# Arterial reconstruction with donor iliac vessels during kidney transplantation in a patient with severe atherosclerosis

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## ABSTRACT

Atherosclerosis is common in patients with end-stage renal disease. Severe calcification of the iliac vessels is expected in the growing pool of kidney transplant candidates. Thus, transplant surgeons must constantly develop alternative operative strategies to deal with the technical challenges that this condition confers. This case report aims to highlight a reconstructive vascular technique to salvage a completely calcified recipient external iliac artery using a deceased donor's arterial iliac allograft from the same donor as the renal allograft in a 59-year-old man, as an effective method to decrease vascular complications. (J Vasc Surg Cases and Innovative Techniques 2019;5:443-6.)

**Keywords:** Kidney transplantation; Vascular complications; Surgical technique; Arterial allograft; Arterial reconstruction; Atherosclerosis

Renal transplantation is the preferred treatment for patients with end-stage renal disease (ESRD).[1] Survival of the renal allograft continues to improve through refinement of multidisciplinary patient care.[2] Nevertheless, severe atherosclerosis is common in patients with ESRD, often making the arterial anastomosis more difficult, or even precluding kidney transplantation[3]; therefore, transplant surgeons must apply creative reconstructive techniques to overcome such vascular challenges. The aim of this case report is to highlight an alternative vascular reconstructive technique in renal transplant recipients with severely calcified iliac arteries.

Written informed consent was obtained before surgery, and permission was given for publication.

## CASE REPORT

The patient was a 59-year-old man with cirrhosis secondary to hepatitis C and ESRD secondary to polycystic kidney disease. He received increasing yearly doses of interferon + ribavirin and a 24-week regimen of simeprevir + sofosbuvir without ribavirin, that proved unsuccessful.[4] After 7 months awaiting transplantation, the patient underwent a sequential cadaveric liver-kidney transplantation. Although the recipient's preoperative computed tomography scan revealed moderate to severe atherosclerosis of both the common iliac artery and external iliac artery (EIA), the patient was asymptomatic, the ankle-brachial index was 0.7 bilaterally, and Doppler ultrasound (US) examination revealed biphasic flow; however, upon intraoperative exploration, the right common iliac artery and EIA were found completely calcified, precluding a direct arterial anastomosis. Anticipating a similar situation on the left side, a decision was made to carry out complete resection of the recipient's EIA and replace with a donor's iliac allograft, harvested to be used in the liver transplant procedure.

Safe places for transection and anastomosis were identified, and soft clamps placed successfully. Proximally, the transection was performed close to the origin of the recipient's EIA. Distally, it was carried out close to the cuff of the inferior epigastric artery (Fig 1). A vascular allograft of sufficient length was prepared to bridge the gap created, suturing close to the take-off of the internal iliac artery. End-to-end anastomoses were performed between the vascular graft and both ends of the recipient's EIA (Fig 2). Finally, the kidney allograft was anastomosed to the interposition vascular graft and the recipient's external iliac vein in a termino-lateral fashion (Fig 3). Of note, the warm ischemia time was 28 minutes, and the allograft perfused homogeneously and functioned immediately.

## RESULTS

Right lower-limb pulses were normal, ankle-brachial index was 0.8, and Doppler US showed adequate flow after transplantation. The postoperative course was characterized by initial slow graft function, and the patient was discharged on postoperative day 9 with blood urea nitrogen of 50 mg/dL and serum creatinine of 3.18 md/dL.

The follow-up examinations included blood and urine samples to assess kidney function, and Doppler US evaluation every 3 months for the first 2 years.

