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KIDNEY DONORS LIVE LONGER1
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Fehrman-Ekholm, Ingela[2,3]; Elinder, Carl-Gustaf[2]; Stenbeck, Magnus[4]; Tydén, Gunnar[5]; Groth, Carl-G.[5]

Departments of Renal Medicine and Transplantation Surgery, Huddinge Hospital, Karolinska Institute, S-141 86 Huddinge, and Center for Epidemiology, National Board of Health and Welfare, S-106 30 Stockholm, Sweden

[2]Department of Renal Medicine, Huddinge Hospital.

[4]Center for Epidemiology, National Board of Health and Welfare.

[5]Department of Transplantation Surgery, Huddinge Hospital.

[3]Address correspondence to: Ingela Fehrman-Ekholm, M.D., Department of Renal Medicine, K56, Huddinge Hospital, 141 86 Huddinge, Sweden.

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Abstract TOP

Background: **A very important issue in living kidney donor transplantation is whether the donation is safe for the donor1,2,3,4. The aim of this study was to examine survival and causes of death in kidney donors and to assess the renal function in those who had donated a kidney more than 20 years ago.**

Methods: **A total of 459 living donor nephrectomies were performed in Stockholm from 1964 until the end of 1994. By using national registers, all 430 donors living in Sweden were traced. Donor survival was analysed using the Kaplan-Meier method. Expected survival was computed using the Hakulinens method and was based on national mortality rates.**

Results: **Forty-one subjects had died between 15 months and 31 years after the donation. The mortality pattern was similar to that in the general population, the majority dying of cardiovascular diseases and malignancies. After 20 years of follow-up, 85% of the donors were alive, whereas the expected survival rate was 66%. Survival was thus 29% better in the donor group. One third of the donors (aged 46-91 years) who had donated >20 years ago had hypertension. There was a deterioration in the renal function with increasing age, similar to what is seen among normal healthy subjects. The average glomerular filtration rate in donors aged 75 years and over was 48 ml/min/1.73 m2.**

Conclusions: **To donate a kidney does not seem to constitute any long-term risk. The better survival among donors is probably due to the fact that only healthy persons are accepted for living kidney donation.**

Since we started our kidney transplantation program, we have been using kidneys from living-related donors whenever feasible, because the results are better. In recent years, we have also used living-unrelated donors, because there are not enough cadaveric donors (1). The results have been excellent. A total of 1720 kidney transplantations were performed in our hospital from 1964 to 1995, and 459 (27%) of these were with related living donors.

A crucial question is whether living donation is entirely safe for the donor, perioperatively and later on. Follow-up studies on living kidney donors have been performed in which investigators have analyzed postoperative surgical complications (2, 3), compensatory hypertrophy of the remaining kidney (4, 5), and renal function several years after the donation (6, 7). Serious postoperative complications occurred in 1.4-2% of the donors, and the average compensatory hypertrophy in the remaining

kidney was 22-33%. Long-term renal function was acceptable, although 18-32% of the kidney donors had developed hypertension. However, none of the studies has analyzed the lifespan of the donors compared with a control population.

In this study, we have assessed survival and the causes of death in the total cohort of living kidney donors residing in Sweden, who had a nephrectomy performed in Stockholm from 1964 to 1994. We have also studied kidney function in the persons who donated a kidney >20 years ago.

DONORS AND METHODS TOP

Of the 459 related living kidney donors, 29 came from foreign countries and returned shortly after the nephrectomy. These subjects were not available for follow-up and they were excluded from the analyses. The study group thus comprised the remaining 430 donors. The age of the donors at the time of nephrectomy ranged between 22 and 74 years, and the vast majority of donors were between 30 and 69 years **(Table 1)**. The donors were related to the recipients as follows: mother (36%), father (22%), sister (19%), brother (15%), spouse (5%), and 3% another relative (twin, child, aunt, uncle, grandparent). There were no perioperative deaths, but 2% of the donors suffered serious complications, such as a pulmonary embolus or severe bleeding requiring re-operation **(3)**. All donors underwent medical check-ups within 2 months after surgery. After this there was no regular checking.

Table 1

Table 1. Donor age when nephrectomies were performed

With the Swedish personal identification number, which is used on all medical and official records, every donor was found in the national and parish registration offices. The death certificates were obtained from the national register, Statistics, Sweden. Survivors were censored at the end of 1995.

The observed survival among the donors, with 95% confidence intervals, is presented by using Kaplan-Meier analysis **(Fig. 1)**. Expected survival for the donors was calculated from mortality data in the general Swedish population from 1964 to 1992 **(8)**. Age, gender, and calendar year-specific mortality rates for the general population were used to calculate the expected mortality in the donor cohort, for which the fact that observations were made over an extended period of time (31 years) was considered **(9)**.

Figure 1

Figure 1. Observed (in black) and expected (in grey) survival rates in a cohort of 430 living kidney donors who underwent nephrectomy in Stockholm, Sweden, 1964-1994. Males and females combined.

