Occasional Survey

National Organ Matching and Distribution Service

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Summary

In the first eleven months of the National Organ Matching and Distribution Service 455 kidney transplants were notified. A high proportion of first transplants failed within seven days of operation, probably reflecting low quality of some of the donor kidneys supplied. To improve the results of renal transplantation and to serve the increasing number of potential recipients registered with the service, as well as to obtain the optimum blood and tissue group compatibility of donor and recipient, many more kidneys are needed.

Introduction

Survival of kidney grafts is longer when donor and recipient are genetically similar than when they are completely unrelated.[1 2] In transplants between siblings the best results are obtained when donor and recipient have identical tissue types.[3 4] It seemed reasonable to hope that the survival of cadaver kidney transplants could also be improved by selecting (if possible) a recipient whose HL-A type is identical with that of the donor.

As knowledge of the HL-A system developed it became apparent that no single dialysis/transplantation unit could maintain a large enough panel of prospective recipients to ensure that cadaver kidneys were given to even reasonably well-matched recipients. Accordingly co-operative groups of transplant specialists developed who pooled their tissue-typing data and tried to allocate their donor kidneys to the best-matched recipients. Van Rood[5] proposed that inter-unit co-operation should be extended beyond national boundaries, and through his efforts the Eurotransplant Foundation was established. Two further kidney-sharing organizations, France Transplant and Scandia Transplant, quickly followed. In Britain a pilot scheme not financed by public funds was established by Festenstein at the London Hospital (the London Transplant Group), which collaborated with many of the transplant units in the United Kingdom and Ireland. Similar co-operative groups were set up at Newcastle and at Guy's Hospital. It was not until February 1972 that a National Organ Matching Service financed by the Department of Health was established. This service, based at the Regional Transfusion Centre, Bristol, receives data about prospective kidney recipients and arranges the transport of kidneys for tranplantation between hospitals when required.

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Recipient File

The basic data concerning patients awaiting kidney transplantation are forwarded to the service. The minimum information required for donor matching includes the recipient's name, hospital, recipient pool number (allocated by the service), ABO group, interpreted HL-A type, presence of cytotoxic antibodies, and details of HL-A immunization by previous transplantation, transfusion, or pregnancy. In addition an "urgency category" is recorded. This is decided for each patient by the doctors in charge, and categories available are: (1) urgent, any ABO-compatible kidney is acceptable regardless of HL-A match; (2) non-urgent, best available HL-A match; (3) good match required though not necessarily HL-A identical—the donor must present no recognized incompatibility to the recipient but may have fewer HL-A antigens than him; (4) good match required, HL-A identical donor only; (9) temporarily unfit for transplantation. The recipient file is updated by the addition of new patients twice weekly and by amendments to urgency category, etc.; and deletions, whether permanent or temporary, can be carried out daily. Twice weekly an antigen-ordered list of recipients is printed out; this can be used in emergency in the event of a failure of the computer. It is also used as a quick check on the matching programme when a donor is offered. In addition to these national lists of patients on the "active" list a weekly print-out is made and posted to each transplant unit showing their own patients and the data about them which the computer uses in the matching programme. The unit is asked to notify the service immediately should the print-out contain any erroneous information.

Procedure When Donor Becomes Available

When a kidney becomes available the transplant unit sends by telephone or telex to the service duty officer details of clinical conditions, blood pressure, renal function, ABO group, and tissue type. The duty officer also notes whether the donor's blood has been tested for the hepatitis B (Australia) antigen and records the telephone numbers of those who can supply the recipient surgeons with further information about the donor.

Donor details are then fed into the South-western Regional Hospital Board's computer and the matching process is set in action. The matching programme selects the most suitable recipient in terms of HL-A matching and the computer prints out three lists of up to 10 recipients. List 1 shows the best matches in the donor centre; list 2 the best matches in the donor region (within three hours' travelling time); and list 3 the best matched recipients throughout the United Kingdom and Eire. The order in which regional and national lists are completed accords with certain criteria: (1) HL-A matching: HL-A identical recipients before those with any mismatch and ABO identity before ABO compatibility; (2) one antigen mismatch; (3) category 1 recipients (urgent); (4) more than one mismatch.