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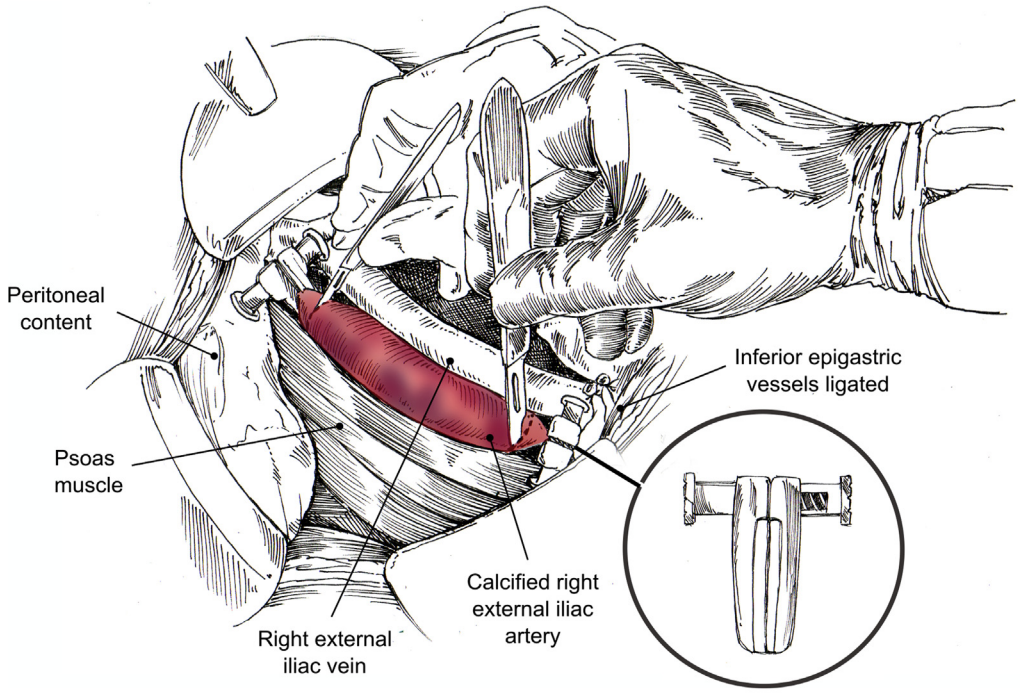


**Fig 1.** Schematic view of recipient's right external iliac artery shows proximal transection close to its origin at the bifurcation of the right common iliac artery, and distally close the take-off of the inferior epigastric artery. Inset: Soft clamps placed successfully.

At 22 months of follow-up, no complications were registered, blood urea nitrogen was 15 mg/dL, and serum creatinine was stable at 1.23 mg/dL.

## DISCUSSION

The number of patients awaiting renal transplantation continues to rise, given both cost and survival benefits offered to virtually all patients with ESRD.[5] Moreover, potential candidates are currently older and often harbor preexisting conditions that increase the difficulty of surgical management, such as atherosclerosis or other chronic comorbidities.[6]

Vascular calcification in chronic kidney disease is an active process induced by the metabolic insults of diabetes, dyslipidemia, oxidative stress, uremia, and hyperphosphatemia, leading to the formation of "osteoblast-like" cells in the vessel wall.[7] Particularly, iliac atherosclerosis develops more rapidly and extensively in patients with ESRD due to impaired endothelial function secondary to prolonged dialysis, hyperparathyroidism, hyperuricemia, and liquid overload.[8] Interestingly, early atherosclerotic lesions also seem to be a feature of chronic hepatitis C infection, being its progression presumably dependent on infection duration.[9]

Cirrhosis secondary to hepatitis C infection by itself represents an absolute contraindication to renal transplantation, unless liver-kidney transplantation is attempted. Conversely, candidates with diffuse lower limb peripheral arterial atherosclerosis are often considered for pretransplant vascular bypass.[10] Although the need for arterial restoration during renal transplantation should decrease due to better preoperative screening protocols, select patients (0.7%-3.6% among series) with severely diseased iliac vessels may require intraoperative vascular reconstructions to ensure adequate perfusion of the allograft and lower extremity.[11-16] Therefore, transplant surgery should constantly evolve to develop alternative strategies aimed to overcome potential vascular complications.

