Case Report

Orthotopic kidney transplantation from a living renal donor after interventional therapy for bilateral arteriosclerosis obliterans of the iliac arteries: A case report and literature review

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Abbreviations & Acronyms
CT = computed tomography
ESKD = end-stage kidney disease
HKTx = heterotopic kidney transplantation
N = number of patients
N/A = not available
OKTx = orthotopic kidney transplantation

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Introduction: Orthotopic kidney transplantation is an option when heterotopic kidney transplantation into the iliac fossa is inappropriate. We report a case of orthotopic kidney transplantation following stenting of both external iliac arteries to treat arteriosclerosis obliterans.

Case presentation: A 56-year-old woman on hemodialysis for end-stage kidney disease underwent living-donor kidney transplantation. Desensitization therapy was administered because of her history of sensitization by pregnancy. Stents had been placed previously in both external iliac arteries. The left kidney was removed via an oblique lumbar incision. The two graft arteries were conjoined and anastomosed to the native renal artery end-to-end. The urinary tract was reconstructed by uretero-ureterostomy with ureteral stent placement. Renal function improved promptly after surgery.

Conclusion: Preoperative imaging of vascular anatomy is important for successful orthotopic kidney transplantation in patients who have previously undergone stenting of both external iliac arteries for arteriosclerosis obliterans.

Key words: arteriosclerosis obliterans, end-stage kidney disease, orthotopic kidney transplantation, renal transplantation.

Keynote message

We herein describe a patient who underwent orthotopic kidney transplantation following bilateral stenting of the external iliac arteries to treat arteriosclerosis obliterans of both lower extremities, and we review similar previous reports. Preoperative imaging of the native renal artery and dissection, including a vein of sufficient length, are important for successful vascular anastomosis for orthotopic kidney transplantation.

Introduction

In patients with ESKD, kidney transplantation provides superior survival and quality of life compared with dialysis.[1] However, HKTx into the iliac fossa is sometimes inappropriate because of highly calcified iliac arteries or occluded iliac veins. OKTx is an alternative in these patients. We report a case of successful OKTx in a patient with previous stenting of the bilateral external iliac arteries for arteriosclerosis obliterans.

Case presentation

A 56-year-old woman on hemodialysis for ESKD caused by diabetic nephropathy presented for living-donor kidney transplantation with a kidney donated by her husband. Arterial anastomosis was considered difficult because of prior bilateral external iliac artery stenting (Fig. 1a). Because preoperative CT showed no stenosis or calcification in the left renal artery (Fig. 1b) and severe calcification was present in both internal iliac arteries from their origin (Fig. 1c,d), OKTx was considered appropriate. The patient had a history of sensitization by pregnancy, and preformed donor-specific antibody was detected by flow cytometry cross-match testing.

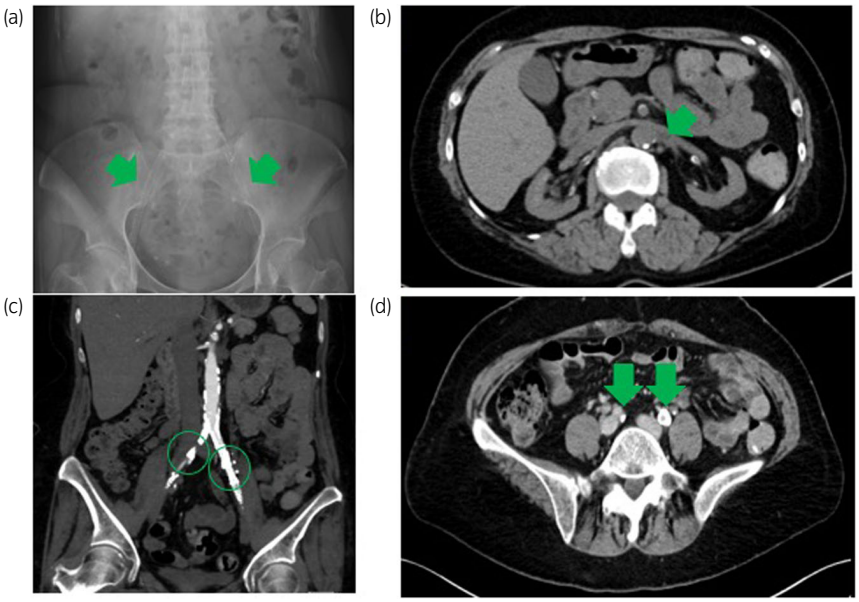

Fig. 1 Preoperative images. (a) Preoperative X-ray image. *Arrowheads*: stents in both iliac vessels. (b) Preoperative CT image. *Arrowhead*: no calcification of the root of the left renal artery is visible. (c) Preoperative coronal section of CT angiography. *Circles*: the internal iliac arteries. (d) Preoperative axial section of the CT angiography. *Arrowhead*: internal iliac arteries.