Subjects who had donated a kidney >20 years ago were asked to make an appointment with the local physician/nephrologist for a medical follow-up including measurement of blood pressure, serum creatinine level, urinary protein, and when feasible, determination of glomerular filtration rate (GFR*) by using clearance of ^{51}Cr-EDTA or iohexol **(10)**.

RESULTS TOP

Forty-one donors had died between 15 months and 31 years after the donation. Thus, 389 persons were still alive, aged between 29 and 91 years, at the end of 1995. The number of person-years in the follow-up was close to 5000. The observed survival rate (males and females combined) is clearly better than that anticipated based on the national mortality averages **(Fig. 1)**. The survival of the donor group was 4% better than expected after 5 years. After 20 years of follow-up, there were still 63 individuals at risk. At this time, the accumulated number of deaths in the donor group was 33, whereas the expected figure was 46, a significant difference (chi-square = 4.31, P=0.04). This corresponds to a survival after 20 years of 85% for donors, compared with an expected figure of 66%. Survival was thus 29% (95% confidence interval 20-38%) better among donors.

The causes of death among donors were cardiovascular disease (18), cancer (10), injury or accidents (4), gastrointestinal disease (3), alcoholism (2), pulmonary disease (1), and infectious disease (2). One donor died abroad and was classified as a cardiac death by the local authority, but as an unspecified cause of death by Statistics, Sweden. There was no death due to renal disease, cancer, or injury in the remaining kidney. The two earliest deaths occurred within 2 years after donation (15 and 18 months) and were caused by ovarian malignancy and myocardial infarction, respectively.

The medical check-up of all individuals, except one, who had donated a kidney before 1976 (n=78) and were still alive (n=54) was made. Nineteen donors (35%) had hypertension (blood pressure above 140-160/90) and 12 (20%) were on antihypertensive treatment. The s-creatinine levels are shown in **Figure 2**. Most of the donors had s-creatinine levels around 100 µmol/L, but 11 (20%) had more than 120 µmol/L, which is the upper normal limit. Most of the subjects with elevated s-creatinine were aged 75

years and over. The GFR was determined in 34 of the donors **(Fig. 3)**. A deterioration in the GFR with increasing age is evident. Among donors aged 75 years and over, the average GFR was 48 ml/min/1.73m^2. Proteinuria was found in 11 donors, but only four had a protein excretion >1.0 g/24 hr.

Figure 2

Figure 2. S-creatinine in kidney donors >20 years after donation.

Figure 3

Figure 3. GFR in kidney donors >20 years after donation.

DISCUSSION TOP

In Sweden, the health of living kidney donors is usually evaluated regularly for only a short period after nephrectomy. However, the follow-ups done by us and others have indicated that serious late consequences of donation are uncommon **(5-7, 11)**. The present study is unique in that it covers all living kidney donors in one hospital. In Sweden, the use of personal identification numbers and national registers make epidemiological studies feasible **(12)**. The mortality pattern was not different from that expected in an aging population. In the Swedish population, 54% die of cardiovascular diseases and 22% die of cancer **(8)**. These patterns were very similar among the donors. In no case did death seem to be associated with nephrectomy.

The overall survival pattern of kidney donors **(Fig. 1)** is reassuring. The data on kidney function in the subgroup of those who donated a kidney >20 years ago are interesting. Kidney function showed no correlation with time since donation, but it decreased with increasing age of the donors. Decline of GFR with increasing age has been shown in a normal aging population **(13)**. However, in very old individuals, we lack GFR data for normal individuals. Our results also provide important information for judging life insurance policies taken out by the donors. The better survival rates of kidney donors probably reflect the careful selection of healthy individuals suitable for donation. We have previously shown that for various reasons only 1 of 3 of the potential donors are accepted **(14)**. Such selection procedures are necessary **(15)**. The better survival rate may thus be an artefact, similar to the healthy worker effect frequently observed in occupational epidemiological studies **(16)**. Indeed, it is difficult to form an ideal comparison group in clinical survival studies, particularly if there is a strong correlation between the duration of observation and follow-up and a tendency to operate on more elderly persons as time goes by **(17)**. However, this was not the case in our cohort of live donors. The important message of this study is not that kidney donation per se increases life expectancy, which is not very likely, but rather that there is no evidence to the contrary, which some potential donors may surmise. Nevertheless, it has been shown that the donors enjoy more self-esteem as a result of the donation, especially when the transplantation is successful **(18)**. Whether this may have a beneficial effect on survival is an interesting question. To investigate this further and to analyze morbidity in the total donor cohort, we plan to evaluate the health of all donors still alive, and include measurements of blood pressure, urinary protein, serum creatinine and, if possible, determinations of GFR.

In summary, our findings support the continued practice of using related and unrelated living subjects as kidney donors. There is no evidence of increased mortality due to renal diseases or of a decreased overall survival. Twenty years after donation, however, one third of the donors had hypertension and renal function among the elderly donors was reduced.

Footnotes TOP

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