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Robotic Kidney Transplantation in an Athlete With End-stage Renal Disease. A Case Report

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Open kidney transplantation is the standard surgical treatment for end-stage renal disease. Robot-assisted kidney transplantation (RAKT) is becoming an increasingly accepted approach in selected patients who receive organs from deceased or living donors[1-4] and in those undergoing a dual transplant through the intraperitoneal or extraperitoneal approach.[5,6] The first complete RAKT, involving vessel and ureteral anastomosis in an obese patient, was performed by Giulianotti et al[7] in 2010 in the US. At our institution, the first RAKT, performed in March 2013, was followed a few months later by a dual transplant.[5] Since then, we have performed 40 RAKT procedures. A professional cyclist who underwent RAKT at our institution in 2016 returned to his sport and went on to break his earlier records.

CASE DESCRIPTION

In August 2016, a 43-year-old man with end-stage renal disease, who had been on hemodialysis for 3 years, received a kidney from a deceased donor and underwent RAKT into the right iliac fossa. The procedure was performed via the intraperitoneal route using 4 laparoscopic ports—three 8-mm ports and a 12-mm port for the camera—and a 12-mm accessory port for the assistant surgeon using the Da Vinci surgical system (Intuitive Surgical, Sunnyvale, CA). To minimize the damage to the abdominal muscles, the organ was introduced into the peritoneal cavity through a high substernal incision measuring about 6 cm (Figure 1). The incision was sutured immediately after placing the graft against the iliac vessels. The graft's renal artery and vein were anastomosed end-to-side to the external iliac artery and vein using a 5-0 Gore-Tex suture. The ureter was anastomosed to the bladder by means of the extravesical Lich-Gregoir technique using 2 semicontinuous 4-0 polydioxanone sutures over a double J ureteral stent. The organ was kept on ice throughout the anastomoses and up until declamping, as described by Menon et al[8] in the phase II IDEAL study. The patient has provided his written informed consent to the publication of his data.

The patient information and operative data are summarized in Table 1. Total operating time was 130 minutes and blood loss was 50 mL. Warm ischemia time was 35 min and is similar to the time described in other recent reports.[9,10] Cold ischemia time was 12 hours. Within a few minutes of clamp removal, the graft began to show a characteristic rosy color that spread to the whole organ. Serum creatinine declined since the first postoperative day, demonstrating prompt recovery of renal function. The procedure was performed without near-infrared fluorescence imaging with indocyanine green, which has been reported to enhance the discrimination of healthy anatomical structures from diseased ones and, through it, procedure execution.[11] There were no intraoperative or postoperative complications, and the patient was discharged on the seventh postoperative day with a creatinine value of 1.1 mg/dL. At 3 years, the patient has normal renal function and a serum creatinine level of 1.2 mg/dL. In May 2015, a year before his transplant, the patient had set the dialysis cyclists hour record at 41.97 km (average speed 43 km and average power 290 Watts). Two months after the transplant, he gradually resumed training, and in March 2017, he set the new dialysis and transplant patients hour record at 43.34 km (average speed 45 km and average power 330 Watts) at Montichiari Velodrome (Italy). In June 2017, he became the transplant patients road cycling and individual time trial world champion at Malaga (Spain).

DISCUSSION

Minimally invasive surgery, be it laparoscopic or robotically assisted, offers significant benefits such as a shorter hospitalization, reduced postoperative pain and morbidity, a shorter recovery, a lower risk of wound infection, and better cosmetic results. In particular, RAKT ensures successful vessel anastomoses and ureter reimplantation

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M.F. was the senior surgeon; he participated in planning the procedure, operated the robot, and participated in writing the paper. A.S., R.C., and S.M. were the assistant surgeon; he participated in planning the procedure and in writing the paper.

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FIGURE 1. The incision is made immediately under the sternum, to minimize abdominal muscle morbidity.

through its 3-dimensional view, strong magnification (×12), surgeon control of the camera arm, and the elimination of hand tremor.[12] In traditional open procedures, the kidney is replaced into the extraperitoneal iliac space,[8] an anatomical site that is prone to lymphocele formation and where the graft is exposed to a variety of traumas that can range from contusion to loss of the organ. Athletes are clearly at greater risk of organ damage, and those who practice contact sports, such as rugby and martial arts, are forced to retire.[13] The conventional RAKT technique, which involves replacing the kidney into the intraperitoneal pelvic space, removes the risk of lymphocele formation and places the graft in a position where it is protected against accidental trauma by the hip bones, the bladder, the pelvic floor, and the intestines. In our procedure, graft introduction through a high substernal incision minimized the damage to the abdominal muscles, which are critical for athletes. RAKT thus frees athletes of the fear of trauma and ensures a swift return to their sport. Recent studies confirm that in expert hands RAKT is a safe, feasible, and reproducible technique. It provides significant surgical advantages, a low rate of complications, also in obese patients, and functional outcomes that are comparable to those of open surgery.[4-10] If reports from larger samples replicate early findings, new technology like near-infrared fluorescence imaging with indocyanine green will further facilitate robot-assisted surgery, hence RAKT.[11] Similarly, confirmation of the preclinical experience recently described with single-port RAKT will make procedures even less invasive.[6] Moreover, a recent study by Siena et al[14] has documented that, after extracorporeal vascular reconstruction, the anastomosis and rewarming time of grafts with multiple arteries and veins from living donors are comparable to those of grafts with single vessels; complications and functional recovery were also similar to those reported with single vessels,[14] suggesting that vessel number may no longer pose limitations in RAKT procedures using grafts from living donors.

TABLE 1.

Patient information and operative data

Patient information	Operative data
Gender	Male
Ethnicity	Caucasian
Body mass index (kg/m^2)	22.86
ASA score[a]	2
Actual surgical time	130 min
Warm ischemia time	35 min
Cold ischemia time	12 h
Hypertension	Yes
Diabetes	No
Intraoperative blood requirements	0
Postoperative dialysis	No
Surgical site infection	No
Donor characteristics	Deceased donor
Serum creatinine	1.1 mg/dL

[a]American Society of Anesthesiologists (ASA).

To the best of our knowledge, this is the first report of a RAKT procedure performed in an athlete. Although a single case does not allow drawing any conclusions, the very good 3-year outcome of this patient suggests that RAKT can become the gold standard treatment for athletes requiring a kidney transplant.

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