Competition for a given place on the list is resolved if one patient is known not to have cytotoxic antibodies. Since it is

unlikely that a positive cross-match will occur when cells from the donor are tested with his serum, this patient is placed above those with antibodies, while those whose antibodies have a low reaction frequency are placed above those with antibodies of a broader specificity. If competition still exists a "fair share" key is used and the patient whose transplant unit has been waiting longer for a kidney is preferred. The recipient pool number, which indicates in general which patient has been waiting longest for a kidney, is used by the computer as a final ordering criterion.

As soon as the recipient list is available the donor centre doctors are contacted, by telephone or telex, and can then elect to offer one, both, or neither kidney for use elsewhere. A kidney made available for distribution is offered to the doctors caring for the patients on the recipient list. Frequently the first patient on the computer list may not be suitable or available for transplantation at that time, but as soon as a kidney is accepted the service duty officer takes complete charge of the arrangements for transport and remains on duty from the time the kidney leaves the donor centre until it arrives at its destination. After a suitable interval (usually next day) a check is made that the kidney has been used so that the recipient may be deleted from the active waiting list.

Progress of the Service

The National Organ Matching Service was brought into operation on 1 February 1972 with a prospective recipient pool of 450. During the first 17 months of operation this number has increased, and on 30 June 1973 was 796. The ABO group distribution of the recipients is of some interest. Group O patients comprise 56-58% of the pool, and group A 30-33% (table I). These figures have remained virtually static during the 17 months. The relatively low proportion of group A recipients is much lower than in the general population (about 42%[6]). A depletion of the group A recipient pool might be brought about by the use of group O kidneys for group A recipients because of good HL-A matching, or because of clinical necessity. Out of a total of 65 kidneys from group O donors used for group A recipients during the 17 months, 33 were used in the donor centre and the service has no control over their use. If all of these 65 kidneys had been given to group O recipients, the ABO distribution of the pool would now differ only slightly from that of the general population. In an organ matching service orientated towards HL-A matching some depletion of the group A pool may be expected. As the number of group A patients in the pool decreases it is more difficult to find well-matched recipients for group A kidneys. Ultimately kidneys of this group may be wasted. If this undesirable situation is to be averted it is important that, within the limits of clinical urgency, donor and recipient should be of identical ABO group; in addition, so as to provide for the occasional use of group-compatible rather than identical kidneys strenuous efforts should be made to increase the number of kidneys obtained from group O donors.

TABLE I—*Total Number and ABO Graft Distribution of Patients Awaiting Renal Transplantation*

	February 1972	September 1972	March 1973	June 1973
	No. (%)	No. (%)	No. (%)	No. (%)
Group A	152 (32·5)	199 (32·5)	219 (30)	246 (31·5)
Group AB	13 (2)	17 (2)	19 (2·5)	20 (2·5)
Group B	31 (7·5)	53 (9)	69 (9·5)	70 (8·5)
Group O	254 (58)	356 (57)	419 (58)	460 (57·5)
Total	450 (100)	625 (100)	726 (100)	796 (100)

All kidneys transported by the service are cadaver organs and are procured at many hospitals without a transplant unit. The largest single cause of death among donors is accidental injury (table II). The number of kidneys obtained varies considerably from month to month, the highest and lowest figures for kidneys transplanted per month to patients on the service list being respectively 53 and 22. Unfortunately the number of kidneys obtained does not yet balance the number of recipients being added to the waiting list. Clearly many more kidneys are needed for transplantation and every effort is made at the service to ensure that all available kidneys are used. Nevertheless, some kidneys offered for distribution cannot be placed (table III).

TABLE II—*Causes of Death in 266 Cadaver Donors Notified to the Service between 1 February and 31 December 1972*

	No. (%) of Donors		No. (%) of Donors
Injury	140 (52·6)	Cardiac arrest	8 (3·0)
Cerebral vascular accident	78 (29·4)	Respiratory failure	4 (1·5)
Cerebral tumour	16 (6·0)	Other causes	4 (1·5)
Self-destruction	16 (6·0)		

TABLE III—*Reason for Inability by Service to place 25 Kidneys Available for Distribution between 1 February and 31 December 1972*

No good HL-A matches available	13
No good matches plus long warm ischaemic time	2
Long warm ischaemic time alone	7
Long warm ischaemia plus anatomical abnormalities in donor vessels	2
Infection in donor	1

Results and Future Developments

As an integral part of the kidney distribution service it is important to identify, if possible, factors which may influence the outcome of transplantation. The European Dialysis and Transplant Association carries out a yearly survey of patients receiving regular dialysis or transplantation, or both. The data obtained provide much information on dialysis, but less on transplantation, so that the service devised and issued an additional questionnaire, including details of warm and total ischaemia times, transplant function, and immunosuppression. The service questionnaire data are incomplete without the European Dialysis and Transplant Association data which, for the patients reported here, are not yet available. Nevertheless, a preliminary analysis of the service data has been carried out (tables IV-VII).

