A Novel Technique of Dual Kidney Transplantation (DKT) From Adult Donors

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OBJECTIVE To discuss a novel technique of dual kidney transplantation that has not been described in literature.

METHODS Dual Kidney Transplantation (DKT) is done for kidneys from expanded criteria donors. The 3 described techniques in literature (bilateral placement, unilateral placement with separate or patch anastomosis) have some disadvantages. This newer technique describes the use of the donor iliac artery as an interposition Y graft for joining both kidneys of the dual kidney transplant. This method can overcome some of the disadvantages associated with the previously described techniques. The ureters were implanted in urinary bladder separately in one recipient and together in another recipient.

RESULTS This technique was used in 2 cases. The cold ischemia time was 275 minutes and 765 minutes, respectively while the operative time was 187 minutes and 192 minutes, respectively in the 2 patients. The first patient has creatinine of 0.83 mg/dl on last follow up at 6 months whereas the other patient has creatinine of 1.12 mg/dl at 3 months follow up. Computed tomography angiography of both the patients revealed good contrast uptake in both kidneys with no stenosis, torsion or lymphocele.

CONCLUSION The newer technique avoids scarring of both iliac fossa in DKT while reducing operative time and secondary warm ischemia time by doing a single arterial anastomosis in the recipient and allows easier placement of both kidneys in the right iliac fossa. UROLOGY 130: 201–204, 2019.

The number of end-stage renal disease patients requiring kidney transplant has risen over the past decade. However enough organs are not available for transplant.[1] This has led to organs being taken from donors which were traditionally not considered optimal for use in recipients. These expanded criteria donors (ECD) have been traditionally defined as those over the age of 50 years with presence of any of the 2 following comorbidities: hypertension, death from cerebrovascular accident or terminal serum creatinine levels >1.5 mg/dl or donors older than 60 years.[2] The kidneys from ECD patients have a lower nephron mass and result in higher rate of delayed graft function and lower graft survival if one kidney is used in each recipient. Dual kidney transplant (DKT) has become an established method to overcome the inferior quality of donor organ.[3]

Three different surgical techniques for dual kidney transplantation (DKT) have been reported in literature. These are bilateral placement of each kidney, unilateral placement with separate anastomoses, and unilateral placement with patch anastomoses.[4] However, there are disadvantages associated with each of these techniques. Bilateral placement of kidney takes a much longer time with both iliac fossa being used for transplant. This can be overcome by placing both kidneys in the right iliac fossa with separate anastomosis. However, separate anastomosis still takes longer time when compared to a single patch anastomosis. Unilateral placement with single patch anastomoses of both renal arteries and veins can overcome the problems of doing separate anastomosis and reduce operative and ischemia times. However, it makes the surgery technically more challenging with the constraints of space and difficulty in final positioning of the medial kidney.

The newer technique describes the use of the donor iliac artery as an interposition Y graft for joining both kidneys of the dual kidney transplant. This method can overcome some of the disadvantages associated with the above mentioned techniques.

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MATERIAL AND METHOD

The electronic databases were searched, including medline via PubMed, EMBASE, Cochrane Database and Google Scholar for techniques described for dual kidney transplantation in English language mapping to MeSH terms "kidney or renal" and "transplant" and "dual or double". The manuscript followed the Declaration of Helsinki guidelines and was approved by the Institutional Ethics Committee. Informed consent was obtained from the patients.

SURGICAL TECHNIQUE

The graft kidneys and the common iliac artery with its bifurcation were retrieved from the deceased donor. The kidneys were divided in situ during organ recovery, leaving the inferior vena cava (IVC) with the right kidney. During back table preparation, the renal arteries were anastomosed end to end using 6-0 Prolene sutures to the limbs of the interposition Y graft formed by the common iliac artery and its branches (Figs. 1, 2A). The right renal vein was lengthened using donor inferior vena cava. Both the graft kidneys were transplanted in the right iliac fossa by anastomosing the stem of the donor common iliac Y graft to the recipient external iliac artery using 6-0 Prolene sutures. Both renal veins were anastomosed end to side in tandem on to the external iliac vein using 5-0 Prolene sutures (Fig. 2B, C). The left kidney was finally placed lateral to the iliac vessels in the usual position whereas the right kidney remained in an inferio-medial position behind the rectus abdominis muscle. This technique was used in 2 cases.