Therefore, she underwent pre-transplant desensitization therapy comprising rituximab, plasma exchange, and high-dose intravenous immunoglobulins. Immunosuppression was induced by basiliximab and maintained by triple immunosuppression comprising tacrolimus, mycophenolate mofetil, and methylprednisolone.

Intraoperative findings

With the patient in the right lateral position, the left native kidney was separated by retroperitoneoscopic surgery. The left renal artery and vein (Fig. 2a) and the ureter were maximally dissected, and the kidney was prepared for removal. An oblique lumbar incision was created with an 11th transcostal flank skin incision. The two donor renal arteries were conjoined on a back table (Fig. 2b). The native renal artery and vein were cut at the most distal positions after clamping, an oblique lumbar incision was created, and the kidney was removed. The kidney graft was placed in the retroperitoneal space, and the renal vein and artery were consecutively anastomosed (Fig. 2c,d). We used bulldog clamps for the native renal vessel clamps. After confirmation of urine output, the graft ureter was anastomosed to the native ureter end-to-end at the U2 level with a 6-Fr 26-cm ureteral stent. The blood loss volume was 30 mL, and the operative time was 5 h 23 min (total ischemic time, 1 h 48 min).

Postoperative course

Renal function improved immediately, and serum creatinine decreased to 0.7 mg/dL (61.89 μmol/L) 3 days postoperatively. The patient was uneventfully discharged 17 days post-transplantation. Postoperative CT revealed a well-perfused kidney allograft with reconstructed renal arteries (Fig. 3a). We removed ureteral stent at 2 months postoperatively after confirmation of no ureteral anastomosis leakage by retrograde pyeloureterocystography (Fig. 3b). No hydronephrosis was observed after ureteral stent removal (Fig. 3c). Ultrasound-

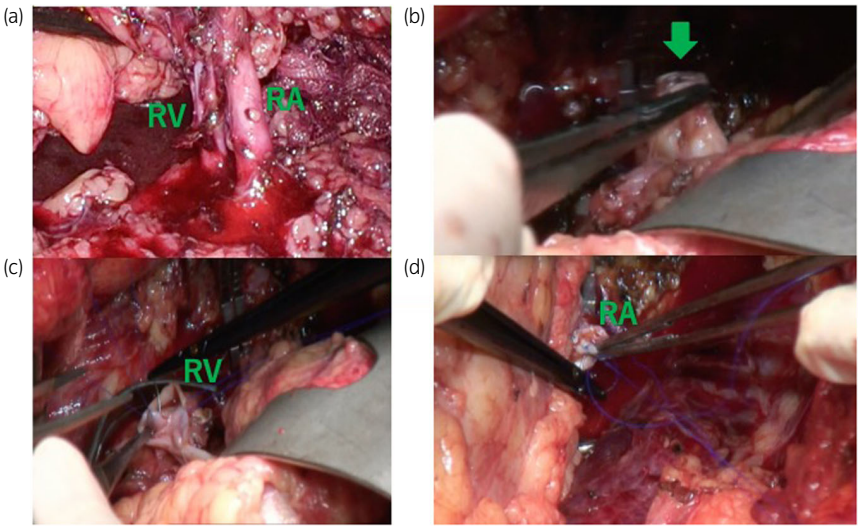

Fig. 2 Intraoperative findings. (a) Renal artery and vein of the left native kidney during laparoscopic donor nephrectomy. (b) *Arrowhead*: the conjoined renal arteries. (c) Anastomosis with native renal vein. (d) Anastomosis with native renal artery.

