NON-HEARTBEATING DONORS, IS IT WORTHWHILE?

J A van der Vliet, M J H Slooff, G Kootstra, R A F Krom, B G Rijkmans

University Hospital, Groningen, The Netherlands

Summary

In view of the shortage of cadaveric organ donors a retrospective study has been performed to determine the results of transplantation of non-heartbeating donor kidneys. Graft and patient survival and renal function in the 60 cases analysed in this study, showed no adverse effect of the use of non-heartbeating donor kidneys. The initial graft function was best after in situ cooling of the kidneys, using an intra-aortic double balloon catheter, followed by machine preservation.

It is concluded that nephrectomy of non-heartbeating donors is worthwhile and that these donors should be included in all organ harvesting programmes.

Introduction

The shortage of cadaveric donors is the main limiting factor for the expansion of kidney transplant programmes [1]. Heartbeating (HB) cadaveric donors are the preferred organ source. Non-heartbeating (NHB) donors are used less frequently, because of the fear of poor quality of the harvested organs [2]. Furthermore, nephrectomy of NHB donors requires prompt action and direct availability of personnel and equipment [3]. In this study the results of transplantation of NHB donor kidneys are evaluated, to determine whether it is justified to include NHB donors in organ harvesting programmes.

Materials and methods

In a ten year period, from 1970 through 1979, 38 nephrectomies in NHB donors were carried out at the University Hospital in Groningen. These resulted in 66 kidneys suitable for transplantation, 10 being discarded for various reasons (Table I). In situ perfusion with Collins' solution, using an intra-aortic double balloon catheter, was employed for the rapid cooling of 39 kidneys [3]. Continuous hypothermic perfusion with an albumin solution, using a Gambro preservation machine, was applied for the preservation of 29 kidneys and simple
TABLE I
Non-heartbeating donor kidneys (N=10) not used for transplantation, because of:
- Traumatic damage to the graft prior to nephrectomy 6x
- No recipient found 2x
- Multiple arteries 1x
- Technical failure 1x

cold storage in the remaining 37 cases [4]. The 66 kidneys were transplanted in different centres, including our own. Questionnaires, concerning patient and graft survival, highest creatinine clearance and initial function were sent to all centres involved. All but two centres replied, resulting in 60 cases to be studied. The Eurotransplant material served as a control group.

All survival curves are computed by actuarial methods. Statistical analysis is done by means of the chi-square test.

Results
Graft survival of the 60 NHB donor kidneys, harvested in Groningen and transplanted in different centres, including our own, did not differ from the Eurotransplant control group (Figure 1). The patient survival in this group was even better (p < 0.02) than that of the control series (Figure 2). The mean highest creatinine clearance of the functioning grafts in this group was 72.7ml/min (Figure 3). In situ cooling and machine perfusion was used in the preservation of 18 kidneys; there was immediate life sustaining function (i.e. no postoperative dialysis required) in 13 cases (72%). Only one of these techniques was used in the preservation of 21 kidneys, which resulted in immediate life sustaining function in 8 cases (38%). In the remaining 21 cases none of these techniques were employed and only 3 (14%) had immediate life sustaining function. The initial function of the grafts was significantly (p < 0.001) better when a combination of in situ cooling and machine perfusion was used.

![Figure 1. Graft survival: NHB donor group and Eurotransplant controls](image)

446
Figure 2. Patient survival: NHB donor group and Eurotransplant controls

Figure 3. Highest creatinine clearance of 43 NHB donor kidneys after transplantation

Discussion

In the data presented no adverse effect of the use of NHB donor kidneys for transplantation on graft and patient survival can be demonstrated. The ultimate graft function, measured by creatinine clearance, of NHB donor kidneys is fair. The immediate postoperative function of NHB donor kidneys can be improved by the combined use of in situ cooling and machine preservation and thus be brought to an adequate level. An additional advantage of machine preservation over cold storage is that it offers an opportunity for selection between viable and non-viable kidneys [2,4–7].

