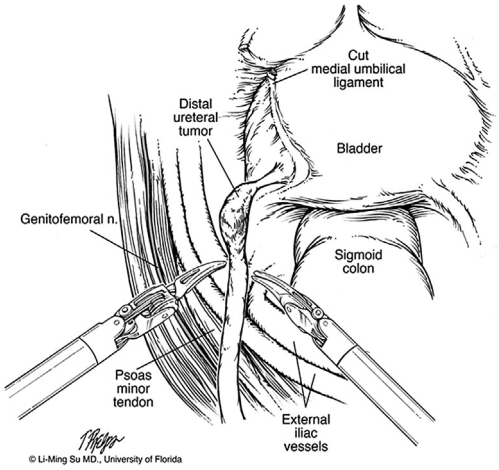

Figure 1 Mobilized ureter with diseased segment exposed following division of ipsilateral medial umbilical ligament.

junction (Fig. 1). Additionally, the superior and sometimes inferior vesical arteries require division to fully mobilize the ipsilateral bladder. When the surgery is being performed for urothelial cancer of the ureter, the ureter can be clipped early in the dissection thus containing the cancer and reducing the risk of tumor seeding the lower urinary tract (Fig. 2).

3.4. Excision of diseased segment

When performing a distal ureterectomy for ureteral cancer, intravesical mitomycin C (40 mg) is instilled 1 h prior to cystotomy and excision of the ureteral orifice. In addition, the bladder is thoroughly rinsed with 300—400 mL of sterile saline to ensure complete clearance of mitomycin C from the bladder. The diseased segment of the ureter and a formal bladder cuff is excised in an extravesical approach with visual confirmation of complete excision of the ipsilateral ureteral orifice. The disease segment is immediately entrapped within a specimen sack for later extraction. The cystotomy is then closed with a two-layered sutured repair using a 3-0 polyglactin suture (Fig. 3).

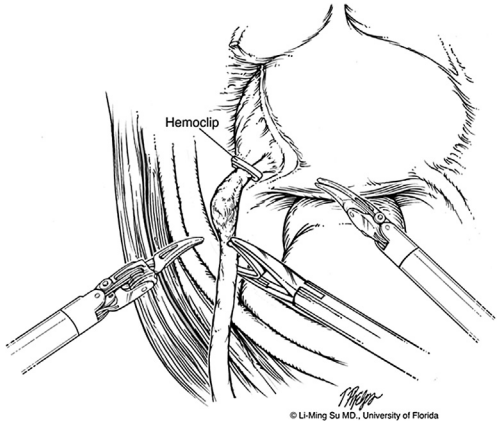

Figure 2 In cases of ureteral carcinoma, the ureter is clipped immediately distal to the tumor to help prevent distal dissemination of tumor cells.

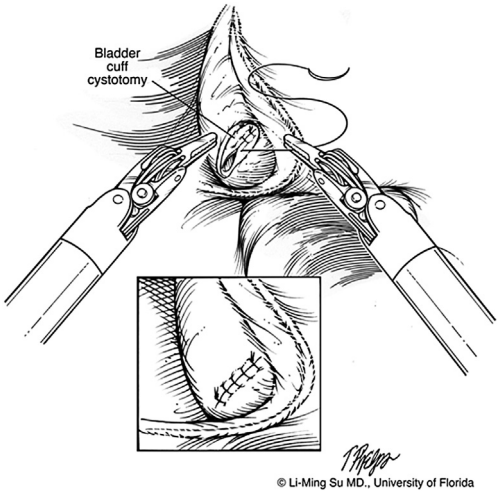

Figure 3 With the ureterovesical junction adequately exposed, a formal bladder cuff with visual confirmation of complete excision of the ipsilateral ureteral orifice is achieved through an extravesical approach and the bladder is closed in two layers.

3.5. Mobilization of the bladder

In preparation for psoas hitch reconstruction, the bladder is further dissected from the anterior abdominal wall by dividing the urachus and contralateral medial umbilical ligament (Fig. 4). In our experience dividing the contralateral pedicle has not been necessary. However, care must be taken to leave adequate blood supply if the ipsilateral pedicle is taken during mobilization of the bladder to remove the distal ureter and bladder cuff for cancer cases.