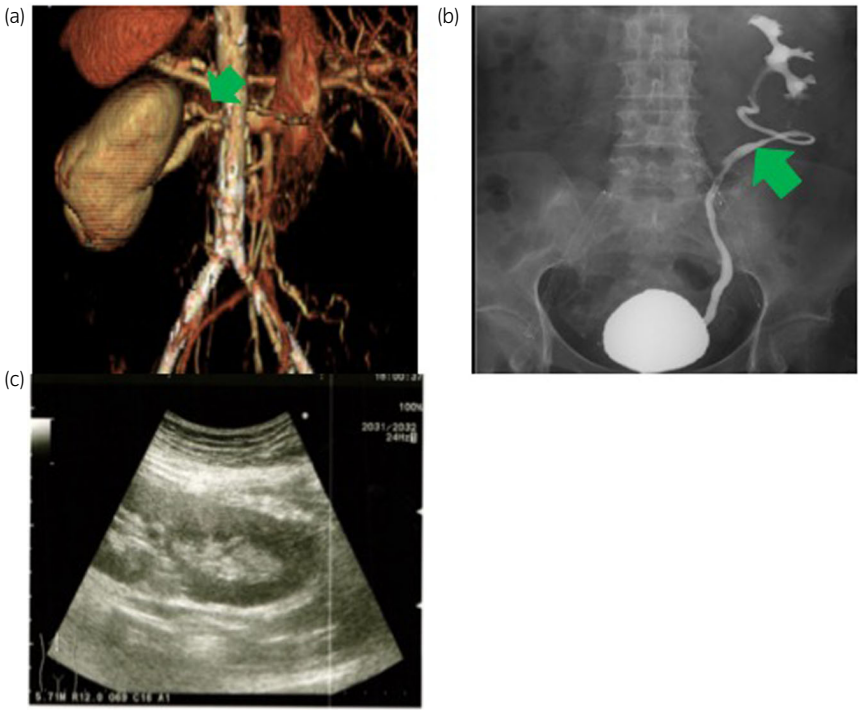

Fig. 3 Postoperative images. (a) Reconstructed CT image. *Arrowhead*: anastomosis of the renal artery. (b) Postoperative retrograde pyeloureterocystography image confirming no leakage. (c) Postoperative ultrasonographic image after stent removal confirming no hydronephrosis.

guided percutaneous graft biopsy showed no evidence of rejection 3 months after OKTx under temporary aspirin discontinuation. The patient had excellent graft function, with a serum creatinine concentration of 0.7 mg/dL 8 months after OKTx.

Discussion

Kidney transplantation improves survival and quality of life for patients with ESKD.[1] The frequency of high-risk kidney transplantation regarding both medical and surgical comorbidities is increasing, given the aging of the recipient population and the increasing number of diabetic patients with vascular arteriosclerosis.[2] However, HKTx using the iliac artery is inappropriate in some patients, and OKTx is a useful alternative. Our case and other reports on OKTx are summarized in the Table 1. In 1978, Gil-Vernet *et al.*[3] first reported a large case series of 123 OKTx procedures using a retroperitoneal approach via an oblique lumbar incision. In most patients, the graft renal artery was anastomosed to the splenic artery, and the graft renal vein was anastomosed to the recipient's renal vein. Renal pyelo-pyelic anastomosis was the most common urinary anastomotic procedure, with temporary nephrostomy or ureteral stenting. The number of reports of arterial anastomosis with the native renal artery and ureteral anastomosis to the native ureter have recently increased because anastomosis to the splenic artery requires simultaneous splenectomy, which is highly invasive and has long-term complications such as immunodeficiency and thrombosis. Aortic anastomosis also requires a larger skin incision and wider peri-aortic dissection, resulting in higher invasiveness. Therefore, we believe that anastomosis to the original renal artery should be performed if the arterial stenosis and calcification are mild. Other anastomoses have also been reported: end-to-side anastomosis to the aorta[2–7] and anastomosis to the inferior mesenteric artery[2] or common iliac artery.[8] We consider uretero-ureteral anastomosis to be technically simple and easy. Moreover, if urine leakage develops, subsequent complications can be avoided by separation between the uretero-ureteral anastomosis and the vascular anastomotic site.

A systematic review published in 2022 showed that the overall survival rate after OKTx was 92% and that the overall graft survival rate was 88%.[9] However, complications were slightly more common with OKTx than HKTx, with vascular and urinary tract complications accounting for 19% and 15%, respectively.[9] Findings in that systematic review and other reports suggested that the high postoperative complication rate is related to the fact that surgeons are unfamiliar with OKTx, and the selected recipients were generally at higher risk because of multiple and systemic comorbidities as well as iliac vascular conditions.[9,10] Another concern is the difficulty of vascular and ureteral anastomosis in a very deep surgical field. However, this can likely be resolved by creating a wide operative field through rib resection and retroperitoneal space dissection. Preoperative CT evaluation of the renal artery anastomosis site is also important. If calcification or stenosis in the autologous renal artery is apparent, anastomosis to the splenic artery, aorta, or other arteries should be considered, and the indication for OKTx may change. Therefore, to evaluate the renal artery more quickly and easily without a large skin incision, we began with retroperitoneoscopic surgery of the renal artery.

