

Dual kidney transplantation from expanded criteria deceased donors: Initial experience from single center

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ABSTRACT

Aim: To evaluate results of dual kidney transplantation from expanded criteria deceased donors.

Materials and Methods: Between January 2000 and December 2009, 23 dual kidney transplantations were performed from expanded criteria deceased donors; 11 were from non-heart-beating donors and 12 from brain-dead heart-beating donors. All transplantations were performed in monolateral iliac fossa.

Results: Two perioperative deaths occurred due to sepsis and multiorgan failure in non-heart-beating group, and one in brain dead group. One- and five-year graft and patient survival in recipients having organs from brain-death heart-beating group were 91.67%. In non-heart-beating group, 1- and 5-year graft survival was 65.45% and 81.82%, and 1- and 5-year patient survival was 43.64% and 61.36%, respectively.

Conclusion: Dual kidney transplantation from expanded criteria brain dead donors has better graft and patient survival than from non-heart-beating donors.

Key words: Cadaver, cardiac death, donation, dual, kidney, marginal, transplantation.

INTRODUCTION

Kidney transplantation from deceased donor is a well-established procedure. In India, however, due to shortage of deceased donors most of the kidney transplantation is from living donors. In the situation of nonavailability of suitable donor and large waiting list of patients with end-stage renal disease, we have started accepting kidneys from expanded criteria deceased donors from year 2000 onward for dual kidney transplantation, transplanted either en bloc or separately into an iliac

fossa. Here we share our technique and outcome of dual kidney transplantation in monolateral iliac fossa.

MATERIALS AND METHODS

The state government of Gujarat has accepted The Human Organ Transplant Act in 1996. Between January 2000 and December 2007, 23 dual kidney transplantations were performed from expanded criteria deceased donor at single institution; organs were procured in 11 cases from non-heart-beating donors and in 12 cases brain-dead heart-beating donors. Three out of 12 cases of dual kidney transplantation from brain-dead donors were pediatric donors having age of 4, 5, and 8 years. Decision of performing dual kidney transplantation was based on donor age of more than 60 years, history of diabetes mellitus, hypertension or CV stroke, terminal serum creatinine >2 mg/dL, macroscopic evaluation and histological findings according to Karpinki's score, as described previously.^[1,2]

In brain-dead heart-beating group, a standard technique of *in situ* perfusion during organ procurement was used in all cases. In brief, midline laparotomy and thoracotomy was performed and infrarenal and supraceliac aorta was dissected. *In situ* perfusion was performed and blood and fluid exanguished in chest. Abdominal organs were ice-

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cooled at the time of *in situ* perfusion and then procured.

Procedure for donation after cardiac death (DCD) was different than the standard procurements performed in donors with brain-death and heart-beating. In five cases, femoral artery cannulation and perfusion with cold Custodiol solution was performed prior to laparotomy; the outlet was provided through cannulation of the femoral vein. This was followed by rapid laparotomy and supraceliac control of aorta and suprarenal control of vena cava. In other six cases, rapid laparotomy was performed first followed by cannulation of iliac artery and venting of the fluid was from vena cava. In all cases, abdominal organs were cooled by ice-slush. After cooling, kidneys were procured by a standard procedure.

All kidneys were removed en bloc. Three pairs of kidney from pediatric donors were transplanted en bloc. Also in one case from adult donor, en bloc transplantation of both kidneys was performed. In other cases, both kidneys were separated, vasculature evaluated for atherosclerosis, and transplanted separately into monolateral iliac fossa. Techniques of en bloc and separate kidney transplantation are as follows.

En bloc dual kidney transplantation

The technique is described previously.^[3] In summary, on bench, both kidney perfusion was performed by clamping aorta proximal to renal artery. Suprarenal aorta is closed by 4/0 prolene suture. Reperfusion was performed to check any fluid leak. Similarly, leak from vena cava is checked and all opening of lumbar veins are closed. Infrarenal aorta and vena cava are anastomosed in end to side fashion to external iliac vessels of the adult recipient. Two parallel incisions were placed on the bladder and both ureters were reimplemented separately by modified Lich's method.

