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Case Report

En bloc Kidney Transplant from Pediatric Donor to an Adult

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Abstract

The use of pediatric kidney donors is not a common practice. Transplant physicians and surgeons are concerned with technical issues as well as inadequate nephrons mass. We reported a case of *en bloc* kidney transplant from a pediatric donor to serve as a teaching case. The donor is a 3-year-old infant who died as a result of influenza. Due to the age and size discrepancy with an adult, it was decided to transplant the kidneys *en bloc* into an adult with successful outcome. *En bloc* technique renders the kidneys transplantable which would have been otherwise discarded and theoretically protect against hyperfiltration injury. Small pediatric donors are excellent resources and should be considered for donation whenever option is available.

Keywords: *En bloc* kidney transplant, end-stage renal disease, glomerular filtration rate, inferior vena cava, kidney transplantation, single kidney transplant, standard criteria donor transplant

Introduction

Kidney transplantation (KT) is the treatment of choice for patients with end-stage renal disease (ESRD), providing better quality of life compared to dialysis.[1] There has always been a disparity between demand and supply of organs; hence, there is an ever ongoing effort to expand the donor pool and minimize the discard rate of organs. One way is to use both kidneys *en bloc* (both kidneys together with inferior vena cava [IVC] and aorta) from very young donors so that enough nephron mass is provided to tolerate the adult hemodynamics.[2,3] At present, dual *en bloc* KT (EBKT) accounts for only 2% of all deceased donor KTs in the United States, representing 200–300 cases/year.[4]

Case Report

A 68-year-old female with ESRD secondary to hypertensive nephrosclerosis was transplanted with both kidneys *en bloc* from brain-dead pediatric donor at our medical center. She was predialysis and remained active on our waitlist for 40 months.

She had a past medical history of anemia; essential hypertension, benign; hyperlipidemia; hypothyroidism; and kidney stones. Her past surgical history included cholecystectomy in 1985 and cataract removal. No significant family history was found. Her physical examination was unremarkable, and all peripheral pulses were palpable. At the time of transplant, her creatinine was 2.5 mg/dl, weight 52 kg, estimated glomerular filtration rate (eGFR) was 18 ml/min (Cockcroft–Gault equation). Body mass index (BMI) was 21.7 Kg/m^2. The donor was a 3-year-old male with BMI 16.3 Kg/m^2 with terminal creatinine 0.26 and eGFR 211 ml/min (Schwartz equation). The donor was positive for influenza A. Recipient had 0% Panel Reactive Antigen (PRA) and had 2B, 1 DR mismatch with the donor, B cell and T cell cross-match was negative.

Kidneys were retrieved from the donor *en bloc*, on the back table, lumbar arteries were ligated, and the cephalic end of the aorta closed with 5-0 prolene, and the kidneys were put immediately on hypothermic pulsatile perfusion pump. Kidneys were pumped [Figure 1] for 538 min before being implanted into the recipient and various pump parameters monitored every hour [Table 1]. The intended parameters

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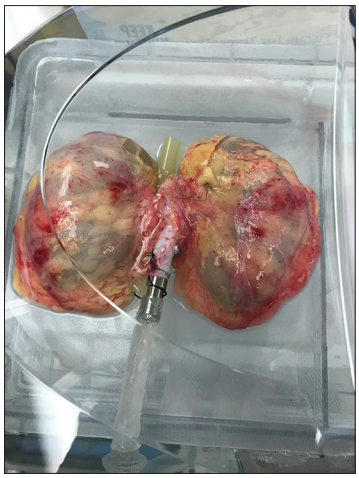

Figure 1: Kidneys on the pulsatile cold perfusion pump

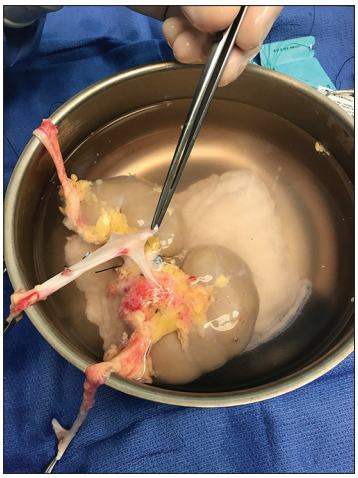

Figure 2: Backbench preparation

Table 1: Kidney pump parameters

h	Systolic (mmHg)	Diastolic (mmHg)	Flow (ml/min)	Resistance	Temp (°C)
1	30	12	67	0.27	5.3
2	30	11	75	0.23	4.2
3	30	10	92	0.18	4.0
4	30	10	100	0.16	4.2
5	30	10	120	0.13	5.1
6	30	10	120	0.13	4.3
7	30	10	120	0.13	4.1
8	30	10	120	0.13	4.7
9	30	10	120	0.13	4.9

on the pump were flow ≥50 ml/min and resistance <0.25. Temperature on pump is maintained between 4°C and 6°C.

