MACHINE PRESERVATION OF 450 CADAVER KIDNEYS

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Summary

Cadaver kidneys procured from homeostatic donors can be preserved for periods up to 67 hours without adversely affecting graft survival. Donor creatinine, use of vasopressors, and perfusion characteristics do not seem important factors.

Introduction

Renal transplantation has become a standard therapy for end stage kidney disease throughout the world. As the number of patients on dialysis increases, the need for transplants similarly increases. Although living related kidney donors are preferred in many centres, here we have developed a large dependence on cadaver donors. In this paper, we shall review 450 consecutively preserved cadaver kidneys in order to determine the general success of such grafts as well as factors impinging on successful procurement, preservation and distribution of these kidneys.

Donor preparation

Procurement: All donors were patients with brain death, between 0.5 and 61 years of age. Cardio-respiratory homeostasis was obtained by use of a respirator, fluids, drugs and a hypo-hyperthermic mattress. Hypotension was reversed or prevented by use of 25% salt poor albumin, electrolyte solution, and vasopressors. Blood and urine cultures were obtained and antibiotics used when appropriate. All donors either had a normal serum creatinine or were able to clear creatinine. Maximal diuresis was established using diuretics (mannitol and furosemide) prior to excision. Phenoxybenzamine 100mg was given intravenously at least 30 minutes prior to excision. Pretreatment with methylprednisolone 30mg/kg ensured a relaxed vasculature and decreased the number of passenger leucocytes. Heparin 20,000 U.S.P. units was given prior to nephrectomy.
Nephrectomy

After opening the abdomen via a midline incision, the right iliac artery was can-
nulated. The anterior viscera were rigidly excised by the previously described
techniques of Merkel [1]. The kidneys were flushed with Collins solution in situ
and removed atraumatically en bloc and plunged into a basin of sterile iced saline
where they were dissected. After rinsing with iced saline the kidneys were preserved
by pulsative perfusion preservation.

Preservation

The 'mox' 100 apparatus is employed using cryoprecipitated plasma [2]. Methyl-
prednisolone 800 milligrams, insulin 80 units, magnesium sulphate 8 milliequa-
lents, phenolsulphonphthalein 12 milligrams and penicillin G 250,000 units are
added. Vasospasm is avoided by adding 15mg Rogitine to the perfusate. Kidneys
are brought on the machine to the centre where monitoring and correction of
pH, pressure, and flow are carried out. The kidneys are monitored continuously
by a perfusion technician. If the kidneys cannot be used locally they are trans-
ported to distant centres, accompanied by a technician. Kidneys have been trans-
ported as far away from Chicago as Rome, Italy [3].

Results

Between August 1973 and January 1980, 450 kidneys were procured and pre-
served at our centre. Of these thirty-eight were discarded for one of the following
reasons; lack of suitable recipients (15); poor perfusion characteristics (9); elevated
donor creatinine (2); contamination (3); multicystic disease (3); adenocarcinoma
adrenal gland (2); congenital abnormality (2); ureteral calculus (1); damage by
recipient hospital (1).

The remaining 412 kidneys were transplanted after preservation time of 4—67
hours. Of these, 66 kidneys (16%) never functioned, usually resulting from initial
tubular injury followed by rejection.

Graft survival and incidence of dialysis were studied in relation to length of
preservation. After 4—23 hours of preservation, the incidence of dialysis was
18.3% (21/115) and the one month graft survival was 67.8% (80/118). With
24—35 hours of preservation, the incidence of dialysis was 31.9% (46/144)
and the one month graft survival was 75.1% (130/173). Finally at 36—67 hours
of preservation dialysis incidence was 40.9% (38/93) and the one month graft
survival was 73.6% (89/121). Graft survival at 3 months (54.8%), 6 months
(45.8%) and one year (41%) was similar in all three preservation groups
(Figure 1).

No differences were noted relating to donor creatinine, use of vasopressors
and perfusion characteristics.
Discussion

Donor selection and preparation are the key factors in our method, and length of preservation has no significant effect on graft survival. Although the incidence of dialysis increases with preservation time, this does not seem to adversely affect results. The average wastage rate of kidneys in the United States is 30%, most frequently a result of length of preservation [4]. With the increasing numbers of patients on dialysis, it is important to increase the supply of kidneys. Using longer preserved kidneys should increase the available numbers by nearly one third. Other factors such as donor serum creatinine, perfusion characteristics, etc, do not seem relevant.

Acknowledgments

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References

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Open Discussion

KURUVILA (Bombay) What is the longest period you would accept on perfusion?

MERKEL Well, we have transplanted kidneys at 67 hours so that we generally calculate how long it will take us to prepare a patient and if its within 72 hours we’ll go ahead and accept the kidney. One of our longest preserved kidneys was transplanted by Dr Cortesini in Rome and that patient now, I heard from one of his associates, is alive and well, and one year post transplant. Incidentally, that particular kidney made urine immediately and the creatinine was normal within three days, so it was a very successful transplant.

KURUVILA I might mention that Sam Kountz brought two kidneys from New York to Bombay on a Water’s preservation machine. The total ischaemic perfusion time was 68 hours and they worked immediately.

MERKEL I think this is a problem that has adversely affected kidney sharings throughout the world and in the United States as well and many transplant surgeons and many nephrologists, especially, are reluctant to let their patients be transplanted if you tell them that you have an old kidney. But a kidney that is 58 or 60 hours old is still going to be a functional kidney.

STRUYYVENBERG (Utrecht) Do you have experience with kidneys which have not been preserved on the machine and what is the length of time you think you can use those kidneys?
MERKEL In Chicago we have almost no experience with simple cold flush and cold storage kidneys, although the Terasaki programme in California has quite wide experience in looking at the data through the end-stage renal disease programme in the United States. It appears that there are no significant differences in results, although very few kidneys are being preserved more than 24 to 48 hours with cold storage, and most transplants take place before that time. I sometimes have procured myself as many as 10 or 12 kidneys in a 15–16 day period, and when you have that many kidneys on preservation machines the logistics of trying to transplant them yourself becomes incredible and impossible and they have to be shipped.

COHEN (Leiden) With rising costs in health care we feel that in most parts of Europe cold storage gives adequate results even with implementation of HLA DR typing which does take more time before you transplant the recipient. We have indeed increased cold ischaemic periods of most kidneys transplanted even up to 50 hours. The results, however, in the kidneys preserved up to 24 hours or preserved for more than 24 hours are exactly the same.

MERKEL That’s interesting. May I ask you what the discard rate is when you consider the total number of kidneys harvested in the Eurotransplant programme?

COHEN Discard rate is only a couple of percentages of those kidneys which have been actually nephrectomised. Just because we have such an extended period of acceptable cold ischaemic periods we are able to ship the kidneys, if we have no suitable recipients ourselves, to other areas of Europe. It is also for this reason we have an increased number of kidneys from the United States coming to Europe.

MERKEL Well, that sounds very good.