Dual kidney transplantation in single iliac fossa

Renal allograft vessels are inspected for any atherosclerotic plaque occluding the ostium either partially or completely. When atheroma was present at the renal artery ostium Carrel's aortic patch was not used. Usually, the left renal allograft vessels were anastomosed to common iliac vessels. After opening, vascular clamp hemostasis was secured. The second transplant is performed distal to the first allograft. Usually, the right renal allograft vessels were anastomosed to external iliac vessels. Both ureters were implanted individually into the bladder by modified Lich's method [Figures 1–4].

Cold ischemia time was defined as time since aortic clamping and starting of perfusion by chilled perfusion fluid solution till the time of opening of vascular clamps during recipient surgery. Delayed graft function was defined as need for dialysis in first week after transplantation. Induction immunosuppressant regime was based on cyclosporine in first five cases of transplantation from heart-beating brain-dead donors, and, antithymoglobulin in all others.

Maintenance immunosuppressant regime was based on cyclosporine/tacrolimus, steroids, and mycophenolate mofetil in all patients.

RESULTS

Mean age of the donor in brain-dead group was 51 years (range 4–82) and in DCD group was 73 years (range 58–89). Mean cold ischemia time was 8.9 (range 4–14.5) hours. Although all kidneys were procured en bloc, on bench both kidneys were separated on all but one occasion to evaluate involvement of renal artery ostium by atheromatous plaque. On one occasion, en bloc transplantation of pair of kidneys was performed from a 65-year-old brain-dead donor without any comorbid condition other than raised terminal serum creatinine value.

Mean age of recipient was 38 years (range 10–57) and 43 years (range 17–76) in brain-dead and DCD group, respectively. There were 7 males and 5 female recipients in brain-dead group and 7 male and 4 female in DCD group. Both kidneys were transplanted in monolateral iliac fossa successfully in all cases. On six occasions, it was second transplantation of the recipient. Technically, all grafts were transplanted successfully. Intraoperative urine output was established from all grafts. Delayed graft function was present in six recipients. Out of these six cases, in two cyclosporine and in other four, antithymoglobulin were used as induction agent. Reason to switch over from cyclosporine to antithymocyte globulin was to avoid nephrotoxicity of the former drug when kidneys procured from expanded criteria donors.

Double J stent was used in both ureters in 16 cases and in all other cases no stent was used. No urinary leak was present in any case. In one case, both transplanted kidneys harboured small stones. The patient passed one stone spontaneously in urine and the other stone required extracorporeal shock wave lithotripsy.

Figures 5 and 6 show graft and patient survival, respectively. Table 1 shows 1- and 5-year graft and patient survival in both groups of patients. One recipient died due to sepsis in brain-dead heart-beating donor group, while two died in NHBBD group in immediate post-transplant period. One recipient has stopped receiving immunosuppressants 13 months after transplantation and lost both allograft functions. Till that time, his serum creatinine was 0.9 mg% (GFR >60 ml/min/1.73 m²).

DISCUSSION

Cadaver kidney transplantation program in India is still in its infancy. Availability of kidneys for patients of ESRD is far less than required. The crisis in organ supply has caused the transplant community to focus on strategies to maximize the use of organ procured from all deceased donors.

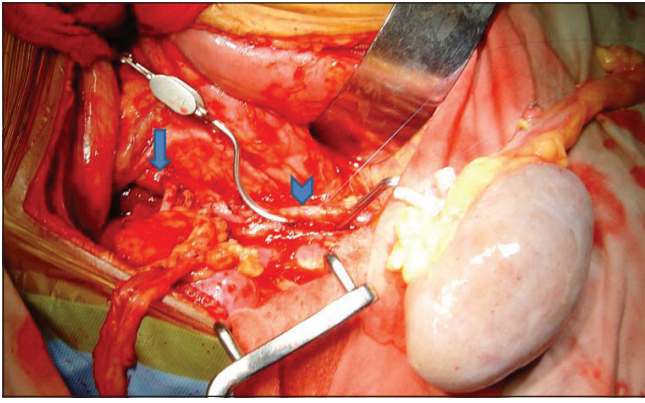


Figure 1: Arrow shows completed anastomosis of first renal allograft artery with common iliac artery. The renal allograft is perfused. Arrowhead shows anastomosis of the artery of other renal allograft with external iliac artery which is in progress