The ureters were implanted in urinary bladder separately in one recipient by modified Lich Gregoir technique. In the other recipient, a common anastomosis was fashioned by joining the terminal portions of both ureters in a side-to-side fashion before implanting on to the bladder by modified Lich Gregoir technique. The ureter implantation was done using 5-0 polydioxanone and bladder wall was sutured with 3-0 vicryl. In both patients, ureteral stents or pigtail catheter were not placed as per the usual practice at our center.

RESULTS

Case 1

A 56-year-old nondiabetic female underwent DKT from a 60-year-old male with history of diabetes for 3 years, serum creatinine of 0.6 mg/dl and normal range microalbumin on urine examination. The frozen section of graft kidneys taken at the time of retrieval revealed 20%-30% interstitial fibrosis in both kidneys with tubular atrophy but no evidence of overt diabetic nephropathy. The cold ischemia time (CIT) was 275 minutes and operative time was 187 minutes. The patient required 2 sessions of hemodialysis in postoperative period but her urine output improved by postoperative day (POD) 5 and his creatinine reached 1 mg/dl on POD 14. Patient maintains creatinine of 0.83 mg/dl on last follow up at 6 months.

Case 2

A 49-year-old male received DKT from a 63-year-old female brain dead donor with history of hypertension for the last 15 years and a terminal creatinine of 1.9 mg/dl. The CIT was 765 minutes and operative time was 192 minutes. Patient had adequate urine output and reached creatinine of 1.2 mg/dl on POD 7 and maintains creatinine of 1.16 mg/dl on last follow up at 3 months.

Computed tomography angiography of both patients revealed good contrast uptake in both kidneys with no stenosis, torsion or lymphocele (Fig. 3A, B).

DISCUSSION

The worldwide shortage of organs has led to expansion of criteria for acceptance of renal donors. Different strategies

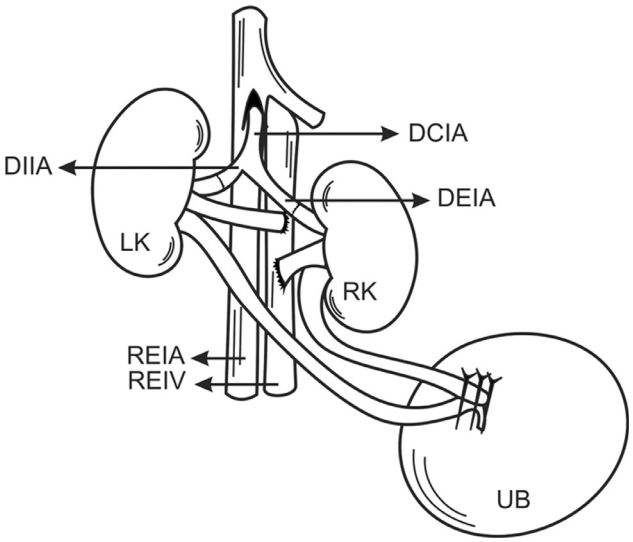

Figure 1. Unilateral placement with donor iliac artery as an interposition Y graft. (DCIA, donor common iliac artery; DIIA, donor internal iliac artery; DEIA, donor external iliac artery; REIA, recipient external iliac artery; REIV, recipient external iliac artery; LK, left kidney; RK, right kidney; urinary bladder).

