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Comparative analysis of kidneys retrieved from the same donor and transplanted into different recipients

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Abstract We have reviewed the outcome of kidney transplantations where both kidneys retrieved from the same donor were transplanted at our Department and the factors which might be decisive in the outcome. Between 1973 and 1996, 1325 kidney transplantations were performed at our Department. In 360 cases, both kidneys retrieved from the same donor were transplanted at our Department. We evaluated only first transplant cases who were treated with a combination of cyclosporin and prednisolon. After this selection, 248 pairs of kidneys were left for analysis. We divided them into three groups. The first comprised immediately functioning kidneys (135 pairs), the second, no immediate graft function in any of the recipients (29 pairs). The third group was mixed: the kidneys retrieved from the same donor were functioning in one recipient and not in the other, so this group was omitted from the analysis. We therefore analysed the donor factors of age, sex and cause of death. We found no

significant difference between the groups relating to the cause of donor death. There was, however a significant difference in the age of donors: those kidneys functioning well in both recipients derived from a younger donor group (16–40 years), 18/58 versus 136/270, $P < 0.01$, $\chi^2 = 7.17$. There were significantly fewer older donors (41–65 years) in the immediately functioning group than in the other, 38/58 versus 110/270, $P < 0.001$, $\chi^2 = 11.84$. We investigated the number of HLA mismatches, ischaemic time, cytotoxicity index and the type and duration of pretransplantation dialysis. It appears from this analysis that the age of the donor is a significant factor in the short-term outcome of transplanted kidneys. Recipient factors as HLA match, ischaemic time and cytotoxicity index seems to be less important.

Key words Kidney transplantation · Outcome · Donor factors · Recipient factors · Paired kidneys

Introduction

It is still not known exactly how non-immunological factors influence the results of kidney transplantations and, in particular, their role in short- and long-term survival [5]. In order to analyse possible factors which might be decisive in the outcome, we reviewed the results of kidney transplantations where both kidneys retrieved

from the same donor were transplanted at our Department [1].

Materials and methods

From 1973 until 31st December 1996, 1325 kidney transplantations were performed at our Department. In 360 cases, both kidneys re-

Table 1 Effect of donor age on the transplantation outcome (Group I, recipients with immediately functioning kidneys, Group II, recipients with non-functioning grafts)

Age group of donors (years)	Group I (number of recipients)	Group II (number of recipients)
< 16	22	2
16–40 ^a	136	18
41–65 ^b	110	38
> 65	2	0
Total	270	58

^a Comparison of outcome: $\chi^2 = 7.17$, $P < 0.01$

^b Comparison of outcome: $\chi^2 = 11.84$, $P < 0.01$

Table 2 Parameters of the recipients which may influence the outcome of transplantation (+ significant factor, – not significant factor)

Parameter	Group I (immediate function)	Group II (no immediate function)	Significance
Average age (years)	42.18	42.17	–
Time of hospital treatment (days)	20.26	27.60	+
Cytotoxicity titre	4.91	2.93	–
HLA-Ab mismatch	1.96	2.02	–
DR mismatch	0.94	0.76	+
Haemoglobin	10.08	8.0	+
Serum creatinine	838.59	840.93	–
Serum potassium	5.33	5.31	–
Serum protein	73.23	74.11	–
pH	7.36	7.37	–
Serum standard bicarbonate	21.18	22.28	–

trieved from the same donor were transplanted at our Department [3]. We analysed the outcome of these transplantations (so-called paired kidneys) [2]. We evaluated only those cases where both recipients received their first transplants and, in order to exclude the influence of immunosuppressive treatment, we investigated only those patients who were treated with a combination of cyclosporin and prednisolon. After this selection, 248 pairs of kidneys remained for analysis; i. e. 248 pairs of kidneys were retrieved from 248 donors and transplanted into a total of 496 recipients.

We divided the recipients into three different groups. The first group included those recipients who had an immediately functioning kidney (135 pairs, i. e. 270 recipients). The second group included those pairs where there was no immediate graft function in any of the recipients (29 pairs, i. e. 58 recipients). The third group was mixed; the kidneys retrieved from the same donor behaved in a different manner, i. e. functioning in one recipient and not in the other. The first and second groups were homogeneous regarding kidney function, therefore we examined these two groups only and omitted the third, heterogeneous group.

Thereafter, we analysed donor factors, evaluating the age, sex and cause of death for each donor.

Results

We compared only the group where both kidneys functioned immediately with that where none functioned. There was no significant difference in the cause of donor death between the two groups; in the majority of cases there was isolated cerebral trauma and cerebrovascular accident, in the same proportion. Regarding the sex distribution of donors, there were more males than females, although this was not significant.

