# Robot-assisted Transplanted Ureteral Stricture Management

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**OBJECTIVE** To assess the feasibility of robot-assisted transplanted ureteral reimplantation as a minimally invasive alternative to open surgery.

**MATERIAL AND METHODS** Between August 2015 and March 2016, 5 patients presented with transplanted ureteral strictures after failure of a previous endoscopic management. All patients underwent robot-assisted ureteral reimplantation. Patients' demographics, perioperative outcomes, and complications are reported.

**RESULTS** All patients presented with deterioration of kidney function with or without recurrent urinary tract infection. Two patients had short strictures (<1 cm) and 2 had long strictures (>1 cm), whereas 1 patient had a nitinol ureteral stent in situ. The location of the stricture varied among these patients with 3 distal and 1 proximal. Intraoperatively, 3 patients had a modified Lich-Gregoir reimplantation and 2 patients had a pyelovesicostomy. The mean operative time was 164 (±52) minutes. There were no intraoperative complications, conversion to open surgery, or significant blood loss necessitating blood transfusion. There were no urine leaks in the immediate or late postoperative period. One patient developed a Clavien grade IVa complication (sepsis). The median length of stay, the duration of catheterization, and the duration of stenting were 1 day (range 1-5 days), 7 days (range 6-14 days), and 39 days (range 25-51 days), respectively. After a median follow-up of 79 days (range 40-139 days), no strictures or delayed leakages were identified.

**CONCLUSION** Robot-assisted transplanted ureteral reimplantation is technically feasible. With a larger number of cases and a longer follow-up, robot-assisted transplanted ureteral reimplantation may provide a new and effective, minimally invasive alternative for the treatment of this complex surgical problem. UROLOGY 105: 197–201, 2017. © 2017 Elsevier Inc.


The reported prevalence of urologic complications following kidney transplantation (KT) is widely variable with an estimated incidence of 5%-30%.[1-3] Although some of these complications are harmless or trivial, such as vesicoureteral reflux or hematuria, a transplanted ureteral stricture (TUS) can cause a silent and detrimental effect on the transplanted kidney function if left without treatment.[4] Depending on the type of implantation performed during the initial KT, the estimated incidence of TUS is 1.9%-3.7%.[5]

Despite the lack of clear guidelines regarding the management of TUS, the general consensus is to consider endourologic management first before proceeding to a complex open ureteral reconstruction. However, because of the high recurrence rates after endourologic management, TUS is still the most common urologic complication that needs eventual surgical revision in two-thirds of the patients.[6] The overall success rate after an open revision is 92%. Nevertheless, this is associated with a complication rate of 16%.[6] Open revision and endourologic management represents 2 extremes in their effectiveness and morbidity, and hence introducing a new treatment option that combines the effectiveness of open surgical revision and the low-risk profile of endourologic management will add a valuable option to the spectrum of management.

The last 2 decades witnessed the inception and the exponential implementation of robotic surgery. Today, the benefits of robotic surgical platforms are well established and have resulted in the complete extinction of some of the most commonly performed operations in the past. Recently, there have been many efforts to explore the role of robotic surgery in KT or donation.[7-9] However, the outcomes of recurrent TUS robotic management were not previously reported. Herein we describe the feasibility of robot-assisted transplanted ureteral reimplantation (RATUR) and report our perioperative outcomes, complications, and early recurrence rates in a small series of patients with emphasis on the surgical technique.

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## MATERIALS AND METHODS

From August 2015 to March 2016, 5 KT patients with TUS were treated with RATUR at our institution. All patients had the diagnosis of a TUS confirmed with an antegrade or a retrograde contrast-enhanced study. The patients were offered a RATUR after an attempt or failure of other minimally invasive options and after ruling out other causes of kidney function deterioration. Institutional review board approval was obtained and patients' detailed preoperative, intraoperative, and postoperative data were retrospectively collected and reported. Postoperative complications were reported based on the Clavien-Dindo classification.[10]

### Surgical Technique

All patients had an extensive preoperative anesthesia risk evaluation. An internal stent was changed to a nephrostomy tube to delineate the length of the stricture (in 3 of 5 patients). The patients were prophylactically treated with broad-spectrum antibiotics before surgery and antifungals were added. The patients were placed in dorsal lithotomy and steep Trendelenburg position with careful padding of all pressure points. A pneumoperitoneum was established using the Veress needle technique. For a transplanted kidney in the right iliac fossa, port placement is as follows: a 12-mm supraumbilical port was used for the robotic camera. Three 8-mm robotic ports were inserted along a horizontal line approximately at the level of the umbilicus. The first robotic port was inserted on the right side 9-10 cm lateral to the camera port. The second port was inserted on the left side in a mirrored location, and the third port was inserted on the right and as lateral as possible. Size 12- and 5-mm assistant ports were inserted in the left lower and upper abdominal quadrants, respectively (Fig. 1). All ports (other than the camera port) should be inserted under direct vision with the laparoscopic camera to avoid injury to the graft or intra-abdominal structures. It should be noted that in case of left pelvic KT, the ports should be reversed.

