CASE REPORT

Intra-corporeal robotic renal auto-transplantation

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Abstract

Renal auto-transplantation (RATx) is a suitable option for managing patients with long upper ureteric or pan-ureteric strictures. The current gold standard approach to RATx is a laparoscopic nephrectomy followed by open auto-transplantation. The advent of robotic-assisted laparoscopic surgery has allowed us to apply minimally-invasive techniques to ever-more complex surgical procedures. We present the case of a 38-year-old patient referred to our institution for management of a failed laparoscopic pyeloplasty resulting in a long upper ureteric stricture with complete ureteric obstruction. After complete evaluation, RATx was determined as a suitable management option. Completely intracorporeal right RATx was performed robotically with intraperitoneal cold perfusion. Total operative time was 6.5 hours, with total ischemia time of only 79 minutes (4 minutes warm ischemia, 48 minutes cold ischemia, 27 minutes re-warming time), comparable to the gold standard approach for RATx. To our knowledge, this is the first reported case of a completely intracorporeal robotic RATx in Canada.

Renal auto-transplantation (RATx) is a management option for patients with severe upper or pan-ureteric stricture disease.[1] With the advent of laparoscopic donor nephrectomy, the overall morbidity of RATx has been greatly improved,[2] although the procedure still requires a large lower abdominal incision to complete the auto-transplantation and necessitates re-positioning the patient.

Recently, Menon and colleagues[3] described their early experience with robotic-assisted renal transplantation and noted that it was a safe and effective procedure with adequate intracorporeal cooling of the graft. Unlike renal allograft transplantation, where a large incision is required to introduce the graft regardless, the robotic approach could be most advantageous for RATx, where the graft is already intracorporeal. In 2014, Gordon and colleagues published their initial experience with the first ever completely intracorporeal robotic RATx.[4] They demonstrated the feasibility and safety of this novel procedure; however, they also reported a slightly prolonged total ischemic time of 126.6 minutes with their technique. In comparison, the established gold standard technique for RATx, laparoscopic nephrectomy with open auto-transplantation, is often associated with a total ischemic time of about 80 minutes[5-7] (2–5 minutes of warm-ischemia, 40–60 minutes of cold-ischemia, and 20–40 minutes of rewarming time).

With a slight modification in technique, we report a completely intra-corporeal robotic RATx with improved ischemic times, further demonstrating the feasibility of this procedure and building on the pioneering work by Gordon and colleagues.[4]

Case report

A 38-year-old woman was referred to our institution for definitive management following a failed right laparoscopic pyeloplasty for ureteropelvic junction obstruction. She presented with a nephrostomy tube in situ, and the initial fluoroscopic evaluation demonstrated a long 3.5-cm segment of upper ureter that was completely obliterated. Renal scintigraphy demonstrated 30% differential function in the right kidney and axial computed tomography images demonstrated renal vascular anatomy suitable for RATx.

The RATx was performed entirely robotically, in 3 separate stages and completely intracorporeally. The patient was prepared and draped in a low-lithotomy position with her right side bolstered up using a standard 8-cm gel bolster. This was done to facilitate patient placement in the low-lithotomy, steep Trendelenberg position and the left lateral decubitus position by only tilting the operative table, without the need for repositioning or re-draping between the 3 stages of the procedure. Both arms were tucked and secured at the patient's side using foam padding. The left side of the patient was further secured using a "toboggan-style" arm-board to prevent sliding during left lateral decubitus positioning.

For the first stage of the procedure, the patient was placed in the low-lithotomy, steep Trendelenburg position. After dropping the bladder flap off of the anterior abdominal wall, the right-sided round ligament was ligated and transected to expose the right external iliac vessels. After dissecting both the external iliac artery and vein, laparoscopic vascular bulldog clamps (Scanlon International, MN) were used to test adequate vascular control. The bladder was then filled with normal-saline, mobilized and a suitable site for pyelovesicostomy was prepared. After undocking the robotic patient cart, the patient was then taken out of the Trendelenburg position and rotated into the left lateral decubitus position.

For the second stage of the procedure, with the robot docked over the right flank, the kidney was completely mobilized, defatted, and prepared for auto-transplantation. The collecting system was identified, ligated and cut at the level of the ureteric obstruction. Prior to ligating the renal vessels, irrigation tubing was introduced into the surgical field through a 12-mm assistant port to allow for intracorporeal cold perfusion. Immediately upon completing the donor nephrectomy, the renal artery was intubated by the perfusion cannula and secured in place using a vicryl Endoloop device (Ethicon US, LLC). The kidney was then perfused with 1 litre of HTK solution that was cooled to 4°C. The kidney was then repositioned into the right iliac fossa and placed anterior to the bladder flap and next to the dissected external iliac vessels. The kidney was perfused continuously with 4°C normal-saline throughout repositioning. The patient cart was undocked, but the robotic camera was left in situ and controlled manually by the bedside assistant to monitor the kidney during repositioning and to ensure continuous cold perfusion was adequate. The patient was carefully repositioned out of left lateral decubitus position and into the steep Trendelenburg position. A laparoscopic clench was used to ensure the kidney remained safely in the right iliac fossa.

For the final stage, the venous anastomosis was first performed using a 5-0 Prolene suture. Cold perfusion was stopped and after the venous anastomosis was tested, the arterial anastomosis was performed in a similar fashion. Once the vascular anastomoses were completed and hemostasis was satisfactory, the pyelovesicostomy was performed over a 12-cm 6Fr ureteral stent placed intracorporeally through an assistant port.

Total operative time was 390 minutes, the estimated blood loss was 400 cc and the total ischemia time was 79 minutes (4 minutes warm ischemia, 48mins cold ischemia, 27mins rewarming time) (Video at http://dx.doi.org/10.5489/cuaj.3015). Doppler ultrasonography on postoperative day (POD) 1 was normal. The patient developed a low-grade fever postoperatively due to atelectasis and also developed candidal bacteriuria on POD 3, but was discharged on POD 5.

Follow-up diuretic renal scintigraphy at 3 months postoperatively demonstrated stable differential function (36%), with no evidence of obstruction.

Conclusion

Completely intra-corporeal robotic renal auto-transplantation is a novel but safe and feasible option for the management of long upper ureteric strictures. Proper case selection is critical, and while further modifications in technique are being explored, ischemic times are comparable to the gold standard.

Competing interests: The authors declare no competing financial or personal interests.

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