The average age of those donors whose kidneys functioned well in both recipients was younger (35.07 years) than in the non-functioning group (43.66 years). This difference was even more marked when we divided the donors into four age groups. In the first group the donors were younger than 16 years, the second group included donors aged between 16 and 40 years, the third, donors aged between 41 and 65 years and the fourth, donors above 65 years.

The kidneys functioning well in both recipients derived from a younger donor group (16–40 years). In the group where none of the kidneys functioned immediately, there were 18 recipients receiving kidneys from donors in the age group between 16 and 40 years and 58 recipients were transplanted with a kidney which derived from donors of the older age groups. Only two received kidneys from very young donors. In the group where both kidneys functioned immediately, 136 recipients received kidneys from donors in the age group between 16 and 40 years and the other 110 recipients were transplanted with a kidney which derived from donors in the age group between 41 and 65 years. The number of younger donors, below 16 years, was 22 and only two patients received kidneys from donors above 65 years.

The difference in the recipient groups when donors from the 16–40 age group was analysed was significant; 18/58 versus 136/270, $P < 0.01$, $\chi^2 = 7.17$ (Table 1).

There were significantly fewer older donors in the well functioning than in the non-functioning group. In the group with immediate kidney function, there were only 110 recipients out of the total number in the group, which was 270, who received a kidney from donors in the age group between 41 and 65 years. In the group of the non-functioning kidneys, on the other hand, there were 38 recipients, out of the total number of 58, who were transplanted with a kidney deriving from donors in the age group between 41 and 65 years. Comparing the outcome for the two groups 38/58 versus 110/270, the difference is significant; $P < 0.01$, $\chi^2 = 11.84$ (Table 1).

We supposed that in those cases where the kidneys from the same donor were functioning in two entirely different recipients, there were no disturbing influencing factors from the recipients' side; the fate of the kidney depended on the donor conditions. We found a sig-

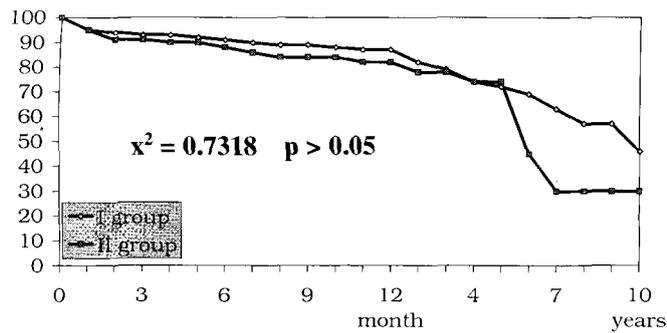


Fig. 1 Cumulative survival rate of kidneys (*I group* immediate function, *II group* non-function)

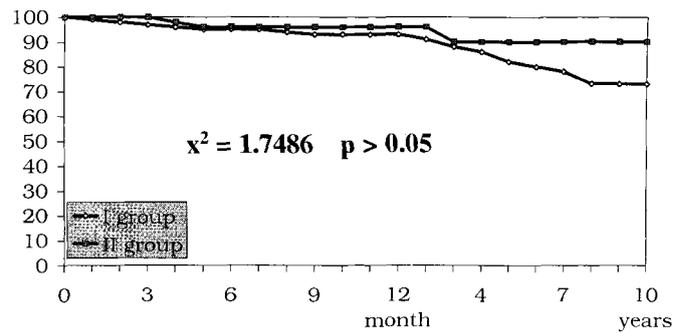


Fig. 2 Cumulative survival rate of patients (*I group* immediate function, *II group* non-function)

nificant difference in the technique of organ procurement. The results were better in those cases where the kidneys were removed separately, compared with the en-block technique. Of the kidneys transplanted in the non-functioning group, 48 had been removed en bloc and only 10 had been retrieved separately. In contrast, in the immediately functioning group, 174 kidneys had been removed en bloc and 96 retrieved separately ($\chi^2 = 7.321$, $df = 1$).

We investigated all those factors which could show differences in the recipients (Table 2). The age distribution, the number of HLA mismatches, the warm and cold ischaemic time, the cytotoxicity index and the type and average duration of the pretransplantation dialysis was the same. We discovered only one factor which showed a significant difference. The recipients' haemoglobin level before transplantation was significantly

higher in the non-functioning cases. This suggests, that a low blood viscosity is an advantageous factor for the early function of the kidney.

Comparing the cumulative survival rates of the kidneys (Fig. 1) and of the patients (Fig. 2) there was no difference between the two groups.

Discussion

From this analysis it appears that the age of the donor is a significant factor in the short-term outcome of transplanted kidneys. The technique of removal and the preoperative haemoglobin value of the recipient may also play a great part. Recipient factors such as HLA match, ischaemic time and cytotoxicity index seem to be less important [4].

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