It is also important to consider the risk and difficulty of graft needle biopsy from the patient's back when considering the indication for OKTx. We have performed this in one patient, and the procedure was very similar to standard ultrasound-guided percutaneous native kidney biopsy except for the subtle respiratory motion of the kidney because of perigraft adhesion.

Table 1 Summary of reported cases of OKTx

Author	Year	*N*	Age	Surgery	Artery	Vein	Urinary	Complications
Gil-Vernet[3]	1978	139	36 (11–67)	Open	Splenic (95.9%)	Renal (93.4%)	Pyelo-pyelic (92.6%)	Vascular complication (3.2%)
					Aorta (4.1%)	Splenic (5.8%)	Uretero-ureteral (4.8%)	Urologic complication (6.5%)
						Cava (0.8%)	Ureterocalicostomy (2.4%)	
Ferri[12]	2000	1	32	N/A	N/A	N/A	N/A	Incisional bleeding
Paduch[13]	2001	5	56 (47–69)	Open	Splenic (80%)	Lt renal (100%)	Stented uretero-ureteral (40%)	None
					Lt renal (20%)		Non-stented uretero-ureteral (40%)	
Rodrigues[4]	2004	4	49.3 (35–62)	Open	Aorta	Lt renal (100%)	Stented uretero-ureteral (100%)	None
De Gracia[14]	2007	6	50.1 (41–62)	N/A	N/A	N/A	N/A	Arterial bleeding (33%)
								Renal artery stenosis (50%)
								Wound infection (33%)
Blanco[15]	2009	1	N/A	Open	N/A	N/A	N/A	Acute bleeding
Musquera[2]	2010	84	46.7 (4.2–73.6)	Open	Splenic (84.5%)	Renal (91.7%)	Pyelo-pyelic (47.6%)	Vascular complication (9.5%)
					Renal (7.1%)	Splenic (2.4%)	Uretero-pyelic (40.4%)	Urologic complication (11.9%)
					Aorta (4.8%)	Cava (2.4%)	Uretero-ureteral (6%)	
					Inferior mesenteric (1.2%)			
Izquierdo[16]	2010	15	N/A	N/A	N/A	N/A	N/A	None
Mikhalski[17]	2011	1	42	Lararoscopic (Intra) + Open	Lt renal	Lt renal	Stented uretero-ureteral	UTI
Hevia[5]	2014	9	48.5 (23.6–63.4)	Open	Splenic (78%)	Renal (78%)	Stented uretero-ureteral (33.3)	Acute bleeding (11.2)
					Aorta (22%)	Cava (22%)	Pyelo-pyelic (33.3)	Arterial thrombosis (11.2)
							Ileal conduit (22.2)	Pancreatic leak (11.2)
							Uretero-pyelic (11.2)	Ureteral stricture (11.2)
								Reflux nephropathy (11.2)
Sasaki[18]	2017	1	70	Open	Lt renal	Lt renal	Uretero-ureteral	Urinary leakage
Markić D[6]	2019	1	32	Open	Aorta	Cava	Pyelon-cysto	None
Chan[8]	2019	3	55.7 (44–69)	Open	Rt. common iliac (67%)	Lt renal (100%)	Pyelon to the native ureter (33.3)	Wound dehiscence
					Lt renal (33%)		Ileal conduit (33.3)	Transfusion
							Uretero-cysto (33.3)	
Vigués[11]	2021	1	65	Robot	Splenic	Lt renal	Uretero-cysto	None
Al-Adwan[7]	2022	1	58	Open	Aorta	Lt renal	Uretero-ureteral	None
Our case	2023	1	56	Laparoscopic (Retro) + Open	Lt renal	Lt renal	Stented uretero-ureteral	Transfusion

Sixteen reports of OKTx have been published to date and are summarized in the table.

The number of kidney recipients with poor vascular conditions is expected to increase[2]; therefore, OKTx may become more frequent. Furthermore, to minimize the invasiveness of open OKTx, robot-assisted OKTx may also become possible.[11]

Conclusion

We have reported a case of OKTx after bilateral external iliac artery stenting to treat bilateral lower extremity arteriosclerosis obliterans. Preoperative imaging of vascular anatomy is important for successful OKTx.

