Totally intracorporeal robot-assisted laparoscopic reverse seven ileal ureteric reconstruction

Nikita Abhyankar, MBChB,[1] Christopher Vendryes, MD,[1] Leslie A. Deane, MD[2]

[1]University of Illinois at Chicago, Chicago, Illinois, USA

[2]Department of Urology, Rush University Medical Center, Chicago, Illinois, USA

ABHYANKAR N, VENDRYES C, DEANE LA. Totally intracorporeal robot-assisted laparoscopic reverse seven ileal ureteric reconstruction. *Can J Urol* 2015;22(2):7748-7751.

We describe the first reported case of completely intracorporeal robot-assisted laparoscopic reverse seven ileal ureteric reconstruction. The patient was a woman with bilateral, long segment ureteric strictures secondary to pelvic surgery and radiation. This report demonstrates that robotic reconstruction is a viable option even in a complex patient with a hostile abdomen.

Key Words: robotic, ureteric reconstruction

Introduction

The introduction of the da Vinci robot has revolutionized the surgical approach to many conditions in many specialties, and its applications continue to be expanded. Upper urinary tract robotic reconstruction has been previously described[1] however, to our knowledge, this is the first description of a completely intracorporeal, robotic reverse seven ileal ureter reconstruction.

Accepted for publication December 2014

Address correspondence to Dr. Nikita Abhyankar, University of Illinois at Chicago, 20 S. Wood Street Clinical Sciences North Suite 515, Chicago, IL 60612 USA

Case report

Patient background

A 57-year-old female with a history of chronic kidney disease stage 3, hypertension, deep venous thrombosis, and cervical cancer presented with bilateral ureteric strictures following pelvic surgery and radiation, not amenable to endoscopic treatment. The patient underwent total abdominal hysterectomy with bilateral salpingo-oophorectomy and extended lymphadenectomy followed by external beam and intracavitary radiation for cervical cancer. As a result of the surgery and radiation, she developed bilateral, long segment proximal to distal, ureteral strictures, Figure 1.

Bilateral indwelling ureteral stents were placed. However, these failed, necessitating bilateral

Figure 1. Pre-operative retrograde pyelogram demonstrating bilateral ureteric strictures.

percutaneous nephrostomy tubes to be inserted and exchanged periodically over a 5 year period. Throughout this time, the patient's course was complicated by recurrent pyelonephritis; therefore, she elected to undergo reconstructive ureteral surgery to render her tube free.

Procedure

The procedure was performed using the da Vinci Si system (Intuitive Surgical, Sunnyvale, CA, USA). The patient was placed in steep Trendelenberg with her legs on spreader bars. Two 12 mm, laparoscopic assistant ports were placed in the right upper quadrant and left upper quadrant. Robot ports were placed midline, supraumbilical (one 12 mm camera port), 10 cm lateral and inferior to the umbilicus (two 8 mm ports bilaterally), and superior to the right iliac crest (one 8 mm port). Instruments used included the monopolar scissors (robotic right arm), bipolar forceps (robotic left arm), the ProGrasp (robotic 4th arm), and supraumbilical camera.

Initially, the omentum was partially resected due to adhesions in order to expose the bifurcation of the iliac vessels bilaterally. Both ureters were identified after careful dissection of the iliac vessels. Significant adhesions and fibrotic reaction were encountered. The left ureter was followed proximally, and 2 cm of ureter was dissected circumferentially. The right ureter was identified, but it could not be dissected similarly, due to significant periureteral fibrosis. The ureter was confirmed using ultrasound to ensure the lack of a vascular waveform, and a needle hole was made in the ureter without venous bleeding present. Extensive adhesions prevented adequate ureteral mobilization, and given the tenuous ureteral vasculature, a decision was made to proceed with a reverse seven-ileal ureter, robotically. The bladder was filled using an intraoperatively placed foley catheter. Bladder capacity was found to be 240 mL, hence bladder augmentation was not necessary.

