ELSEVIER

Long-Term Safety of Living Kidney Donors Aged 60 and Older

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ABSTRACT

In Japan, kidney transplantation procedures are usually dependent upon live donors. As the recipient ages have been increasing, so has there been a corollary increase in the age of the live donors. Despite this being controversial, the use of older donors is becoming increasingly common. The purpose of our study was to evaluate the long-term safety of accepting older living kidney donors and graft survival rates. We retrospectively analyzed long-term donor outcomes for consecutive patients at our institution between January 1990 and December 2011. Older live kidney donors were defined as ≥60 years and younger live kidney donors were defined as <60 years old. Thirty-three were ≥60 years and 55 donors were <60 years. The mean follow-up term was 7 years and 4 months. Predonation, older donors had a lower estimated glomerular filtration rate (eGFR) level (77.1 ± 9.5 mL/min/1.73 m^2) than younger donors (85.8 ± 14.6 mL/min/1.73 m^2; $P < .01$). More older donors had a history of hypertension (42.4% vs 9.1%; $P < .01$). In both groups, eGFR levels decreased about 40% immediately after nephrectomy. Residual renal function though was stable on long-term follow-up. The incidence of de novo hypertension and proteinuria after nephrectomy was not different between the 2 groups. In older donors, there were no perioperative complications that required extended hospital stays. Graft survival over a period of 10 years was similar in both groups. In our study, donor age had no influence on the deterioration of renal function after nephrectomy. Regardless of age, careful evaluation and follow-up are important for the donor's long-term safety after donation.

IN JAPAN, live kidney transplantation accounts for 85% of all kidney donations because there is a lack of cadaveric donors. As recipients' ages increase, the ages of live donors is also rising. About 40% of live donors in Japan are aged 60 and older. Even though these older donors are being accepted, there are few studies about the long-term safety of older donors. In this study, we evaluated the long-term safety of older living kidney donors and graft survival.

MATERIALS AND METHODS

From January 1990 to December 2011, a total of 100 nephrectomies were performed with live donors at the Japanese Red Cross Kumamoto Hospital. We collected data about donor's age, gender, body mass index (BMI), smoking status, pre- and postnephrectomy hypertension, proteinuria, and estimated glomerular filtration rate (eGFR). Hypertension was defined as systolic blood pressure ≥140 mm Hg, diastolic blood pressure ≥90 mm Hg, or as previous hypertension remediated by the use of antihypertensive medications. The result of a dipstick test confirmed the donor's proteinuria status. eGFR was calculated using the formula that is recommended by The Japanese Society of Nephrology, using serum creatinine values, age, and gender:

$$\left(\text{eGFR}\ (\text{mL/min/1.73 m}^2) = 194 \times \text{creatinine}^{-1.094} \times \text{age}^{-0.287}\right.$$
$$\left.(\text{if man})[\times 0.739\ (\text{if woman})]\right)$$

We reviewed respective medical charts or, in cases where the donor followed-up by visiting their general physician (GP), we inquired into the donor's health status with their GP. We were able to obtain comprehensive information on 88 donors. We retrospectively analyzed long-term donor outcomes and graft survival rates in older live kidney donors (≥60 years old) compared with younger donors (<60 years).

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0041-1345/14/$–see front matter
http://dx.doi.org/10.1016/j.transproceed.2013.11.019

Table 1. Baseline Characteristics

	<60 y (n = 55)	≥60 y (n = 33)	*P* Value
Age (y)	51.9 ± 6.3	65 ± 3.9	–
Sex (Male/Female) (n)	18/37	13/20	NS
Observation Period (mo)	93.1 ± 83.8	78.4 ± 71.4	NS
BMI (kg/m^2)	23.0 ± 3.0	24.2 ± 2.9	NS
Hypertension* (n)	5	14	<.001
Smoking (n)	5	4	NS
Pre-Transplant eGFR (mL/min/1.73 m^2)	85.8 ± 14.6	77.1 ± 9.5	<.001