Operative procedure

At the backbench, all of the branches of the left renal vein and vena cava were doubly ligated, the vena cava above the renal veins was stapled with a TA stapler, and hence, the vena cava was made into a conduit with only the left and right renal veins are left attached, and distal end of the vena cava was used as the site for anastomosis to the recipient [Figure 2]. The aorta had already been dissected, and lumbar arteries were ligated. The upper end of the aorta and the superior mesenteric artery orifice above the left renal artery were suture ligated using running 5-0 prolene and a 10 mm clip applied over the suture line. Both kidneys had single artery bilaterally. The aorta and vena cava were flushed to make sure that there were no leaks. The kidneys were marked at the superior and anterior wall of them using 5/0 prolene stitch to assist in orientation. In the recipient, the kidneys were placed retroperitoneally on the right side through standard right inguinal transplant incision. Proximal and distal controls of the iliac vessel were achieved. First, the vena cava of the donor was anastomosed to the right external iliac vein in an end-to-side fashion with a running 5-0 prolene. The vena cava was oriented so that the right kidney sits in the right side of the iliac artery and the left kidney to the left side of the iliac artery. Then, the aorta was anastomosed to the right external iliac artery in a similar fashion. Both anastomoses were opened and kidneys perfused well with immediate urine output. All bleeding points were controlled using electrocautery, as well as clips. Both ureters were anastomosed to the dome of the urinary bladder adjacent to each other separately over a 6 Fr double-J ureteral stent. Submucosal tunnel was created with 4-0 Dexon sutures for anti-refluxing anastomosis. The kidneys were appropriately positioned in the retroperitoneum. Incision was closed in a single layer and skin stapled. The patient had noncomplicated postoperative course with good Urine Output (UO) and discharged on postoperative day 6 with creatinine 0.59. The patient was followed up weekly in the clinic till the writing of this report (2019) with normal renal function.

Discussion

Transplantation of pediatric donor kidneys into adult recipient is viable option; however, many transplant centers are hesitant to utilize kidneys from very young donor, especially below 5 years of age due to concern about size disparity between donor and recipients. Higher body mass and elevated blood pressures are thought to lead to hyperfiltration injury to immature pediatric glomeruli.[5] Due to size disparity concerns, one tends to choose recipient with lower BMI, and small body habitus as was done in this case. Pediatric kidney transplants are technically challenging due to small size of vessels and ureters.[6] There is high incidence of thrombosis of vessels due to small size, but the *en bloc* transplant is helpful in this regard because of anastomosis to the donor aorta and IVC.[7] Risk factors for thrombosis in all renal transplants include young donor age (<5 years), cold ischemia time >24 h, previous recipient transplantation, African-American race, and increased panel reactive antibody.[8] In pediatric donors, the absence of an aortic patch during single-kidney transplant (SKT) and donor age <12 months with EBKT are also risk factors for graft thrombosis.[8]

There is also increased concerns about urinary leaks,[9,10] we routinely stent all our kidney transplants which have been advocated by other authors.[11] Urinary complications in small

pediatric donor kidneys have been reported between 2.5% and 11% with no significant differences between EBKT and standard KT.[12]

Acute rejection episodes have been cited as the major reason for graft loss in recipients.[8] Role of different induction agents in the prevention of rejection is unclear. Another challenging aspect of this surgery is the positioning of the kidneys as small vessels are more prone to kinks and may twist postoperatively.

The *en bloc* transplantation of pediatric kidneys into adults is an attractive option, as most of these kidneys are considered nontransplantable individually. *En bloc* transplant has been shown to have better graft survival in these kidneys.[13] *En bloc* kidney transplant is also attractive because it addresses theoretical possibility of protection against hyperfiltration injury.

Graft failure is, however, a major concern for all pediatric donors (EBKT or SKT), with most single-center studies and transplant registries reporting early graft failure at higher rates than those of standard adult donors. After approximately 12-month posttransplant, survival outcomes with EBKT equal that of standard criteria donor transplant, with one study even showing superiority of EBKT over living donor kidneys.[14] It is, therefore, crucial to identify and minimize risk factors for graft failure during this early posttransplant period.

Conclusion

Small pediatric donors are excellent resources and should be considered for donation whenever option is available.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that name and initial will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

Authors' contribution

NS drafted this article; AR: Editing and final revision; EAE: the idea, editing, final revision

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Conflicts of interest

There are no conflicts of interest.

Compliance with ethics principles

No prior ethical approval is required for single case reports. However, the patient provided consent for publication as stated above.

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