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# Living kidney donors >60 years of age: is it acceptable for the donor and the recipient?

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## Summary

Donors >60 years are now frequently accepted for living kidney transplantation (LKT). We asked whether a donor age >60 years may result in a higher risk for donor and recipient. All adult LKT from May 1996 to June 2005 were included. Long-term outcome was analysed, and results were compared for donors >60 and ≤60 years. Thirty-five grafts were obtained from donors >60 (group A) and 158 from donors ≤60 years (group B). In group A 40% and in group B 37% of grafts came from unrelated donors ($P = 0.769$). The mean hospital stay of donors was 8 days in group A and 7 days in group B ($P = 0.171$). The complication rate was 11% in group A and 17% in group B ($P = 0.409$). Following LKT primary graft function was observed in 97% in group A and 96% in group B. One- and 5-year graft survival was 97% and 90% in group A and 99% and 91% in group B. For the first 2 years, mean serum creatinine was significantly higher in recipients of group A. Thereafter, values were comparable for both groups. As excellent results are achievable using living donors >60 years, we suggest that age should no longer be considered as a contra-indication for living donation.

## Introduction

As the waiting list of patients with end-stage renal disease grows continuously, donors aged >60 years are now accepted for living kidney transplantation (LKT) in certain transplant centers [1–4]. However, there is still an ongoing discussion which donor age could be accepted for living donation [1,5,6]. Graft function was lower when organs from older donors were compared with those from younger donors during the first years after transplantation [1,6]. However, reports focusing on long-term graft function are rare [2]. We present results of organs from living donors aged >60 years compared with those from younger donors. Short- and long-term data of corresponding transplant recipients are discussed.

## Patients and methods

### Donors and recipients

From May 1996 to June 2005, a total of 193 living donor nephrectomies (DN) and subsequent kidney transplants were performed at our center. Based on age at the time of DN, donors were divided into two groups. As a cut-off a donor age of >60 years was used. As donors >60 years were not accepted for paediatric recipients, paediatric transplants were excluded. Routine donor evaluation was performed prior to donation. Donation was approved by the local ethics committee. Until April 2001 flank incision was used. Thereafter, DN was performed via anterior vertical mini-incision [7]. Donor data were recorded prospectively. Donors were routinely examined in our

 

outpatient clinic. Details and courses of corresponding transplant recipients were studied retrospectively. Peri-operative details and long-term graft function up to 8 years after transplantation were of particular interest.

### Immunosuppressive therapy

Standard immunosuppressive therapy consisted of cyclosporin A (Sandimmun Optoral; Novartis Pharma, Basel, Switzerland), mycophenolate mofetil (CellCept; Roche, Basel, Switzerland) and prednisolone (Decortin H; Merck, Darmstadt, Germany). An anti-IL2 monoclonal antibody (Simulect; Novartis Pharma) was introduced in 1999. Cyclosporin A target levels ($C_0$) were 150–250 ng/ml for the first 6 months and 100–150 ng/ml thereafter. Target levels were the same regardless of donor and recipient age.

### Statistics

All DN and transplants performed until 30 June 2005 were included. Mean follow-up of donors and recipients was 52 months (range: 1–109 months). Details of donors and recipients of both groups were compared using chi-quadrate test or *t*-test as indicated. Graft and patient survival rates were calculated using Kaplan–Meier analysis. For comparison of subgroups log-rank test was used. Statistical analyses were performed using SPSS software package version 12.0 (SPSS Inc., Chicago, IL, USA).

## Results

### Donors

Demographic and peri-operative details of living donors are shown in Table 1. Gender distribution, body mass index, Human Leucocyte Antigen (HLA) matching and operating time were comparable for older and younger donors. Left-sided DN was performed in 51% of older and 59% of younger donors (n.s.). Sixty percentage of kidneys from older donors were harvested using the mini-incision approach, whereas this technique was used only 42% of younger donors (n.s.). There was a comparable proportion of living unrelated donations among both donor groups. Mean hospital stay was 1 day longer for donors >60 years compared with younger donors (n.s.). Surgical complications following DN are listed in Table 2. Early complications were observed in one (3%) of the donors >60 years compared with 12 (8%) of younger donors. The incidence of pseudohernias was slightly higher in the group of older donors (9% vs. 4%). However, the overall incidence of early and late complications was comparable for both groups (Table 2).