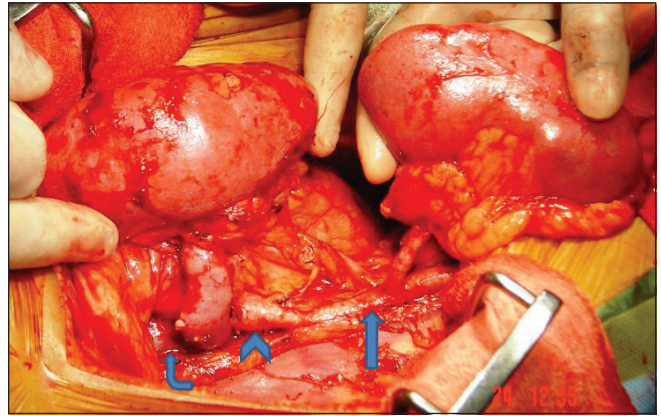


Figure 2: Straight arrow shows external iliac artery, arrow head shows common iliac artery, and curved arrow shows common iliac vein. Note perfusion of both renal allografts

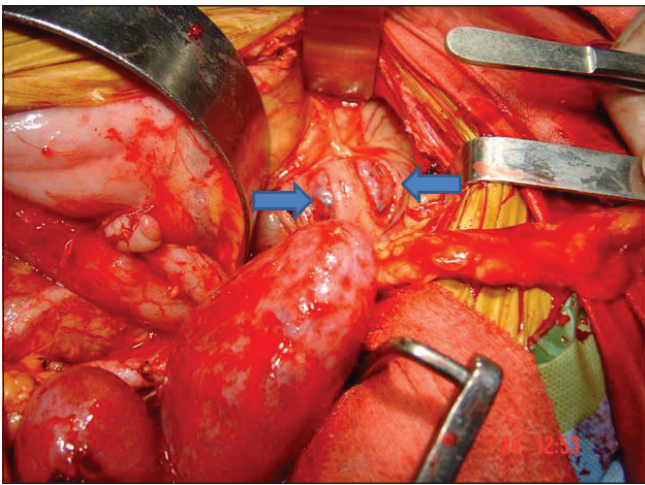


Figure 3: Submucosal dissection of the bladder at two nearby places for each ureteral implantation

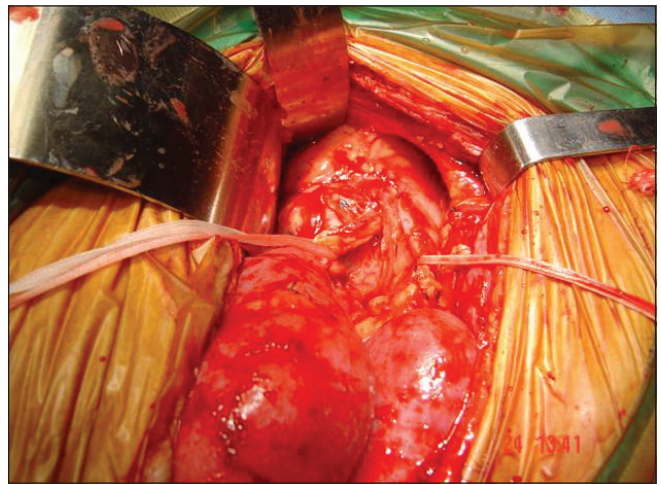


Figure 4: Sling shows two implanted ureters

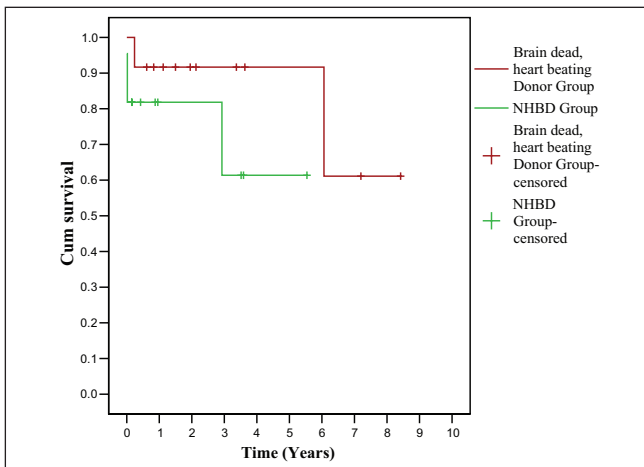


Figure 5: Kaplan curve for graft survival of NHBD Vs brain dead, heart beating donor group