The important anatomic landmarks include the transplanted kidney, the ipsilateral medial umbilical ligaments, and the vas deferens in men or the round ligament in women. Once identified, the paravesical space should be developed lateral and parallel to the medial umbilical ligament and should be started as anterior as possible to avoid injury to the transplanted ureter. Once this space was developed, the medial umbilical ligament was retracted medially with the third robotic arm and placed the transplanted ureter under tension. As we started our careful dissection trying to identify the ureter, the retraction was adjusted periodically during the procedure to maintain tension. The location of the ureter was variable, and the ureter was often surrounded by a dense desmoplastic reaction from previous surgery or endoscopic interventions. Most often, the ureter is identified crossing lateral to the medial umbilical ligament and anterior to the vas deferens or round ligament. It is important to positively identify the transplanted ureter by exposing a maximum length as it may be confused with other tubular structures such as the native ureter, the obliterated umbilical artery, or the vas deferens in male patients. If a nephrostomy tube is still in place, this can be intermittently flushed with sterile saline to help distend and identify the ureter proximal to the stricture. Distention of the urinary bladder can be used as well to identify the distal end of the ureter. Proximal dissection proceeded with extreme care in all cases to avoid injury to the transplanted hilar vessels or the renal pelvis. Once the area of stricture was identified, it was dismembered and the appropriate reconstruction technique was applied depending on the extent and location of the stricture. The previous implantation site was securely closed with a barbed suture, and all anastomoses were performed in a water-tight, tension-free, stented, spatulated manner with an absorbable 4-0 polydioxanone suture (PDS®, ETHICON, Somerville, NJ) as shown in Figure 2.

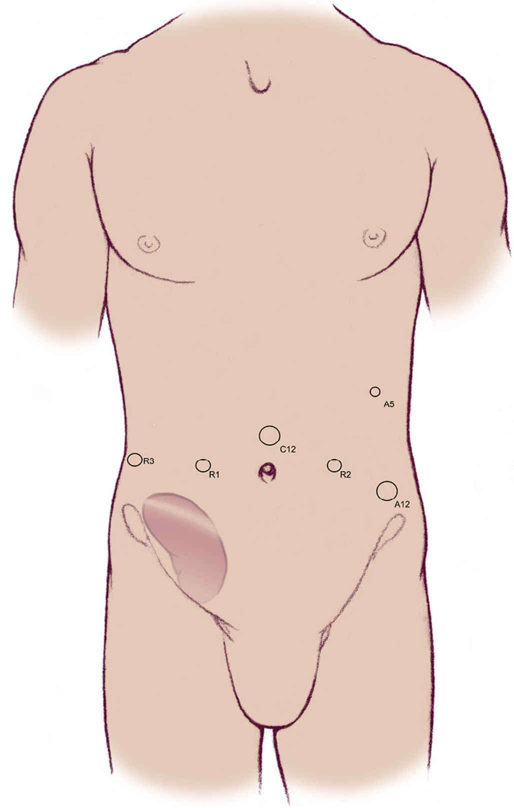


**Figure 1.** Port locations. R1 = 8-mm robotic port for arm number 1, R2 = 8-mm robotic port for arm number 2, R3 = 8-mm robotic port for arm number 3, C12 = 12-mm camera port, A5 = 5-mm assistant port, A12 = 12-mm assistant port. (Color version available online.)

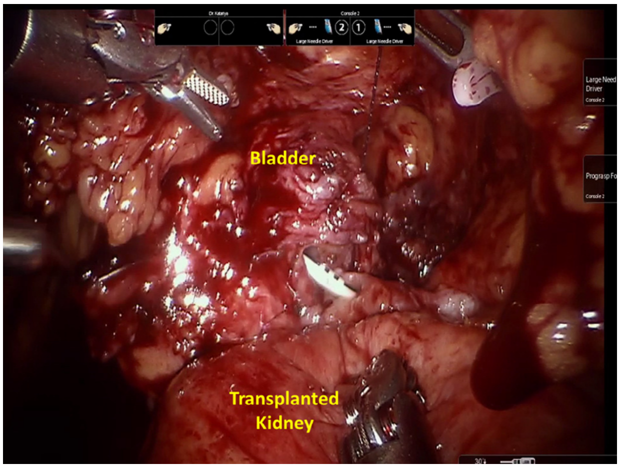


**Figure 2.** Intraoperative image showing the anastomosis before its completion with the stent inserted. (Color version available online.)

### Postoperative Care and Follow-up

Postoperatively, all patients had a creatinine check through the drain before discharge to rule out early leakage. Nephrostomy tubes

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