3.6. Psoas hitch

When performing a psoas hitch, the psoas minor tendon is identified immediately superior and lateral to the ipsilateral common iliac vessels. A 2-0 PDS suture is used to fix the ipsilateral dome of the bladder to the psoas muscle and tendon. Care must be taken to avoid injury to the nearby genitofemoral nerve (Fig. 5).

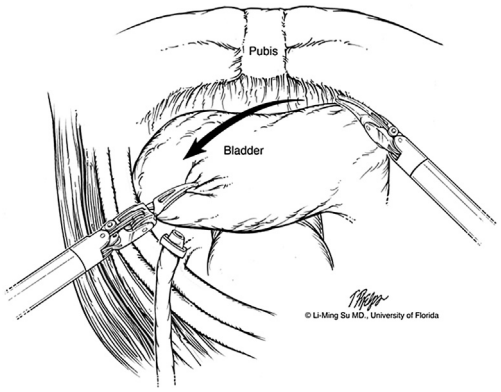

Figure 4 The urachus and contralateral medial umbilical ligament are divided to optimize mobilization of the bladder in efforts to achieve a tension-free ureteroneocystostomy.

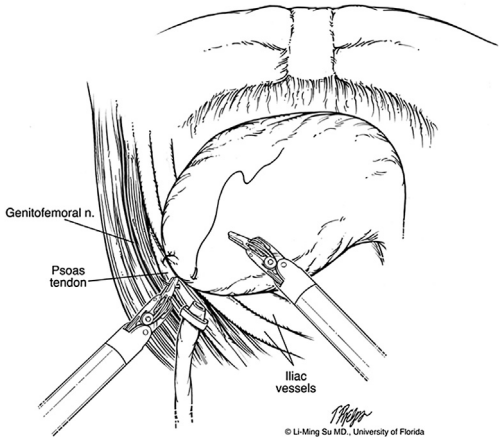

Figure 5 Ipsilateral dome of the bladder is sutured to the psoas minor tendon and muscle with 2-0 PDS suture taking great care to avoid injury to the nearby genitofemoral nerve.

3.7. Ureteroneocystostomy

An approximately 1.5 cm incision is made in the bladder dome along the anterolateral surface in a location where the remnant ureter can be implanted in a tension free manner. The ureter is spatulated posteriorly and an extravesical mucosa to mucosa anastomosis is performed using 4-0 polyglactin suture in an interrupted fashion (Fig. 6). Prior to closing the anterior portion of the anastomosis, a ureteral stent is placed in a retrograde fashion with the aid of a guide wire (Fig. 7). The anastomosis is tested by filling the bladder with 150—200 mL of normal saline. A closed suction drain is then placed (Fig. 8). The specimen is extracted and all port sites are closed.

3.8. Post-operative care

Most patients can be safely discharged by postoperative day 2. The pelvic drain can be removed prior to discharge as long as outputs are low. The urethral catheter is removed

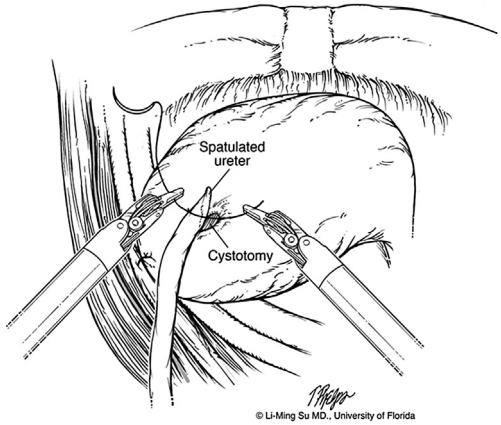

Figure 6 Ureteroneocystostomy is completed by spatulating the ureter posteriorly, creating a 1.5-cm cystotomy and re-approximating the mucosal surfaces using 4-0 polyglactin sutures.

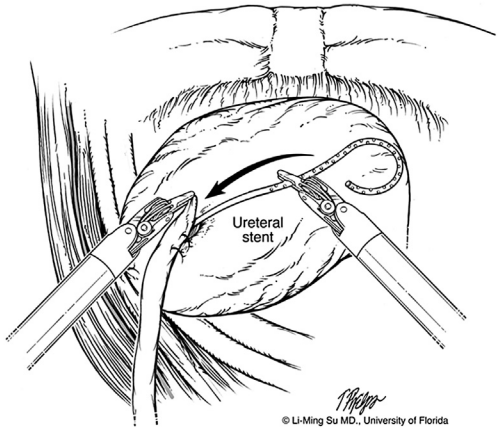

Figure 7 A double pigtail ureteral stent is placed in a retrograde fashion before completion of the anterior anastomosis.

