ELSEVIER

Graft Survival Rates of Kidneys Harvested From Non–Heart-Beating Donors Using In Situ Machine Washout

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IN JAPAN, non–heart-beating donors (NHBDs) are still a major source of kidneys for cadaveric renal transplantation, although new legislation for organ transplantation has begun to allow the harvesting of organs from heart-beating cadavers.[1] In 1982, we developed an in situ machine washout (ISMW) technique for kidney harvesting from NHBDs that minimizes warm ischemic injury.[2] In this study, we evaluated the function and long-term survival rates of kidneys harvested and transplanted from NHBD using our ISMW technique following intra-aortic catheterization after declaration of death.

MATERIALS AND METHODS

From 1982 to 1995, 102 kidneys were harvested from 51 NHBDs (20 females and 31 males, ages 10 to 69 years; average age 40.8 ± 13.4 years) with ISMW following intra-aortic catheterization after declaration of death. Fifty-three cases (17 females and 36 males, ages 15 to 45 years; average age 32.7 ± 8.1 years) of cadaveric renal transplantation from NHBDs were performed at the Sakura National Hospital, and were analyzed in this study. Forty-nine kidneys were shipped out to other transplant centers and excluded from the study because of different postoperative care and immunosuppression. No kidneys were discarded in our program.

We start the harvesting procedure from NHBDs immediately after declaration of death by heart-beat criteria. After laparotomy is performed, a catheter for in situ perfusion is inserted into the abdominal aorta through the iliac artery and ISMW is started with cold-modified Euro-Collins or modified Collins-HES solution[3] at an initial flow rate of 150 mL/min, increasing to 500 mL/min. The apparatus for ISMW has been previously described.[3] Briefly, it consists of an insulated cool box, roller pump, flow meter, and pressure regulator. In the insulated box, four bags containing 2.5 L of perfusate are immersed in ice slush, and are connected to a multihole catheter inserted into the donor's abdominal aorta. Nine to 20 L of perfusate are usually used throughout the entire procedure. Warm ischemic time (beginning at the declaration of death and ending when ISMW is started) and total ischemic time (ending when the graft is revascularized in the recipient) of the kidneys has ranged from 0 to 30 minutes (average 14.9 ± 6.8 minutes) and 6 hours 45 minutes to 20 hours 30 minutes (average 8 hours 56 minutes ± 3 hours 45 minutes), respectively. As maintenance immunosuppression, 34 patients received cyclosporine and prednisolone, whereas 17 cases were treated with azathioprine, cyclosporine, and prednisolone. FK506 and prednisolone were administered to two cases, postoperatively.

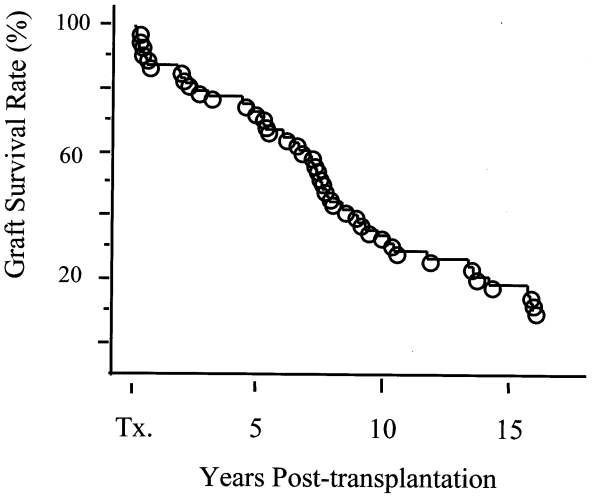

Fig 1. Graft survival rates of kidneys harvested and transplanted from non–heart-beating donors with in situ machine washout following intra-aortic catheterization after declaration of death.

RESULTS

Among 53 kidneys, 13 (24.5%) functioned immediately and 37 (69.8%) were delayed in the recovery of their function and required postoperative hemodialysis for 1 to 39 days (average 11.9 ± 10.2 days) after transplantation. In three cases (5.7%), the grafts never functioned. In the 50 cases that received a functioning graft, the serum creatinine level was 1.87 ± 0.83 (0.6 to 4.3) mg/dL at the time of discharge. As shown in Fig 1, graft survival rates of those 50 cases at 5 and 10 years posttransplantation were 64.0% and 33.2%, respectively.

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DISCUSSION

NHBDs have been the major source of kidneys for cadaveric renal transplantation in Japan, even though new legislation for organ transplantation has allowed harvesting of organs from heart-beating cadavers since 1995.[1] Because of this, insertion of a double-balloon catheter prior to declaration of death has become standard procedure for in situ cooling to prevent ischemic damage of the kidney.[4] Occasionally, however, this method could not be used because of the donor condition or the family's objection. To minimize warm ischemic injury, we originally developed the ISMW technique[3] and used it for kidney harvesting from NHBDs in which catheterization was performed after declaration of death. In this study, we analyzed not only early graft function but also graft survival rates of the kidneys harvested and transplanted from NHBDs using the ISMW technique, in order to prove its clinical efficacy.

Kidney graft survival rates under our procurement program from NHBDs are comparable to those of other renal transplant cases in Japan, 57.4% and 33.5% at 5 and 10 years, respectively,[5] according to the 1994 annual report of the Japanese Transplantation Society. As a single-center analysis in Japan, Yokoyama et al reported a relatively higher graft survival rate of 72.7% at 5 years with the use of a double-lumen catheter. Since 1995, we have been using a double-balloon, triple-lumen catheter inserted prior to declaration of death for ISMW in those cases in which the family's consent was obtained. However, because of the small number of such cases and the lack of long-term follow-up, the beneficial effects of the double-balloon catheter procedure with ISMW on organ harvesting from NHBDs are still under investigation. In any case, even when the insertion of the double-balloon catheter is not available prior to cardiac arrest, ISMW provides sufficient vessel washout and thus is useful for preventing warm ischemic injury of kidneys from NHBDs and for retrieving grafts with good function. This technique could also be applied to organ procurement not only in developing countries[6] but also in other countries to help relieve the chronic shortage of cadaver donors.[7–9]

REFERENCES

1. Ota K: Jpn J Transplant 33:8, 1998

2. Suzuki T, Asano T, Watanabe K, et al: Jpn J Transplant 16:482, 1981

3. Arita S, Asano T, Enomoto K, et al: Transplant Proc 23:2589, 1991

4. Yokoyama I, Uchida K, Tominaga Y, et al: Clin Transplant 7:258, 1993

5. Sonoda T: Jpn J Transplant 30:428, 1995

6. Kootstra G, Wynen R, Van Hoof JP: Transplant Proc 24: 2040, 1992

7. Light JA, Kowalski AE, Sasaki TM, et al: Transplant Proc 29:3553, 1997

8. Cho YW, Terasaki PI, Cecka JM: Transplant Proc 30:3795, 1998

9. Valero R, Sanchez J, Cabrer C, et al: Transplant Proc 27:2899, 1995