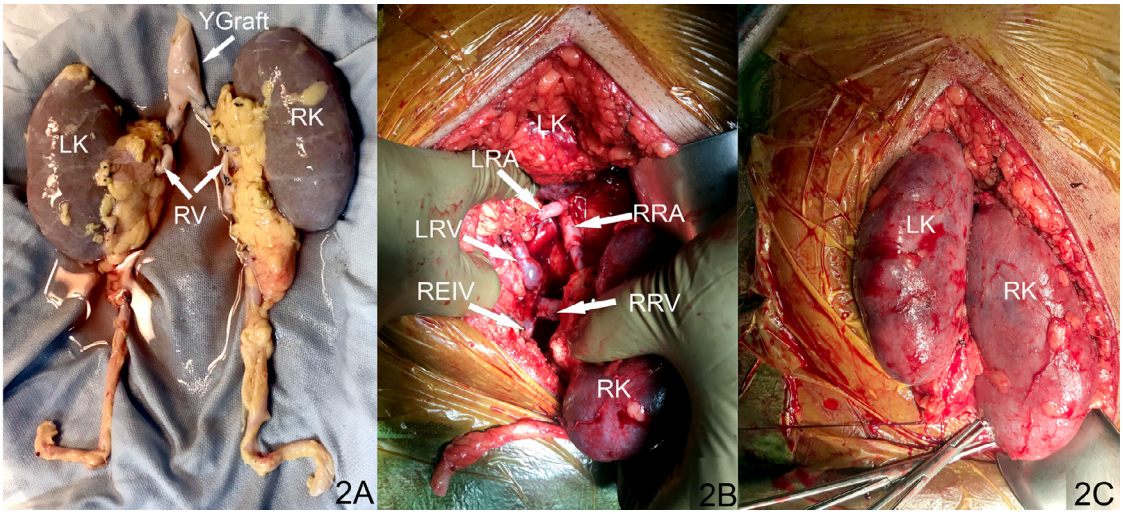

Figure 2. (A) Donor derived interposition Y graft serving as common conduit for both kidneys. (**B and C**) Both kidneys placed in right iliac fossa. (LK, left kidney; LRA, left renal artery; LRV, left renal vein; REIV, recipient external iliac vein; RK, right kidney; RRA, right renal artery; RRV, right renal vein; RV, renal veins; Y graft, interposition Y graft consisting of donor common iliac division). (Color version available online).

have been advocated to use ECD kidneys like transplanting these kidneys in elderly recipients or those with a limited life span. The use of both kidneys in a single recipient is another approach to improve the graft function and survival of ECD kidneys. The marginal kidney donor or ECD has been traditionally described as a donor with suboptimal organ quality.[5] There have been 3 different techniques described in literature for DKT. The simplest method has been placing both kidneys in separate iliac fossa either through a midline incision (intraperitoneally),[6-9] or by bilateral Gibson incisions (extraperitoneally).[7-11] Graft vessels are anastomosed with iliac vessels on either side. Bilateral kidney transplantation takes the longest operative time amongst all the