**Table 1.** Details of living kidney donors.

| Details | Age > 60 years ($n = 35$) | Age ≤ 60 years ($n = 158$) | *P*-value* |
|---|---|---|---|
| Age [years (mean ± SD)] | 65 ± 4 | 49 ± 7 | 0.000 |
| Gender [males (*n*)] | 14 (40) | 60 (38) | 0.824 |
| BMI [kg/m$^2$ (mean ± SD)] | 26 ± 4 | 26 ± 4 | 0.682 |
| Left kidney (*n*) | 18 (51) | 94 (59) | 0.382 |
| Related (*n*) | 21 (60) | 99 (63) | 0.769 |
| Mismatch (mean ± SD) | 3.2 ± 1.4 | 3.2 ± 1.6 | 0.876 |
| Hospital stay [days (mean ± SD)] | 8 ± 4 | 7 ± 3 | 0. 171 |
| Operation time [min (mean ± SD)] | 134 ± 31 | 128 ± 28 | 0.306 |
| Mini-incision DN (*n*) | 21 (60) | 66 (42) | 0.050 |

Values in parenthesis are expressed as percentage.
BMI, body mass index; DN, donor nephrectomy.
*Chi-quadrate and *t*-test.

### Recipients

Demographic details of transplant recipients are presented in Table 3. Recipients receiving kidneys from donors >60 years were significantly older compared to recipients of kidneys from younger donors. All other details such as gender distribution, body mass index, duration of dialysis prior to transplantation, cold ischemia time and number of transplants did not differ significantly for recipients of organs from older and younger donors. The incidence of surgical complications was comparable for both groups (data not shown). Vascular complications occurred in two donors >60 years (6%), while the incidence of vascular complication was 3% in the group of younger donors ($P = 0.338$). One case of vascular complication in the older donor group was related to arteriosclerosis of the recipient resulting in an early graft loss. The other case

**Table 2.** Early and late complications following donor nephrectomy.

| | Age > 60 years ($n = 35$) | | Age ≤ 60 years ($n = 158$) | |
|---|---|---|---|---|
| Complication | Complication | Revision | Complication | Revision |
| Early complication | | | | |
| Bleeding (*n*) | 1 (3) | – | 3 (2) | 3 |
| Wound infection (*n*) | – | – | 5 (3) | – |
| Others (*n*) | – | – | 4 (3) | 2 |
| Late complication | | | | |
| Pseudohernia (*n*) | 3 (9) | 1 | 7 (4) | 1 |
| Neuralgia (*n*) | – | – | 8 (5) | 1 |
| Total (*n*) | 4 (11)* | 1 (3) | 27 (17)* | 7 (4) |

Values in parenthesis are expressed as percentage.
*$P = 0.409$ for incidence of complications (chi-quadrate).

**Table 3.** Details of transplant recipients.

| Details | Donor age > 60 years ($n = 35$) | Donor age ≤ 60 years ($n = 158$) | *P*-value* |
|---|---|---|---|
| Age [years (mean ± SD)] | 50 ± 13 | 38 ± 14 | 0.000 |
| Gender [males (*n*)] | 19 (54) | 105 (66) | 0.174 |
| BMI [kg/m$^2$ (mean ± SD)] | 24 ± 3 | 24 ± 4 | 0.599 |
| Pre-emptive transplant (*n*) | 2 (6) | 12 (8) | 0.685 |
| Years on dialysis [years (mean ± SD)] | 3.2 ± 4.6 | 3.2 ± 4.0 | 0.986 |
| CIT [min (mean ± SD)] | 172 ± 46 | 175 ± 45 | 0.694 |
| First transplant (*n*) | 32 (91) | 142 (90) | 0.780 |
| Second transplant (*n*) | 3 (9) | 14 (9) | 0.956 |
| Third transplant (*n*) | – | 2 (1) | 0.503 |

Values in parenthesis are expressed as percentage.
BMI, body mass index; CIT, cold ischemia time.
*Chi-quadrate and *t*-test.

was related to an initma flap of the donor artery and was successfully treated by re-anastomsis.