After the site for ureteral anastomosis on each side was selected, the distal ileum was transected 15 cm proximal to the ileocecal valve. The proximal portion of this transected ileum was taken down to the bladder to ensure it would reach and held there with the fourth arm of the robotic system. The elbow of the reverse seven ureter was then taken up to the selected site for anastomosis to the right ureter and held there, once again with the fourth arm of the robotic system. The more proximal segment of the ileal seven was then draped across the abdomen to the left ureter, all in a tension free configuration. Using this tension free technique, it became unnecessary to pre-select the ileal length, thus obviating accurate measurement. The proximal ileum was then transected and enteral continuity was reestablished with an endoscopic stapler. The ileal segment was anastomosed to the proximal ureter on each side. Neither ureter was extensively mobilized due to dense adherence and scarring in the retroperitoneum and in an effort to maintain an already tenuous vascular supply. The left ureter was spatulated at its transected site. Patency of the left ureter was confirmed with gentle, methylene-blue irrigation of the nephrostomy, and it was found to have an appropriate caliber for anastomosis. An enterotomy was made in the proximal ileal segment and two 4-0 monofilament absorbable sutures were run in opposite directions starting at the apex of the spatulated ureter to anastomose the ureter to the enterotomy in an end to side fashion. The middle segment of bowel was brought across to the right upper quadrant, and the right ureter was anastomosed to the bowel in a side-to side fashion, as dense adhesions prevented a circumferential dissection of the right ureter. Prior to closure a 6 Fr, 20 cm, double J stent was placed into the right renal pelvis and across the anastomosis. No stent was placed on the left side as there was a widely patent, spatulated, mucosa to mucosa and watertight anastomosis created. The senior author is no longer routinely stenting uretero-enteric anastomoses performed robotically.

The distal end of the bowel segment was anastomosed to the bladder to ensure antegrade peristalsis. First, the stapled end of the bowel was excised and removed. An incision was made in the bladder using monopolar cautery. The bowel was anastomosed in an end-to side fashion using 3-0, unidirectional, barbed suture. Two stitches were placed posteriorly in the midline position and run anteriorly. The resected omentum was removed in an endo-catch bag. A closed suction drain was placed in each paracolic gutter. The midline fascial incision was closed with a wound closure device and subsequently skin was then closed. Both nephrostomy tubes were left in place. Estimated blood loss was 50 mL. The duration of surgery was 12 hours.

Postoperative course

The patient was kept intubated overnight due to prolonged operative time and positioning. Bilateral nephrostomies were initially kept to gravity drainage but were later capped. She recovered well in the intensive care unit for 2 days. Her pain was controlled with a preoperatively placed epidural. The epidural was placed with concern for conversion to open surgery. The drain creatinine revealed no urine leak. She was discharged on postoperative day 7, having tolerated a regular diet. Twenty-eight days postoperatively, a cystogram was performed that showed no urinary extravasation, and the foley was removed. The left nephrostomy tube was removed 4 weeks postoperatively, and the right stent and nephrostomy tube were removed 6 weeks postoperatively. An antegrade nephrostogram showed patency, Figure 2 and follow up ultrasound demonstrated resolution of preoperative hydronephrosis, Figure 3. The patient has maintained stable renal function and continues to be tube and infection free 22 months post reconstruction. Her creatinine was 1.5 mg/dL before surgery and 1.09 after surgery.

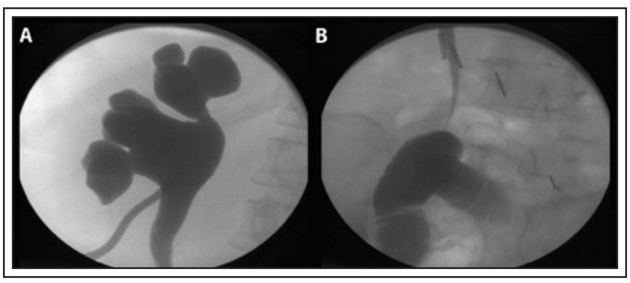

Figure 2. Postoperative nephrostogram demonstranting no leak and adequate anastomosis between ileum and ureter.

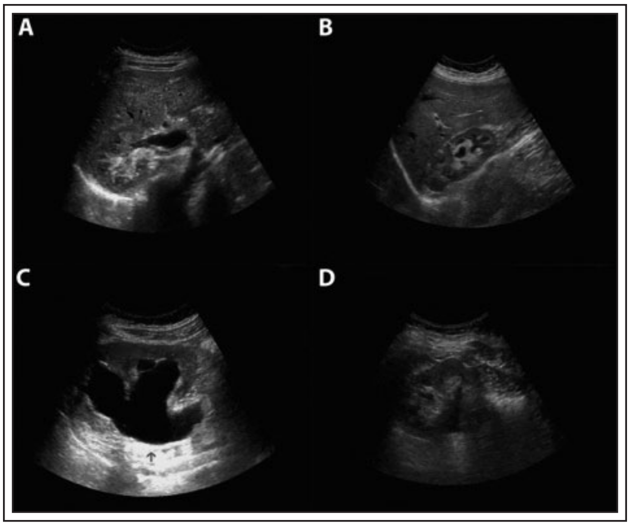

Figure 3. Ultrasound images of kidneys demonstrating improvement in hydronephrosis after surgery. Images **A** and **C** are right and left kidneys respectively preoperatively. Image **B** and **D** are postoperative right and left kidneys respectively.

