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OBSERVATION

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Long-term renal function, complications and life expectancy in living kidney donors

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Abstract

Living kidney transplantation is now a widely accepted treatment for end stage renal disease (ESRD) because it provides excellent outcomes for recipients. However, long-term outcomes of living kidney donors have not been well understood. Because securing the safety of the donor is essential to the continued success of this procedure, we reviewed articles discussing long-term outcomes of living kidney donors. Most studies found no decrease in long-term survival or progressive renal dysfunction in previous kidney donors. Moreover, the prevalence of hypertension was comparable to that expected in the general population, although some did report otherwise. Urinary protein showed small increases in this population and was associated with hypertension and a lower glomerular filtration rate. Quality of life following living kidney donation seems to be better than the national norm. We also encountered several reports of ESRD in previous living kidney donors. Regular follow-up of kidney donors is recommended and future controlled, prospective studies will better delineate risk factors which cause health problems following living kidney donation.

Key words: Living kidney donor; Long-term survival; Hypertension; Proteinuria; Renal function; Quality of life

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INTRODUCTION

Although securing the long-term safety of living kidney donors is essential to the continued success of this procedure, the long-term consequences after kidney donation are not fully understood. There have been several studies of living kidney donors which found no decrease in long-term survival. Most of the data suggests that the donors had normal renal function, with an incidence of hypertension comparable to that expected in the age-matched general population, while others demonstrated that donor nephrectomy is associated with mild proteinuria and hypertension. In this editorial, we will review the articles which focused on the outcome of living kidney donors to clarify the current status in this field.

LIFE EXPECTANCY FOLLOWING LIVING KIDNEY DONATION

Most long-term follow up studies of living kidney donors

find no decrease in long-term survival. According to the analysis of 430 previous living kidney donors in a Swedish single center, the survival rate of 20 years was 29% better than the expected survival rate calculated by using national registers[1]. Moreover, the analysis of 481 previous Japanese living kidney donors also showed that the survival rate of kidney donors was better than the age- and gender-matched cohort from the general population and the patterns and causes of death were similar to the general population[2]. The study of larger numbers of donors, as many as 3698, who donated kidneys during the period from 1963 to 2007 for a longer follow-up period in a US single institute, also ascertained that the survival of kidney donors was similar to that of controls that were matched for age, sex and race or ethnic group[3]. Thus, the overall evidence suggests that living kidney donors have a survival better than or similar to that of non-donors. These results might be attributed to the fact that only healthy persons are accepted for living kidney donation.

HYPERTENSION FOLLOWING LIVING KIDNEY DONATION

Hypertension is thought to be one of the major concerns following living kidney donation. However, a couple of studies demonstrated no increase of hypertension after living donor nephrectomy. A 15-year experience of 162 living donors in Italy showed that the long-term incidence of hypertension in living donors was similar to the general population[4]. Furthermore, the analysis of 402 donor nephrectomies in Sweden showed that, although hypertension was present in 38% of the donors, the age-adjusted prevalence of hypertension among donors was not higher than in the general population[5].

On the other hand, some studies demonstrated an increase of hypertension after living donor nephrectomy. Analysis of 75 donors in a US single center showed that the prevalence of hypertension was significantly increased when compared with age/sex matched data from epidemiological studies of the general population, especially in those over the age of 55 years[6]. Also, in a live kidney donor cohort with a 93% retrieval rate of the 152 donors, mean blood pressure had significantly increased by 9 mmHg in systolic and by 2 mmHg in diastolic pressure, which remained significantly below normal[7]. One meta-analysis showed that kidney donors may have a 5 mmHg increase in blood pressure within 5 to 10 years after donation, over that anticipated with normal aging[8]. Future controlled, prospective studies with long periods of follow-up will better delineate the risk of hypertension following living kidney donation.

PROTEINURIA FOLLOWING LIVING KIDNEY DONATION

Most reported data suggests that proteinuria increased in the living kidney donor population, although the follow-up period and measurement of proteinuria and/or microalbuminuria differed by report. German experience at a single center of 102 living kidney donors for 35 years showed that microalbuminuria was found in 22.6% of the donors[9]. Another study showed that 56% of 152 donors developed proteinuria (> 150 mg/d) but only 10% had albuminuria[7]. In an analysis of 402 outcomes after donor nephrectomy in Sweden, significant proteinuria (> or = 1.0 g/L) was found in 3% and slight proteinuria (< 1.0 g/L) in 9% of the donors and proteinuria was associated with hypertension and a lower glomerular filtration rate (GFR)[5].

One meta-analysis, which analyzed a total of 5048 donors from 48 studies with an average follow-up of 7 years after donation (range 1-25 years), demonstrated that the average 24 h urine protein was 154 mg/d and concluded that kidney donation results in small increases in urinary protein[10].