The incidence of acute rejection was comparable for both groups (28.6% for grafts from older donors and 31.6% for grafts from younger donors). Median time to the first rejection episode was 37 days among older donor organ recipients (range: 9–185 days) and 41 days among younger donor organ recipients (range: 4–977 days).

### Patient and graft survival of recipients

Patient and graft survival rates were comparable for both groups (Fig. 1). One- and 5-year patient survival was 97% and 97% for recipients of grafts from donors >60 years and 100% and 97% for recipients of grafts from younger donors. Corresponding death-censored graft survival rates were 97% and 90% for grafts from older and 99% and 91% for grafts from younger donors. In the group of older donor organs one graft was lost early because of arterial occlusion and one was lost 4 years after kidney transplantation because of chronic allograft nephropathy (CAN). Fourteen grafts were lost in the younger donor organ group. Causes of graft loss were CAN in seven cases, recurrent disease in three cases, acute rejection in two cases and septic complications in two cases.

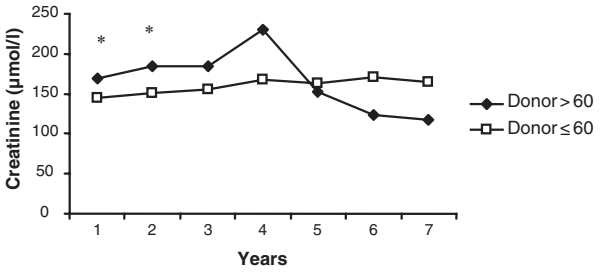


**Figure 2** Mean serum creatinine of transplant recipients from living donors >60 and ≤60 years of age. *$P < 0.05$ (*t*-test).

### Graft function

The primary function rate of kidney grafts from older donors was 97% compared with 96% for grafts from younger donors. Long-term graft function expressed by serum creatinine is presented in Fig. 2. For the first 2 years after transplantation serum creatinine was

