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Total intracorporeal robotic renal auto-transplantation: A new minimally invasive approach to preserve the kidney after major ureteral injuries

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ABSTRACT

BACKGROUND: Renal auto-transplantation is a suitable option for managing patients with major ureteric injury. Conventional Renal auto-transplantation is however, underutilized because of its invasiveness. Completely intra-corporeal robotic renal auto-transplantation is a suitable option to decrease the morbidity. In this case, we report the first use of total intra-corporeal robotic renal auto-transplantation outside of North America.

CASE REPORT: A 30-year-old woman presented with an extensive upper left ureter defect, following a high kinetic energy trauma. She underwent 2 median laparotomies, with extensive resection of small intestine, and 1 transverse laparotomy to repair a massive rupture of abdominal muscles. The procedure was performed via a transperitoneal approach, with the assistance of the da Vinci Si robot (Intuitive Surgical Inc. Sunnyvale, CA, USA). The renal auto-transplantation was conducted entirely robotically, in 2 separate stages, using a 4 robotic arm approach. Total operative time was 300 min: 150 min to harvest the kidney including adhesiolysis, 20 min to reposition the patient, and 130 min for the robot assisted kidney transplantation (RAKT). The total ischemia time was 96 min (3 min of warm ischemia, no cold ischemia, 93 min of rewarming time). The estimated blood loss was 150 mL.

CONCLUSION: To our knowledge, this is the first case successfully performed as a total robotic approach outside of North America.

1. Introduction

Renal auto-transplantation (RATx) is a suitable option for managing patients with major ureteric injury. The first case was performed by JD Hardy in 1963 to repair a ureteric injury [1]. Conventional RATx is, however, underutilized because of its invasiveness. The laparoscopic approach has now become commonplace in many urological diseases' management, decreasing the morbidity of RATx [2]. The current gold standard approach is a laparoscopic nephrectomy followed by open auto-transplantation [3]. Robot-assisted RATx (R-RATx) is a recent innovative application of the robotic surgery platform for severe ureteric strictures' management. In this case, we report the first use of total intra-corporeal robotic RATx outside of North America. This work has been reported in line with the SCARE criteria [4].

2. Presentation of case

A 30 year-old women presented with an extensive trauma from a high kinetic energy car crash. On admission, clinical examination revealed an abdominal trauma with haemorrhagic shock. The initial lesion CT scan report liver laceration, splenic laceration, dissection of the abdominal aorta, rupture of the superior mesenteric artery with haemorrhagic disinsertion of the mesentery, massive rupture of abdominal muscles. She had undergone 2 median laparotomies with an extensive resection of small intestine and right colectomy and 1 transversal laparotomy to fix a massive rupture of abdominal muscles due to the safety belt. After few days, a flow through the abdominal wall made suspect an urinoma. A new abdominal CT scan was performed and revealed a lesion of the left ureter with retro-peritoneal urinoma. A left retrograde

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Fig. 1. Retrograde and antegrade opacification showing an extensive upper left ureter defect (nephrostomy and per-cutaneous drain in place).

uretero-pyelography and pyelography were performed and found an extensive defect of the left ureter (Fig. 1). Nephrostomy and percutanous drainage were done in emergency. The patient had a nephrostomy for two months. The patient was counselled on management options, including nephrectomy or RATx. Reconstruction using ileal interposition was not possible in this case because the small intestine was too short after the first intervention. The preoperative serum creatinine was 60 μmol/L. Institutional review board approval was gained, along with the patient's consent to undergo the procedure.

3. Surgical technique

The patient was placed in right lateral decubitus position for a robotic donor nephrectomy. The procedure was performed via a transperitoneal approach, with the assistance of the da Vinci Si HD robot (Intuitive Surgical Inc. Sunnyvale, CA, USA). The left kidney harvesting was conducted entirely robotically, using a 4 robotic arm approach. Five ports were used: a 12 mm camera port at the junction between the umbilicus and the left costal edge, an 8 mm port in the left upper quadrant, an 8 mm in the left lower quadrant, an 8 mm port in the left axillary line and a 12 mm in periumbilical area for the assistant.

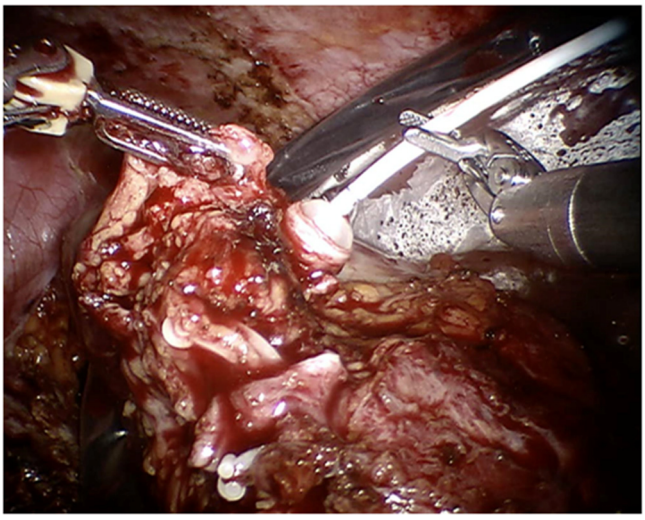

Fig. 2. Renal artery perfusion with a continuous ice-cold lactated ringer solution. (Edwards lifesciences®, Fogarty®, REF12TLW805F35).

3.1. First step: left kidney harvest

As expected, extensive adhesiolysis was necessary to clear the surgical field. The nephrectomy was difficult because of the severe desmoplastic changes due to urinoma. Before dividing the renal vessels, a Fogarty (Edwards Lifesciences®, Fogarty®, REF: 12TLW805F35) was introduced through the 8 mm port in preparation for intracorporeal hypothermic renal perfusion, and renal pelvis dissection and spatulation was performed. After this preparation, the renal artery and vein was then transected above the clips. The kidney was perfused with a continuous ice-cold lactated Ringer solution, under gravity, until clear effluent was observed from the renal vein (Fig. 2). The warm ischemia time was 3 min.

3.2. Second step: left kidney robotic transplantation in the left iliac fossa

The patient was repositioned in dorsal decubitus with steep Trendelenburg, and the da Vinci Si HD robot was docked between the legs. The same ports were utilized for the Robot-assisted Kidney Transplantation (RAKT). A RAKT was performed using the standard technique previously described by Breda et al. from the European Robotic Urology Section (ERUS) group [5,6]. We chose to implant the kidney on the left side to minimize adhesiolysis that would be needed on the right side and to re-use the same ports. The kidney was continuously cooled with a saline solution prior to transplantation. Vascular anastomosis time was 31 min. The native distal ureter was dissected to allow a tension-free anastomosis with the renal pelvis. A double-J stent, 6 fr-24 cm was positioned intracorporally to protect the anastomosis (Fig. 5).

4. Results

Total operative time was 300 min: 150 min to harvest the kidney including adhesiolysis, 20 min to reposition the patient, and 130 min for the RAKT. The total ischemia time was 96 min (3 min of warm ischemia, no cold ischemia, 93 min of rewarming time). The estimated blood loss was 150 mL. The follow-up was normal and Doppler ultrasonography on postoperative day (POD) 1 was normal as well. Bladder catheter was removed at POD 2 and the patient was discharged on POD 3. The creatinine at POD 3 was 62 μmol/L. A DMSA renal scintigraphy 3 weeks after the RAKT, demonstrated