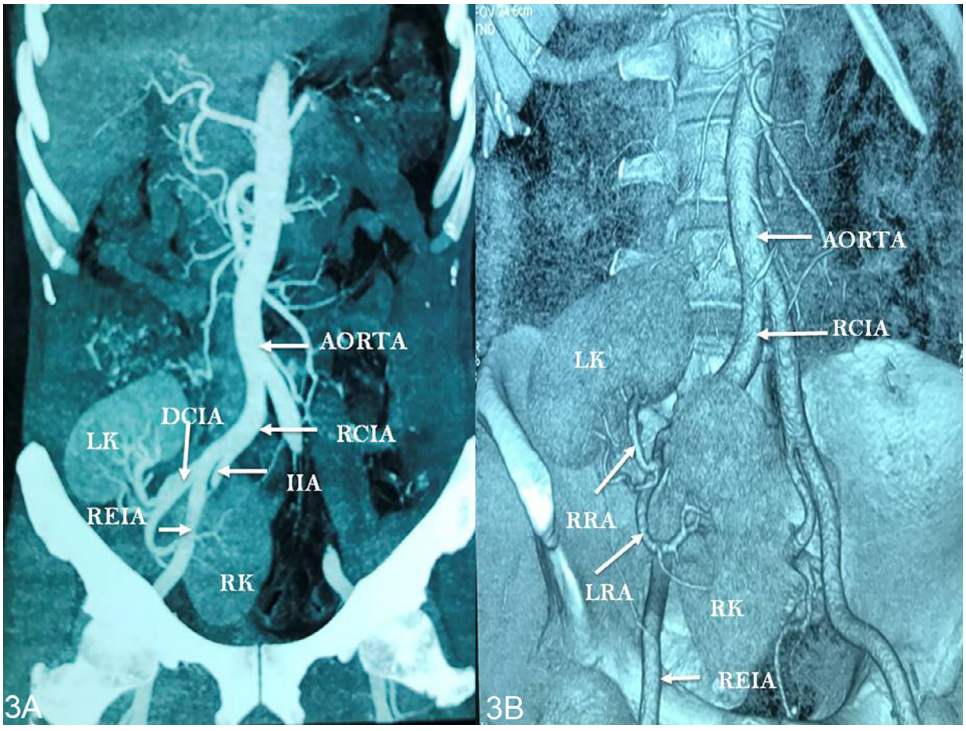

Figure 3. (**A and B**) Computed tomography angiography showing equally good contrast uptake in both kidneys with no stenosis, torsion or lymphocele. (DCIA, donor common iliac artery; IIA, internal iliac artery; LRA, left renal artery; LK, left kidney; RCIA, recipient common iliac artery; REIA, recipient external iliac artery, RK, right kidney, RRA- right renal artery). (Color version available online).

techniques[4] and is particularly disadvantageous for elderly recipients who as prolonged anesthesia time can be. In addition, both iliac fossa are used up making a future transplant more difficult. In unilateral placement, both the kidneys are placed on the same side (usually on the right).[12-14] If separate anastomoses are being done, the right kidney is placed superiorly and laterally in the lower right flank[13] or behind the right colon and outside the pelvis.[11] The right renal vein is lengthened by incorporating donor inferior vena cava and is anastomosed end-to-side to recipient inferior vena cava[12,13] or common iliac vein,[14] while the right renal artery is anastomosed to the common iliac artery,[12,13] external iliac artery, or internal iliac artery.[14] The left donor kidney is transplanted inferior to right kidney and the left renal vein and artery are anastomosed end-to-side to the external iliac vessels and is placed inferior-medially.[12-14] This still requires 4 different anastomosis, a longer operative time and a longer incision to reach IVC or the common iliac vein.

A technique of single patch anastomosis of arteries and vein has also been described where the right renal vein is lengthened by incorporating inferior vena cava[15] and the left renal vein is placed superiorly and its posterior margin sutured to the anterior margin of the right renal vein.[15] In another variant of this technique, the left renal vein is shortened by 3 cm and reimplanted on the vena cava which serves as an outflow for both the kidneys or the right renal vein is implanted on to the left renal vein to create a common venous channel.[16] The aortic patches of both renal arteries were sutured together. The lateral Carrel patch is placed superiorly to the other as the lateral kidney is placed in a higher position in the pelvis than the medial kidney.[15] The joined veins and the aortic patch bearing both renal arteries are anastomosed end-to-side to the external iliac vein[15,16] and common iliac artery[12] or external iliac artery.[16] Unilateral placement with patch anastomoses makes the surgery technically more challenging especially while positioning the kidneys at the time of closure. The long length of IVC is prone to extrinsic compression and combined aortic patch becomes large in size while anastomosing to external iliac artery. However, it reduces the operative time and has been reported to lead to faster recovery. In this novel technique, back table preparation is undertaken to implant both kidneys on to an arterial Y graft using the donor common iliac and its bifurcation. This results in a common arterial supply from a single arterial anastomosis in the recipient. The use the common lilac artery as the interposition graft results is a lesser size discrepancy as compared to a joined aortic patch and is therefore more convenient to anastomose. The length of renal arteries can be shortened as desired to avoid any kinking. The venous outflow can also be provided as a common channel during back table preparation. However, the authors anastomosed both the veins separately to external iliac vein as it made placement of the medial kidney easier while having all the advantages of unilateral placement. An additional advantage is that the length of the renal vein of the medial kidney can be trimmed as per need at the time of anastomosis.

Ureters are implanted in urinary bladder with separate extravesical ureteroneocystomies (modified Lich Gregoir, Lich technique or 1 stich technique)[6-10] with or without placement of ureteral double J stent. Both the ureters can also be sutured together to have a common channel.[15,16] A single ureteroneocystostomy is performed according to the Lich-Gregoir technique with a double-J stent for each ureter[15] or a single double pigtail catheter.[16]

CONCLUSION

The newer technique avoids scarring of both iliac fossa in DKT while reducing operative and secondary warm ischemia time by doing a single arterial anastomosis in the recipient and allows easier placement of both kidneys in the right iliac fossa.

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