The Impact of Donor and Recipient Age on the Outcome of Kidney Transplantation

O.J. Kwon, H.G. Lee, and J.Y. Kwak

ABSTRACT

Background.   As survival has improved in the general population over the last few decades, the age of patients participating in renal transplantation has also increased. This study sought to investigate the impact of donor and recipient age as predictors of long-term graft survival in renal transplantation.

Materials and Methods.   We analyzed transplantation outcomes in 598 patients who received renal transplants from 1979 to 2002. Patients were divided into 4 groups according to their age at renal transplantation. Group A (donor age <50 years, recipient age >50 years, n = 19/3.2%); group B (donor age >50 years, recipient age <50 years, n = 153/25.5%); group C (donor age <50 years, recipient age >50 years, n = 69/11.6%), and group D (donor age <50 years, recipient age <50 years, n = 357/59.8%). Univariate analysis to assess the effect of donor and recipient age as predictor factors of graft outcome was complimented by Kaplan-Meier and log-rank methods to assess graft survival with $P < 1.05$ considered significant.

Results.   In the elderly donor group, graft survival was 92.8% at 1 year and 85.6% at 3 years; in the younger donor group, they were 93.4% and 90.2%, respectively, a difference that was stastistically significant ($P = .02$). Univariate analysis of age factors showed a significant reduction in graft survival among recipients who received kidneys transplants from donors older than 50 years, although recipient age >50 years was not found to be an independent risk factor. The incidence of acute rejection was 24.6% in the elderly donor group and 23.5% in the younger donor group (P = not significant). Among the 4 groups, the best result was group D with 1-year and 3-year graft survival rates of 93.3% and 90.5%, respectively, but this result was not statistically significant.

Conclusions.   These results may help the design for transplantation strategies for kidneys procured from elderly donors and for allocation to elderly recipients.

THE INCREASING gap between demand and availability of human kidneys for transplantation has resulted in the use of cadaveric and living donors with decreased renal function, including donors who are older than 50 years. In many studies, donor age has been identified as the most important factor determining long-term outcomes after kidney transplantation. Prommool et al[1] suggested the strongest factor affecting long-term outcome at 5 years after renal transplantation was donor age ≥55 years. However, there are many controversies[2] regarding the quality of graft function and survival after transplantation with an "aged kidney." The aim of our study was to determine whether donor and recipient age, or donor/recipient age matching affected graft survival.

PATIENTS AND MATERIALS

We analyzed 598 patients who received renal transplants from 1979 to 2002. We divided the 2 groups according to donor age: the young donor group included 426 donors <50 years (35.1 ± 8.1); the old donor group, 172 donors aged >50 years (56.2 ± 4.6). We also divided the transplants into 4 groups according to age matching: group A (donor age ≥50 years, recipient age ≥50 years, n =

From the Department of Surgery, College of Medicine, Hanyang University, Seoul, Korea.

Address reprint requests to O.J. Kwon, Associate Professor, Department of Surgery, College of Medicine, Hanyang University, Seoungdong Post Office Box 93, SeoungdongKu, 133-600 Seoul, South Korea. E-mail: ojkwon@hanyang.ac.kr

Table 1. Characteristics of Study Population Group According to Donor Age

	Donor Age		
	Age ≥50 (n = 172)	Age <50 (n = 426)	P
Donor age (y) (Mean ± SD)	56.2 ± 4.6	35.1 ± 8.1	NS
Acute rejection (%)	24.6	23.5	NS
HLA-AB matching (mean, no.)	2.79	2.75	NS
HLA-DR matching (mean, no.)	1.10	1.02	NS
Diabetics (%)	5.3	5.5	NS
ATN (%)	2.4	0.7	.09
Malignancy (%)	2.3	1.2	NS
Serum creatinine 1 y (mg/dL) (Mean ± SD)	1.7 ± 0.5	1.5 ± 1.2	NS
Graft survival (1 y/3 y/5 y, %)	92.8/85.6/78.1	93.4/90.2/86.2	.02

Abbreviation: NS, not significant.

19/3.2%): group B (donor age ≥ 50 years, recipient age <50 years, n = 153/25.5%): group C (donor age <50 years, recipient age ≥50 years, n = 69/11.6%); and group D (donor age <50 years, recipient age <50 years, n = 357/59.8%). We retrospectively compared 4 groups for their long-term outcomes of renal transplantation. The protocol of immunosuppression was similar for each group. Univariate analysis was used to assess the effect of donor and recipient age as predictive factors for graft outcome, using the Kaplan–Meier method (log-rank) with $P < .05$ considered significant.