Calcified arteries pose two distinct problems: difficult clamping (amenable to soft clamp/Fogarty catheter use for control) and impaired patency (amenable to repermeability or replacement procedures). When possible, soft clamps are preferable over Fogarty catheters since they provide better flow control and surgical comfort during the anastomosis.[17] Different approaches have been proposed to improve luminal patency, such as the use of an autologous long saphenous vein graft to bypass an EIA dissection.[12] Also, reconstruction using a synthetic graft or the insertion of an intravascular stent has been described for this purpose with successful outcomes.[16-18] Although valuable, the use of synthetic material in immunocompromised patients must be contemplated cautiously given its increased risk for infection. Orthotopic kidney transplantation represents another feasible option,[18] but extensive preoperative assessment is mandatory because atherosclerosis is a

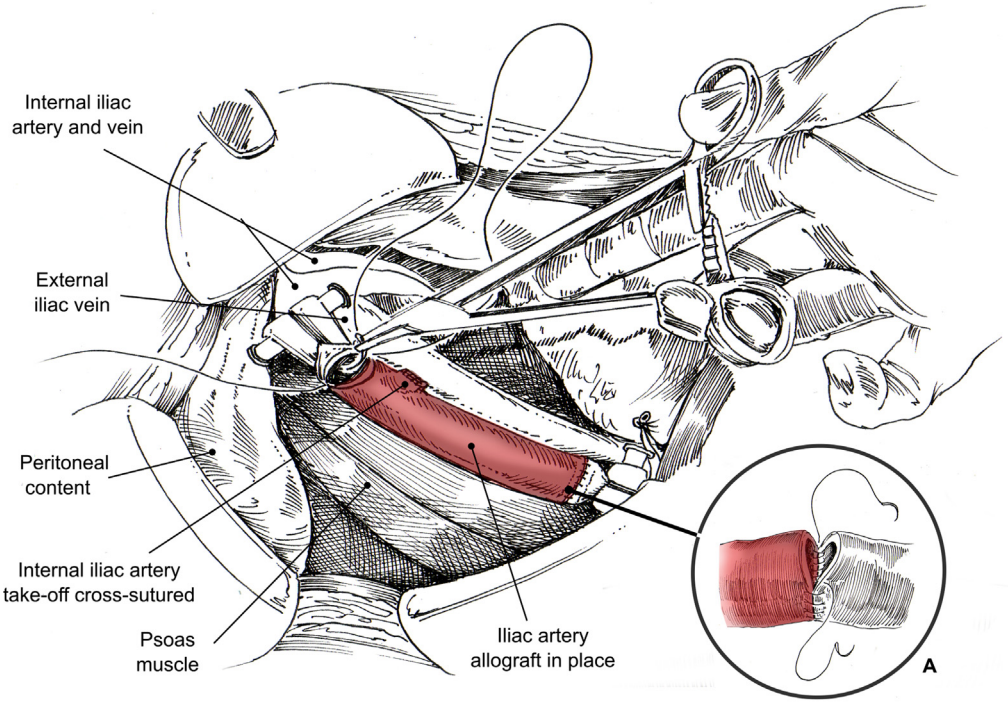


**Fig 2.** Schematic view shows (*inset*) proximal anastomosis between the donor's common iliac artery (CIA) and the recipient's EIA. Distal anastomosis was performed between the recipient's and donor's external iliac artery (EIA).