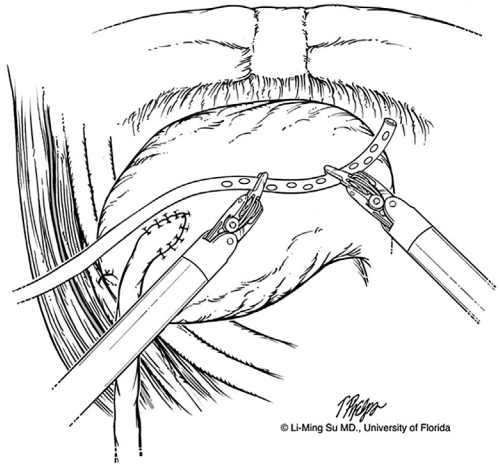

Figure 8 Final view of completed robotic psoas hitch and ureteroneocystostomy with placement of a pelvic drain.

7—10 days after surgery. A cystogram can be performed prior to removal of the urethral catheter. In this series no patient required a cystogram because all patients had a water closure intraoperatively and low drain output postoperatively. The ureteral stent is removed 4 weeks after surgery.

4. Results

Table 1 lists patient demographics and perioperative data for the robotic distal ureterectomy group. The median age was 69.5 years (46—91). The median operative time was 285 min (range: 210—330 min), estimated blood loss was 50 mL (range: 50—75 mL), median length of stay was 2.5 days (1—6), and there was one complication in this group involving readmission for failure to thrive and dehydration (Grade II). Four of the patients underwent surgery for ureteral strictures secondary to stone disease with pathology demonstrating fibrosis. The remaining four patients underwent surgery for upper tract urothelial carcinoma. Pathology was carcinoma *in situ* (CIS) in one patient, pT1 in one patient, pT2 in one patient and pT3 in one patient. Lymph node dissection was performed in all four patients and they were N0 collectively. All surgical margins were negative. The remaining four patients were done for stricture disease/fibrosis.

5. Discussion

With the recent expansion of robotic surgery in the field of urology, the robotic platform has being applied to treat many genitourinary disease processes in both the upper and lower urinary tract. For appropriately selected patients, robotic distal ureterectomy is a viable treatment option. The robotic platform has some distinct advantages over both open and laparoscopic approaches. The articulating wrist of the robot facilitates easier intracorporeal suturing for the psoas hitch and the anastomosis as compared to conventional laparoscopy. The 10× magnification allows for

Table 1 Patient demographics and operative details.

Patient no.	Age (year)/sex	Surgery	OR time (min)	EBL (mL)	LOS (day)	Complications	Pathology	Follow-up (month)
1	84/M	Left robotic distal ureterectomy	285	50	3	None	CIS	24
2	53/M	Left robotic distal ureterectomy	210	50	1	None	Fibrosis	N/A
3	77/F	Left robotic distal ureterectomy	285	75	3	None	pT3N0	30
4	46/F	Left robotic distal ureterectomy	210	50	2	None	Fibrosis	N/A
5	62/F	Left robotic distal ureterectomy	210	50	2	None	Fibrosis	N/A
6	84/M	Right robotic distal ureterectomy	300	75	3	Readmission/ dehydration	pT1N0	18
7	91/F	Right robotic distal ureterectomy	300	75	6	None	pT2N0	12
8	48/F	Left robotic distal ureterectomy	330	50	2	None	Fibrosis	N/A

OR, operative time; EBL, estimated blood loss; LOS, length of hospital stay; CIS, carcinoma *in situ*.

better visualization and more precise dissection. As compared to open surgery, the same standards of surgical repair can be achieved in a minimally invasive fashion with less incisional morbidity and postoperative convalescence.

6. Conclusion

The technique of robotic distal ureterectomy with psoas hitch and ureteroneocystostomy is an excellent alternative to other surgical techniques for treating various distal ureteral pathologies. Advantages include ease and precision of excision of the ureter and bladder cuff as well as efficiency in intracorporeal suturing.

Conflicts of interest

The authors declare no conflict of interest.

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