Nephrectomies of NHB donors are relatively laborious, especially when the
above mentioned techniques are used. In the Groningen transplant centre NHB donors form 30% of all available donors and are an important source of cadaveric kidneys for transplantation. The results of this study justify inclusion of these donors in all harvesting programmes.

Acknowledgments

The authors wish to thank Mr VJ Fidler for his help with the statistical analysis and Mr H Groningen á Stuling for the preparation of the figures.

References

1 Eurotransplant foundation. Annual Report 1978
5 Toledo-Pereyra LH, Simmons RL, Moberg AW, Olson LC, Najarian JS. Arch Surg 1975; 110: 1031
7 Anderson CB, Sicard GA, Etheredge EE. Surg Gynecol Obstet 1979; 149: 697

Open Discussion

BRYNGER (Chairman) Are these donors brought into hospital dead on arrival or do they have sudden deaths in the hospital?

SLOOF People who are brought in dead on whom resuscitation is tried but they are not heart-beating. We have certain laws which allow us to take out kidneys. There are also the cases of heart surgery who die on the table and we harvest them too.

BRYNGER In Sweden we relied solely on these kind of kidneys up to 1974 and I have personal experience of rushing for donors and I am personally very happy that we are able to take them out after ventilator switch-off nowadays.

SLOOF The most important thing is that you don’t have to rush anymore with this type of donor. The catheter can be placed by the junior resident. It is not a difficult procedure and then he can call the transplant surgeon and that’s the most important point I think from the paper.

MERKEL (Chicago) I do think that as time goes on more and more differences between the use of preservation and just simple cold storage is going to become apparent. I think that it is difficult to imagine that one is going to be able to preserve for longer periods than 50 hours with cold storage because cold storage doesn’t do anything to keep the kidney going. Possibly perfusion at cold temperatures may provide some biochemical basis for longer preservation. Perhaps normothermic preservation in the end will allow us to preserve kidneys for even longer periods, perhaps up to two weeks. I am not quite certain how you decide whether
a patient is going to receive your balloon method of in situ preservation and then organ retrieval. Are these patients who have cardiac arrests and cannot be resuscitated or are these patients that you just allow to arrest but who are in good shape and have been resuscitated and have been well hydrated? If you are able to use it in non-prepared patients this would be a major advance. Finally, I wonder if there are any differences in age groups because we found that preservation of kidneys in younger people seems to work better than preservation of older kidneys. Not that a kidney of 55 or 60 years old will not support life and work well but if there are flaws in our removal technique or in our preservation technique the 50 year old kidney or the 60 year old kidney does not seem to survive as long on preservation and does not seem to work quite as well. Could you elaborate on this?

SLOOF We have not looked into the different age groups, but I fully agree with you that there must be a difference in the older age groups. Of course there are many differences with the non-heart beating donor. You have what I call the ventilator switch off donor, that is, you have quite a lot of people in the country who refuse to accept the criteria of brain death. They say you may only remove the kidneys when the heart has stopped. That’s a very good donor too because we just place the patient in the operating room and then we switch off the ventilator and we wait until we have cardiac arrest. It is very difficult to compare these types of donor but we did compare because we have a small group. There is a difference from the donor we receive after a road traffic accident who has been dying on the road.

McCOWN (Belfast) Over the years we have not used heart beating donors and have no locally retrieved kidneys as yet from heart beating donors. Through ’78 and ’79 we had the ventilator switch-off type you have just described, who certainly have a much higher incidence of immediate kidney function. But what matters is the long term kidney function and the majority of our kidneys up to 1975 have had a substantial initial warm ischaemia time after heart beat ceased, 30–80 minutes for that group of patients, and their long term graft survival including loss of grafts, from any cause either related or unrelated to the transplant, is 72%. I feel the point you have made that non-heart beating donors are a useful source of material is very important.