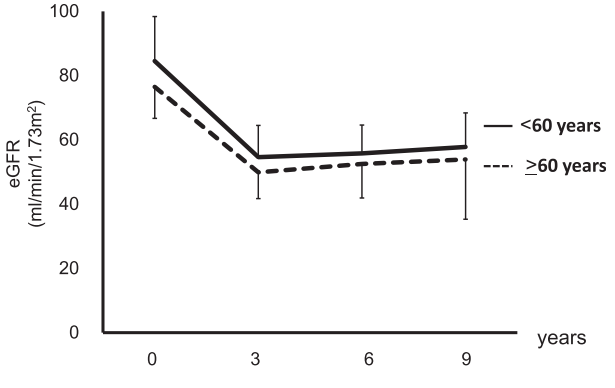
BMI, body mass index; eGFR, estimated glomerular filtration rate; NS, not significant.
*Blood pressure > 140/90 mm Hg.

Statistical Techniques

We used chi-square and Fisher exact test for categorical data, and the Student *t* test variance for continuous data. Values were expressed as mean ± standard deviation, unless otherwise specified. *P* values <.05 were considered to be statistically significant. Death-censored graft survival was analyzed using Kaplan-Meier analysis and compared using the log-rank test. Statistical analyses were conducted using SPSS version 16 (SPSS Inc., Chicago, IL, USA).

RESULTS

We were able to obtain precise information on 88 donors (88% of the total). Thirty-three were aged 60 or older and 55 donors were younger than 60 years old (range, 35–79). The mean follow-up period was 7 years and 4 months. BMI, smoking status, and the time period since donation were similar among the 2 groups (Table 1). Predonation, older donors presented more cases of hypertension (42.4% vs 9.1%; $P < .01$) and a lower eGFR (77.1 ± 9.5 vs 85.8 ± 14.6 mL/min/1.73 m^2; $P < .01$). In both groups, eGFR values decreased about 40% just after nephrectomy, but residual renal function was stable on long-term follow-up (Fig 1). There were no differences between the groups as regards the following: incidents of de novo hypertension, cardiovascular disease, cerebrovascular disease, malignancy, or proteinuria (Table 2).



Solid line indicates<60; Dotted line indicates≥60

Fig 1. Changes in eGFR After Donation.

Table 2. Complications After Nephrectomy

	<60 y (n = 55)	≧60 y (n = 33)	*P* Value
Hypertension (de novo)	11 (6)	16 (2)	.005 (NS)
Cardiovascular disease	2	2	NS
Cerebrovascular disease	1	2	NS
Malignancy	1	2	NS
Proteinuria	3	1	NS

During the study period, both open and laparoscopic donor nephrectomy were performed. We started carrying out laparoscopic nephrectomies in 2007. The laparoscopic nephrectomy rate was similar in both groups. Neither operation time (minutes; 229.3 ± 56.7 vs 224.0 ± 48.8; $P =$ not significant) nor length of hospital stay (days; 12.7 ± 3.8 vs 12.5 ± 2.4; $P =$ not significant) differed between the 2 groups. In older donors, there were no perioperative complications that required an extended hospital stay (Table 3).

Graft survival over a period of 10 years was similar in both groups (Fig 2).

DISCUSSION

Due to an overall organ shortage, kidney transplantations using older donors are becoming increasingly accepted. About 40% of the live donors in Japan are 60 years old or older. Recently, the number of older kidney donors has also been increasing in our center. The Japanese Society for Clinical Renal Transplantation recommends careful evaluation of predonation parameters for older donors, older than 70 years.