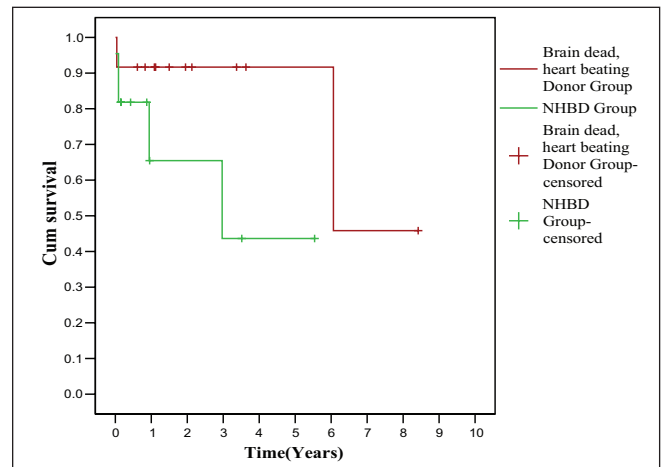


Figure 6: Kaplan curve for patient survival of NHBD Vs brain dead, heart beating donor group

Among the efforts that have been made to increase the number of kidneys available for transplantation is the use of deceased donor organs. However, the discard rate of

kidney from cadaver donors has increased substantially, and this increase has been attributed to the aging donor population.^[4] The discard rate of kidneys recovered from

Table 1: One- and five-year graft and patient survival

	NHBD group		Brain-dead, heart-beating donor group	
	1 Year (%)	5 Year (%)	1 Year (%)	5 Year (%)
Patient survival	65.45	43.64	91.67	91.67
Graft survival	81.82	61.36	91.67	91.67

donors more than 60 years is approximately 50%.^[4] The reasons for refusal of these organs were advanced donor age, history of hypertension, donor instability, more than 20% glomerulosclerosis on biopsy, or a combination of these factors. However, the results of transplantation of such single kidney show poor graft survival. The 5-year graft survival for the single kidney transplant group was 50.9%, while 5-year graft survival for the dual kidney transplant group was 79.5% reported on the UNOS database.^[5] It has been hypothesized that initial nephron mass contributes to graft survival.^[6-8] Increase in the transplanted nephron mass decreases the likelihood of hyperfiltration and sclerosing glomerular injury. Matas *et al.* have shown that additional nephron mass may diminish the immune response against the graft.^[9] The benefit of long-term survival with dual kidney transplantation with donor's initial creatinine clearance of >75 ml/min have shown better results than those donors having creatinine clearance of <75 ml/min.^[10] This further underscores "nephron dose" hypothesis. Remuzzi *et al.* have demonstrated good long-term outcome of renal grafts allocated on the basis of the histological score before transplantation.^[1] In their series, at 3 years of follow-up the creatinine clearance was stable and proteinuria was within normal range predicting good long-term allograft outcome.

The outcome recipients having dual kidney transplantation from DCD donors are poor compared to brain-dead donors. The fundamental problem with DCD donor is warm ischemia, which may lead to suboptimal transplanted organ function. Primary nonfunction or delayed graft function are directly related to primary warm ischemia time. Currently, double balloon catheters for perfusion are not available in India and hence, with the technique described above, improper perfusion of organs might occur, leading to prolonged warm ischemia time. Delayed graft function predicts worse outcome independent of acute rejection.^[11,12] Alfrey *et al.* have shown that major improvement in using the expanded criteria donors as dual versus single graft was a decrease in the incidence of delayed graft function.^[13]

Some centers prefer to place one kidney in either side iliac fossa. We believe that ipsilateral placement of both renal allograft reduces the magnitude of operation. Cadaveric kidney transplant is life saving.^[14] In India, cadaver transplant program is developing. This is an early and limited experience of using marginal donors. We believe that not accepting marginal donors may dampen the enthusiasm of organ donation. To our knowledge, this is the first report

from India showing outcome of dual kidney transplantation using the kidneys from marginal donors.

In conclusion, dual kidney transplantation from expanded criteria brain dead donor gives better long-term graft and patient survival than from non-heart-beating donors. Further refinement in procurement technique, especially for non-heart-beating deceased donor, should improve the overall outcome.

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