RESULTS

Table 1 summarizes the characteristics of the study population group according to donor age. The cumulative incidence of acute rejection episodes among patients who received grafts from an older donor was higher (24.6% vs 23.5%) than that for young donor grafts, but the difference was not statistically significant. Among the total population (n = 598), the cumulative graft survival was 93.2% at 1 year; 88.9% at 3 years; and 83.8% at 5 years. There was a statistically significant difference in 1-, 3-, and 5-year graft survival rates between the groups partitioned according to donor age (Table 1). According to recipient age, the 1-, 3-, and 5-year graft survival rates were 92.8%, 87.1%, and 85.9% in old recipients (age ≥50 years) and 93.3%, 89.2%, and 83.4% in young recipients (age <50 years), respectively. There were no significant differences between the 2 groups according to recipient age. Among the 4 groups classified according to donor/recipient age matching: Group A (old donor/old recipient) had the lowest 1-year, and

3-year graft survival rates of 89.4% and 83.8%, respectively. Moreover, this group displayed the highest acute rejection rate of 42.1%, and an acute tubular necrosis rate of 5.6%, which was the highest among the 4 groups (Table 2).

DISCUSSION

In clinical practice, variable results have been reported after transplantations from elderly renal donors. Sakellariou et al[2] reported the results of engrafting living donor kidneys from age-matched recipients, showing no difference in graft survival between kidneys from living donors older versus younger than 45 years. Darmady[3] observed that the 5-year graft survival rate of kidneys from donors between age 21 and 30 years was twice that obtained with donors between age 61 and 84 years. Also, the United Network of Organ Sharing (UNOS) registry[1] from 1987 to 1995 showed an 81% 5-year survival rate of HLA-matched kidneys for donors aged 21 to 30 years. This success decreased to 39% when the donor age was >60 years. In our experience, there was statistically significant lower cumulative graft survival for the so-called aged kidney (≥50 years of age).

Darmady[3] postulated that the higher graft failure rate of older kidneys may be due to nephron aging changes with "decreased adaptability" after transplantation. But Speybroeck et al[4] suggested the cause of the graft failure would more likely be immunologic or technical rather than directly attributable to "nephron aging." Fijter et al[5] suggested that the loss of older kidneys was related to an increased incidence of acute rejection episode in the first

Table 2. Characteristics of Study Population Group According to Donor and Recipient Age

	Group A	Group B	Group C	Group D
Donor age (y) (Mean ± SD)	56.4 ± 5.8	56.2 ± 4.5	33.9 ± 8.6	35.3 ± 7.9
Recipient age (y) (Mean ± SD)	55.0 ± 3.4	33.9 ± 8.1	54.4 ± 3.5	34.9 ± 8.3
Acute rejection (%)	42.1	22.4	23.2	23.2
HLA-AB matching (mean, no.)	2.3	2.8	2.6	2.7
HLA-DR matching (mean, no.)	0.9	1.1	1.0	1.0
Diabetics (%)	5.3	5.3	17.4	3.2
ATN (%)	5.6	2.0	1.4	0.5
Malignancy (%)	5.3	2.0	2.9	0.8
Serum creatinine 1 y (mg/dL) (Mean ± SD)	1.6 ± 0.4	1.7 ± 0.5	1.4 ± 0.5	1.0 ± 0.4
Graft survival (1 y/3 y, %)	89.4/83.8	93.4/86.2	93.7/87.8	93.3/90.5

few posttranplantation months. Namely, grafts from older donors may already display tissue inflammation at the time of procurement and transplantation, which in turn may increase immune recognition. Our study confirmed that the changes associated with aging, such as progressive decrease in number and size of glomeruli, progressive decrease in the glomerular filtration volume, and increased immunogenicity of aging kidney, could impact the outcome of kidney transplantation. Furthermore, we showed that the old donor/old recipient group had the lowest 1-year and 3-year graft survival rates, the highest ATN rate (although statistically insignificant), and the highest acute rejection rate. We conclude that old living donor kidneys should, if possible, be donated to young recipients. Furthermore we should be concerned about the immunosuppressant regimen in the old age donor group.

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