Concerning the long-term risks, some studies have shown that mortality, chronic kidney disease (CKD), or end-stage renal disease (ESRD), proteinuria, and hypertension were influenced by age [1]; however, there is a study that shows the overall health status in live kidney donors could be considered better than that of the general population when matched for age [2]. Donors followed by Goldfarb et al for a mean of 25 years were 64 years old. The prevalence of hypertension in this study reached 48%, but it was lower than that in the National Health and Nutrition Examination Survey for subjects aged 65 to 74 years old (54%) [3]. In our study, the incidents of de novo hypertension and proteinuria were not different in either group. Although the eGFR value was lower and the prevalence of hypertension was higher in older donors predonation, renal function was stable after nephrectomy. Balachandran et al, in accordance with our data, reported there was no progressive decrease in older donor renal function and they concluded that there was no

Table 3. Perioperative Complications

	<60 y (n = 55)	≧60 y (n = 33)
Wound Infection	1	0
Delayed Wound Healing	1	0
Others	skin rash 2	hematoma 1depression 1
Prolonged Hospitalization due to Complications	2	0

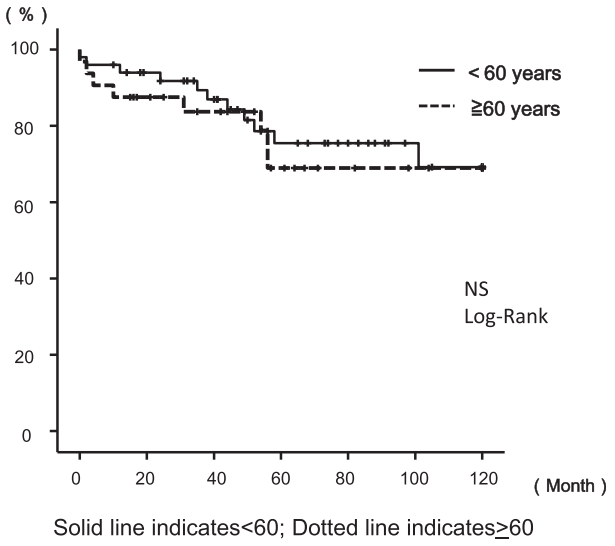


Fig 2. Graft survival.

accelerated decrease in renal function in a carefully selected older donor cohort [4].

Concerning our study, one of the reasons why older donors with hypertension and low eGFR are stable after nephrectomy is that their health was regularly checked by nephrologists or their GPs. We check a donor's condition at 3 months, 6 months, and annually after donation. Hypertension can remain stable with proper treatment and we were able to find complications that could deleteriously affect a donor's renal function at an early stage because of our intensive monitoring of the patients.

The major risks of live kidney donation are perioperative complications. Dols et al demonstrated that age did not have any significant associations with major or minor complications; however, they also reported that blood loss and length of hospital stay were longer in their older group [5]. At our center though, there were no perioperative complications that required an extended hospital stay in older donors, perhaps as a result of our individualized care system.

In a recent meta-analysis of 12 clinical studies, the 5-year patient and graft survival rate was worse for recipients of kidneys from older live donors compared with from younger donors; however, this association was less prominent over time across the studies [6]. Our study showed current intermediate-term graft survival was not different in either group. Balachandran et al noted recipients of older kidneys had higher mean serum creatinine levels but death-censored graft survival at 5 years after transplantation was not significantly different [4]. De La Vega et al also reported patient and graft outcomes from older live kidney donors were similar to those from younger donors despite lower eGFR levels [7]. Young et al compared recipients of older live kidneys (≥60 years) with recipients of deceased standard criteria donor (SCD) kidneys on outcomes of death and/or graft loss. They concluded that recipients of older kidneys had similar 4-year total graft survival compared with recipients of SCD kidneys [8]. Controversy remains though as older living kidneys may help to overcome in part the organ shortage of cadaveric donors. In many studies, the follow-up observation period was not long. An extended follow-up period is warranted.

Our study had some limitations. We could not collect all the data on all of our donors. We had complete information on 88% of our donors. The number of enrolled donors was relatively small and some data was incomplete.

If kidney donation influenced a donor's renal function or overall health status, a longer follow-up period would be necessary. In this regard, we might need to pay more attention to the younger donors because this event could negatively affect their quality of life for a longer relative time.

In conclusion, in our survey, donor age did not influence either the deterioration of renal function after nephrectomy or graft survival. If we screen carefully, donation by older people is safe. Regardless of age, careful evaluation and follow-up are important for the donor's long-term safety after donation.

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