RENAL FUNCTION FOLLOWING LIVING KIDNEY DONATION

Renal function is the greatest long-term concern after living kidney donation. In a report analyzing 25 living kidney donors, total kidney function measured as creatinine clearance (CCr) showed a significant drop of 36% of the pre donated value. However, remaining kidney clearance increased by an average of 34% as measured by Tc 99m DTPA renography. Compensatory hypertrophy of the remaining kidney measured by ultrasound attributed to an increase in the renal volume of 15%[11]. Other investigations show a 25% decrease of GFR with mean time after uninephrectomy of 11 years[7] and a 27% decrease with mean patient follow-up of 25 years[12].

In a Swedish study, the average estimated GFR (12 years after donation) was 72% ± 18% of the age-predicted value. The ratio of the estimated to the predicted GFR showed no correlation to the time since donation, indicating that there is no accelerated loss of renal function after donation[5]. These results demonstrated that, although living kidney donors lose GFR by 15%-25%, they usually do not show the accelerated loss of renal function if they do not have risk factors for chronic renal disease (CKD). One unique study examined renal function more than 20 years after donation by comparing that with siblings. They showed no significant difference in serum creatinine, blood urea nitrogen and CCr between donors and their siblings[13].

END STAGE RENAL DISEASE IN PREVIOUS DONORS

There were considerable reports of end stage renal disease (ESRD) of previous kidney donors. In a survey which used the Organ Procurement and Transplantation Network (OPTN) database, a total of 56 previous living

donors were identified as having been listed for deceased donor kidney transplantation. They concluded that living renal donation has long-term risks that may not be apparent in the short-term and that the numbers reported underestimate the actual number of living donors with renal failure because they include only patients listed for a kidney transplant[14]. In the latest survey of OPTN and the Center for Medicare and Medicaid Services databases, 126 cases of ESRD among 56 458 living kidney donors (0.22%) were found. The ESRD rate was nearly five times higher for blacks than for whites and two times higher for males than females, which were similar to those previously reported for ESRD in the general population[15].

In an analysis of 402 donor nephrectomies in Sweden, no donor died with uremia or had dialysis treatment before death. However, three donors developed renal disease and one was in dialysis treatment. In two of these cases, hereditary factors were possibly involved[5]. In a Mexican experience, four kidney donors developed ESRD thereafter, three becoming kidney recipients[16]. Another two case reports described kidney donors who developed ESRD[17,18]. Analysis of 464 outcomes after donor nephrectomies at the University of Minnesota showed that 84 had died and 380 were alive. Of the 84 donors who had died, three were known to have had kidney failure. Of the 380 still alive, three had abnormal kidney function and two had undergone transplantation[19].

One Japanese study carefully investigated the association between postoperative clinical courses and changes in renal function in eight donors who developed ESRD. According to their findings, except for one donor who developed ESRD, none of the donors developed progressive renal dysfunction immediately after donation. Their renal functions remained stable for a long period but started to decline after developing new comorbidities, especially risk factors known as progression factors (proteinuria or hypertension) or accelerating factors (cardiovascular event or infection) of CKD[20]. However, the overall evidence suggests that their risk of ESRD is not increased.

QUALITY OF LIFE IN LIVING KIDNEY DONORS

As in medical issues, quality of life (QOL) in living kidney donors is crucial to be able to continue this procedure. According to the experience in a German single institute of 102 living kidney donors, everyday life was managed as well as before surgery after 2-4 wk by the highest percentage (42%) of patients, but working capacity was only regained after 1-3 mo by a comparable percentage (44%). Ninety-one percent would again decide in favor of a donation[9]. In another survey, the majority of living kidney donors had an excellent QOL. As a group, they scored higher than the national norm on the SF-36. However, 4% were dissatisfied and regretted the decision to donate. Furthermore, 4% found the experience extremely stressful and 8% very stressful. Multivariate analysis found that relatives other than first degree and donors whose recipient died within 1 year of transplant were more likely to say they would not donate again if it were possible. Furthermore, donors who had perioperative complications and female donors were more likely to find the overall experience more stressful[21].

Women considering kidney donation are frequently anxious about their ability to have children after nephrectomy[22]. There is a single center survey which described 490 pregnancies in 239 donors after donation. Compared to pregnancies before donation, pregnancies after donation had increased rates of gestational diabetes, gestational hypertension, preeclampsia, prematurity and fetal loss. The authors reported that these incidences of adverse events observed in donors were similar or better than expected levels for the general population[23]. Therefore, pregnancy after kidney donation is not necessarily a contraindication, although it is better to be avoided.

CONCLUSION

We have reviewed long-term outcomes in living kidney donation. As the background differs by region, it is difficult to build an international standard. Regular follow-up of kidney donors is recommended in order to manage complications effectively and to detect health problems early in those who may develop them. A national registry is necessary to enable data collection so that long-term risk can be accurately assessed.

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