Discussion

Ureteric strictures are a known long term complication of pelvic radiation, endoscopic ureteric surgery and pelvic surgery after radiation. The incidence of ureteric strictures after pelvic radiation for cervical cancer is approximately 2.5%. Incidence increases with time but plateaus after 25 years.[2] Thus long term surveillance of patients who have had radiation is necessary. Pelvic surgery, along with radiation has been shown in some studies to increase the incidence of ureteric stricture disease due to devascularization.[2] The proximal, mid and distal ureter receives its blood supply from the ureteric branch of the renal artery, branches of the iliac and gonadal artery, and branches of superior and inferior vesicle arteries, respectively.[3] Preservation of these sources is integral to minimizing the risk of stricture from surgical dissection, but sacrificing them in many instances may be unavoidable. It is therefore critical to avoid over skeletonization of the ureters, to maintain the integrity of the mural vascular connection, and to protect the small vessels traveling within the periureteral adipose tissue. This is especially critical when adjuvant radiation therapy is planned or anticipated.

Many methods have been utilized in the management of ureteric strictures, both endoscopic and open. Endoscopic methods have the benefit of reduced morbidity, cost, operative time and hospital stay, although they are not thought to achieve the same success rates as open approaches.[4] Endoscopic options include: balloon dilatation, laser or cold knife endoureterotomy. Endoscopic procedures are less efficacious for mid-ureteric strictures, radiation associated strictures, if the kidney contributes less than 25% of function, and strictures of long length.[4] For long ureteric strictures, ileal substitution can be used to replace the defect, as in this case. For distal strictures, ureteroneocystomy can be performed, with or without a psoas hitch, and a Boari flap can be made, if segments are excised and the ureter is not long enough to reach the bladder.[5,6] The initial case report of laparoscopic ileal interposition described by Gill et al in 2000 demonstrated the feasibility of performing this reconstruction using a minimally invasive technique.[7] A small study comparing laparoscopic ileal ureter to open showed a shorter time to convalescence with a minimally invasive approach but equal morphine use.[8] Since then, there have been a number of reports of robotic-assisted ileal interposition[9] and completely intracorporeal robotic ileal ureter,[10] but we could find no description of a reverse seven ileal ureter performed totally intracorporeal using robotic assistance. The case presented is unusual due to the strictures being bilateral, long, proximal, and occurring as a result of prior extensive surgery and radiation therapy. We believe that this is a challenging clinical scenario in which a patient benefitted significantly by a minimally invasive approach to remedy a longstanding, debilitating problem. □

References

1. Mufarrij P, Shah O, Berger A. Robotic reconstruction of the upper urinary tract. *J Urol* 2007;178(5):2002-2005.
2. Wood D, Greenwell T. Surgical anatomy of the kidney and ureters. *Surgery* 2013;31(7):326-328.
3. Mclntyre, JF, Eifel, PJ; Levenback, C; Oswald, MJ. Ureteral stricture as a late complication of radiotherapy for stage IB carcinoma of the uterine cervix. *Cancer* 1995;75(3):836-843.
4. Hafez, KS, Wolf JS. Update on minimally invasive management of ureteral strictures. *J Endourol* 2003;17(7):453-464.
5. Wenske S, Olsson CA, Benson MC. Outcomes of distal ureteral reconstruction through reimplantation with psoas hitch, boari flap, or ureteroneocystostomy for benign or malignant ureteral obstruction or injury. *Urology* 2013;82(1):231-236.
6. Yang C, Jones L, Rivera ME et al. Robotic-assisted ureteral reimplantation with Boari flap and psoas hitch: a single-institution experience. *J Laparoendosc Adv Surg Tech A* 2011;21(9): 829-833.
7. Gill IS, Savage SJ, Sung GT et al. Laparoscopic ileal ureter. *J Urol* 2000;163(4):1199-1202.
8. Stein RJ, Gill IS, Desai MM et al. Laparoscopic assisted ileal ureter: technique, outcomes and comparison to the open procedure. *J Urol* 2009;182(3):1032–1039.
9. Wagner JR, Schimpf MO, Cohen JL. Robot-assisted laparoscopic ileal ureter. *JSLS* 2008;12(3):306-309.
10. Brandao LF, Autorino R, Zargar H et al. Robotic ileal ureter: a completely intracorporeal technique. *Urology* 2014;83(4):951-954.