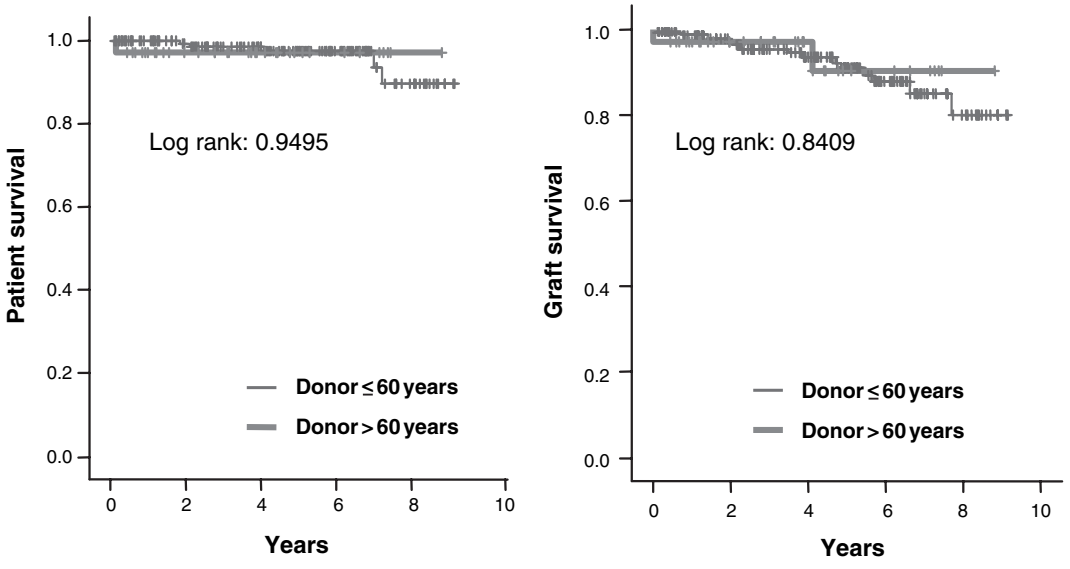


**Figure 1** Patient and graft survival of transplant recipients from living donors >60 and ≤60 years of age.

superior for grafts from younger donors. However, there was no statistically significant difference for both groups in the further follow-up.

## Discussion

Living kidney donation has become a routine procedure to expand the limited donor pool. New strategies such as ABO-incompatible [8] and cross-over kidney transplantation [9] were developed to increase the number of living donations. A broader acceptance of living donors >60 years may further increase the donor pool. However, there are limited reports to prove that this would be acceptable for both the donor and the recipient.

In contrast, kidneys from cadaveric donors >60 years are routinely accepted for transplantation. It has been shown that a donor age >60 years is associated with a significant higher serum creatinine at 3 and 12 months following transplantation compared with a younger donor age [10]. Further, donor age >60 years was associated with a higher incidence of delayed graft function and reduced graft survival time [10–12]. As LKT results in better outcome compared with cadaveric transplants, the question was whether the observed differences dependant on donor age would be detectable in living transplant recipients.

In this study, we present short- and long-term results of 35 donors >60 and 158 donors ≤60 years. The mean hospital stay was only 1 day longer for older donors compared with younger donors. The overall incidence of complications following living donation was not increased among older donors (11%) compared with younger ones (17%). The introduction of an open mini-incision approach for DN in 2001 further reduced the incidence of surgical complications such as pseudohernia or neuralgia for both groups [7]. Jacobs *et al.* [4] have presented results of laparoscopic DN comparing donors >60 and <60 years. The incidence of postoperative complications was slightly, but not statistically significant higher for older donors (21%) compared to younger donors (12%). Hsu *et al.* [3] have reported of six patients aged ≥65 years undergoing laparoscopic DN with good results.

De la Vega *et al.* [6] compared results following LKT from donors ≥50 and <50 years. Three years after transplantation patient and graft survival were comparable for both groups. Long-term results of living kidney recipients are presented by Toma *et al.* [2]. In their patient population graft survival curves drifted apart 5 years post-transplantation for donors aged ≥60 and <60 years. In fact, donor age ≥60 years was the most important risk factor for long-term graft failure after 5 years post-transplantation [2]. In our study population, we could demonstrate excellent and comparable patient and graft survival rates for both donor groups up to 8 years after LKT. The negative trend beyond the fifth-year post-transplantation was not detectable in our recipients. However, a longer follow-up might be required.

As a result of the decreasing nephron mass among kidneys from elderly donors one would expect a lower graft function compared with grafts from younger donors. This was shown by de la Vega *et al.* [6]. In their study a cut-off donor age of 50 years was chosen. Mean serum creatinine as well as iothalamate clearance at 1, 12 and 24 months was significantly better among recipients of kidneys from younger donor [6]. In our study, we used serum creatinine to assess renal function over time. One has to keep in mind that the mean age of patients receiving kidneys from older donors was significantly higher compared with recipients of grafts from younger donors. Given the fact that older recipients may have a lower muscle mass compared with younger recipients, kidney function might be overestimated among recipients of kidneys from donors >60 years. However, mean serum creatinine was significantly higher up to 2 years after transplantation among recipients of kidneys from older donors. Thereafter, post-transplant serum creatinine values were not statistically significant different among both groups.

In summary, donors >60 years did not experience an increased risk of complications. However, one has to keep in mind that open donor nephrectomy was performed in all cases. Graft function of older grafts was somewhat lower compared to kidneys from younger donors. However, this did not influence graft survival up to 8 years after transplantation. In the future, we will more liberally accept donors >60 years for living donation.

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