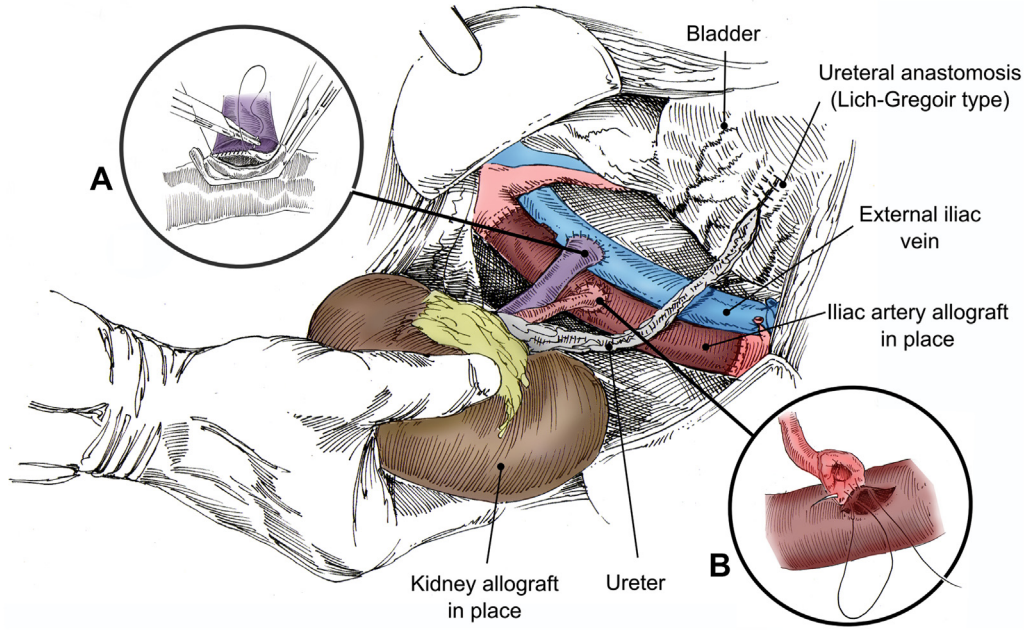


**Fig 3.** Left grafted kidney vein **(A)** and artery **(B)** with Carrel patch, were anastomosed in situ to the interposition arterial graft and the recipient's external iliac vein, respectively.

systemic disease, and lesions commonly extend to other native arteries.

Sterioff et al[19] showed that kidney allograft arterial anastomosis was feasible on arterial prostheses. For a two-stage approach using this method, the increased risk of infection, difficult dissection of the external iliac vein due to dense adhesions, and the human and economic costs derived from two procedures, remain

significant drawbacks. In contrast, when arterial reconstruction is carried out simultaneously, no redo-associated complications are expected, hospitalization time and costs are decreased, and anesthesia-related risks are significantly decreased. Delayed graft function related to prolonged ischemic times remains a concern against a simultaneous approach. To minimize the impact of cold ischemia time, we use a hypothermic perfusion machine instead of static cold storage in all our kidney allografts, up until the arterial reconstruction is finished.[20] By doing so, minimal impact on cold ischemia times and no impact on warm ischemia times are generated.

Arterial harvesting is of great relevance and has become routine in all multiorgan procurement procedures. The use of fresh arterial allografts has been considered safer, given that allografts are easier to handle and anastomose, retain their physical properties, and concerns for endothelial rejection are less justified in immunocompromised patients.[21] Many authors have reported the safe and successful use of donor's arterial allografts to replace the recipient's diseased iliac arteries.[15-17] These operative strategies share with our approach the principle of replacing the whole segment of diseased vessel, resulting in a graft with notably wider lumen and inherently reduced risk for infection when compared with the native damaged artery and synthetic prostheses, respectively. Based on our experience, vascular allograft harvesting would also be advisable for reconstruction purposes in the only-kidney setting when vascular compromise is anticipated.

## CONCLUSIONS

Severe atherosclerosis is to be expected in the increasing pool of candidates awaiting renal transplantation and can hinder the possibility of successful organ transplantation. Therefore, surgeons should be prepared to undertake unexpected vascular reconstructions. A donor's iliac interposition allograft renders an adequate alternative in these cases. The need to harvest extra arterial grafts, monitor the postoperative course closely, and carefully assess the immunosuppressive regimen remains crucial. Our patient showed no complications during surgery, the immediate postoperative period, or in long-term follow-up, attesting to the success of this procedure.

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