Clearly no definite conclusions can be drawn about long-term function, so that consideration has been given only to whether a transplant has functioned or failed; if the transplant has failed before 31 December 1972 the interval between transplantation and failure was noted. During the 11 months 1 February 1972 to 31 December 1972 455 transplants were notified to the service. Of these, 411 were carried out on or before 30 November 1972, allowing a minimum of one month's follow-up. Relevant to these 411 transplants 375 completed questionnaires were returned (91·2%), of which 324 referred to first transplants and 51 to second or subsequent grafts.

The proportion of first transplants which failed has been compared with the number of antigens in common (table IV). No information on the accuracy of tissue typing is available and quite possibly some of the transplants, ostensibly four-antigen identical, may, in fact, have been only "three in common." Similarly a proportion of the "three in common" group may have been four, or even two. There is no major trend in the short-term failure rate of kidney transplants analysed according to initial warm time, total ischaemic time, or age of donor (tables V, VI, and VII), but these aspects will be reviewed regularly. Second and subsequent transplants in general fared worse than first transplants, but numbers are too small to justify more detailed analysis.

A distressing feature of the results obtained is the high proportion of first transplants (17·3%) which failed within the first

TABLE IV—*Outcome of Transplantation Analysed by Number of HL-A Antigens Shared by Donor and Recipient*

	Number of HL-A Antigens Shared by Donor and Recipient					
	4	3	2	1	0	Total
No. of transplants	17	109	136	33	29	324
Functioning at 31/12/72	11	74	84	15	16	200
Failed before 31/12/72	6 (35%)	35 (32%)	52 (38%)	18 (55%)	13 (45%)	124
Failed before end of first week after transplant	3	16	22	8	7	56

TABLE V—*Outcome of First Transplantation versus Warm Ischaemia Time*

	Initial Warm Ischaemia Time (min)					
	0-15	16-30	31-45	45	No Details	Total
No. of transplants	88	143	50	34	9	324
Functioning at 31/12/72	62	79	34	19	6	200
Failed by 31/12/72	26 (30%)	64 (45%)	16 (32%)	15 (44%)	3 (33%)	124 (38%)

TABLE VI—*Outcome of First Transplantations versus Total Ischaemia Time*

	Total Ischaemia Time (hrs)					
	0-3	4-6	7-9	10-12	12	Not Recorded
No. of transplants	15	65	99	63	62	20
Funtioning at 31/12/72	9	37	59	45	35	15
Failed by 31/12/72	6 (40%)	28 (43%)	40 (40%)	18 (29%)	27 (44%)	5 (25%)

TABLE VII—*Outcome of Transplantation versus Age of Donor*

	Age of Donor						
	0-10	11-20	21-30	31-40	41-50	51-60	60+
No. of transplants	25	74	58	32	56	32	8
Functioning at 31/12/72	14	49	29	25	30	20	6
Failed by 31/12/72	11 (44%)	25 (34%)	29 (50%)	7 (22%)	26 (47%)	12 (37%)	2 (25%)

seven days of operation. This figure must include a significant number of kidneys which failed to function at all (primary non-function) because of irreversible ischaemic damage. It therefore reflects to some degree the quality of the kidneys used for transplantation. The present shortage of donor kidneys doubtless encourages the transplant surgeons to use organs which they might prefer to discard but for reasons of clinical urgency they are forced to use.

Kidney transplantation is by no means a permanent cure for irreversible renal failure. Nevertheless, the recipients of a satisfactory graft lead a normal life, and the apparatus (and hospital staff) on which they depended for dialysis are freed for treating new patients. Transplantation thus permits dialysis centres to increase the number of patients treated, though at present less than half the people who might benefit from haemodialysis or transplantation, or both, do actually receive it.[7] For this reason, and to reduce the number of non-viable kidneys transplanted, there is a deep need for more kidneys made available for transplantation. Most of the burden of donor procurement must be borne by the transplant surgeons themselves, but their efforts will not achieve great success without support and encouragement from their clinical colleagues at all levels in hospital.

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