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Author contributions

Takehiro Ohyama: Conceptualization; writing – original draft; writing – review and editing. Hajime Sasaki: Supervision. Kyoko Minamisono: Supervision. Sho Nishida: Supervision. Daiki Iwami: Project administration; supervision; writing – review and editing.

Conflict of interest

The authors declare no conflict of interest.

Informed consent

Not required by our institution.

Registry and the Registration No. of the study/trial

Not applicable.

Approval of the research protocol by an Institutional Review Board

Not required by our institution.

References

1 Levin A, Hemmelgarn B, Culleton B *et al*. Canadian Society of Nephrology. Guidelines for the management of chronic kidney disease. *CMAJ* 2008; **179**: 1154–62.

2 Musquera M, Peri LL, Alvarez-Vijande R, Oppenheimer F, Gil-Vernet JM, Alcaraz A. Orthotopic kidney transplantation: an alternative surgical technique in selected patients. *Eur. Urol.* 2010; **58**: 927–33.

3 Gil-Vernet JM, Caralps A, Ruano D. New approach to the splenic vessels. *J. Urol.* 1978; **119**: 313–5.

4 Rodrigues P, D'Império M, Campagnari M, Azevedo LA, Campagnari JC, van Bellen B. Alternative grafting technique for patients unsuited to heterotopic transplantation due to diseased pelvic conditions. *Urol. Int.* 2004; **73**: 316–9.

5 Hevia V, Gómez V, Álvarez S, Díez-Nicolás V, Fernández A, Burgos FJ. Orthotopic kidney transplant: a valid surgical alternative for complex patients. *Curr. Urol. Rep.* 2015; **16**: 470.

6 Markić D, Oguić R, Krpina K *et al*. Kidney transplantation using a colon pouch (Mainz pouch III): a case report. *Croat. Med. J.* 2019; **60**: 545–51.

7 Al-Adwan Y, Singh N, Rajab A *et al*. Orthotopic kidney transplant as a fifth intra-abdominal organ after two previous kidney and two previous pancreas transplants. *Case Rep. Transplant.* 2022; **2022**: 3823066.

8 Chan E, Sener A, McAlister VC, Luke PP. Techniques—orthotopic kidney transplantation in patients with diseased inferior vena cavas. *Can. Urol. Assoc. J.* 2019; **13**: E154–6.

9 Castillo-Delgado CA, García-Perdomo HA, Musquera M, Alcaraz A. Orthotopic kidney transplantation survival and complications: systematic review and meta-analysis. *Arab J. Urol.* 2022; **20**: 212–8.

10 Musquera M, Peri L, Álvarez-Vijande R, Ajami T, Alcaraz A. Orthotopic renal transplantation: indication, technique and outcomes. *Curr. Urol. Rep.* 2020; **21**: 14.

11 Vigués F, Bonet X, Etcheverry B *et al*. Orthotopic robot-assisted kidney transplantation: first case report. *World J. Urol.* 2021; **39**: 2811–3.

12 Ferri M, Russell JD, Whelan JP. Orthotopic renal transplantation in a patient with a massive pelvic arteriovenous malformation. *J. Urol.* 2000; **163**: 899.

13 Paduch DA, Barry JM, Arsanjani A, Lemmers MJ. Indication, surgical technique and outcome of orthotopic renal transplantation. *J. Urol.* 2001; **166**: 1647–50.

14 De Gracia R, Jiménez C, Gil F *et al*. Revision del trasplante renal ortotópico en nuestro centro [Orthotopic renal transplant: our experience]. *Actas Urol. Esp.* 2007; **31**: 1123–8.

15 Blanco M, Medina J, Gonzalez E *et al*. Third kidney transplantation: a permanent medical-surgical challenge. *Transplant. Proc.* 2009; **4**: 2366–9.

16 Izquierdo L, Peri L, Piqueras M *et al*. Third and fourth kidney transplant: still a reasonable option. *Transplant. Proc.* 2010; **42**: 2498–502.

17 Mikhalski D, Wissing KM, Bollens R, Abramowicz D, Donckier V, Hoang AD. Laparoscopic-assisted recipient nephrectomy and recipient kidney procurement during orthotopic living-related kidney transplantation. *Case Rep. Transplant.* 2011; **2011**: 153493.

18 Sasaki H, Nakazawa R, Iwata T *et al*. Orthotopic kidney transplantation in an elderly patient with various severe comorbid conditions: a case report. *Transplant. Proc.* 2017; **49**: 2388–91.