

The long-term consequences of living-related or unrelated kidney donation

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Abstract

Since the frequency of living-related and unrelated kidney donation has increased in the past decade, the risk of uninephrectomy should not be neglected. Major complications after kidney donation are rare. No serious problems like infection or bleeding are common with an overall perioperative complication rate of 14%. Risk of long-term mortality is lower compared to the expected mortality. Little decrease of glomerular filtration rate immediately after transplantation occurs with no further decline. Risk of end-stage renal failure in living donors is ~0.2–0.5%. Only a few patients develop proteinuria. After age adjustment, no increase of blood pressure is noted. The benefit of living kidney transplantation is superseding the potential risks. After careful work-up of the donor short- and long-term risks are minimal.

Keywords: blood pressure; living related; living kidney donation; proteinuria; renal transplantation; uninephrectomy

Introduction

In view of the severe organ shortage, the frequency of living-related or unrelated kidney donation has increased over the past decade. In 2001 for the first time, more living donor kidneys than cadaveric kidneys were transplanted [1] in the USA. At the same time, living-related kidney transplantation has also been steadily increasing in the Eurotransplant countries, with living-related kidney transplantations [2] currently accounting for 16–17%.

In contrast, there has been a long tradition of living-related renal transplantation dating back for more than

30 years in Scandinavia. For instance, single centre reports from Sweden record 177 donor nephrectomies from 1996 to 2001 (Fehrman-Eckholm, personal communication) or 1332 donated kidneys over a period of 32 years from Norway [3].

Despite this rapid increase in living-related kidney donation, the risks involved in uninephrectomy should not be neglected.

We wish to provide an overview on both short- and long-term mortality and morbidity after live kidney donation. In addition, we wish to review data on blood pressure and proteinuria following uninephrectomy for living-related or living-unrelated kidney donation.

Perioperative morbidity and mortality

Nephrectomy, like any other operation, may entail complications during the perioperative phase. The risk of complications might be lower because elective surgery is done in otherwise healthy people. However, the overall perioperative complication rate is ~14% [4]. In a prospective study rather minor problems were commonly reported with as most frequent complication infections (incision site, pneumonia) and post-operative bleeding (16.5 vs 1.6%) [5].

Major complications are rare. In a survey conducted by United Network of Organ Sharing (UNOS) of 15 162 patients uninephrectomized for living kidney donation, two patients died post-operatively within 4 days [6]. In contrast, in a single centre report from the Oslo Rikshospitalet no mortality among 1800 living donor nephrectomies [5] was reported. Among the more than 200 living donor nephrectomies at our own centre no donor death has occurred to date (Table 1).

Risk of long-term mortality following kidney donation

The long-standing experience (>30 years) of living-related kidney donation in the Scandinavian countries

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Table 1. Short-term mortality (within 5 years post-kidney donation) in living kidney donors in the USA and Sweden compared to our own unit (Heidelberg, Germany) [4,5]

	USA	Norway	Heidelberg
Number of donors	15 162	1800	200
Total mortality	2	0	0
Percentage	0.001%	0%	0%

allows an estimation of the long-term mortality rate in patients who have undergone living-related donor uninephrectomy. It is of note that the observed mortality in living kidney donors is lower than the expected mortality [3,7]. A possible explanation is that living kidney donors are followed up more thoroughly in the long term. Another speculation is that those who are willing to donate a kidney have a greater health awareness.

Risk of end-stage renal disease following living donor nephrectomy

As the number of living-related donors increases, more information on the risk of terminal renal failure becomes available. In a report from Norway seven out of 1800 living kidney donors progressed to end-stage renal failure (ESRD) [5]. In Sweden only one out of 402 donors is on chronic haemodialysis [8]. In a recent analysis of the Organ Procurement and Transplantation Network (OPTN) data, Ellison *et al.* [9] reported about 56 cases in which ESRD developed in kidney donors. In our transplant unit one patient out of more than 200 living donors progressed to ESRD due to unknown diabetic nephropathy, prior to uninephrectomy (Table 2).

The course of renal function after living uninephrectomy

In a meta-analysis, Kasiske *et al.* [10] found a decrease of glomerular filtration rate (GFR) of 17 ml/min immediately after uninephrectomy. A similar finding is well known for uninephrectomy for reasons other than living-related renal transplantation. However, the long-term follow-up of the uninephrectomized donors is notable. Per decade GFR did not decrease further—on the contrary, it rose by 1.4 ml/min/decade.

Table 2. Percentage of ESRD in living kidney donors in Scandinavian countries compared to our own unit (Heidelberg, Germany) [5,22]

	Norway	Sweden	Heidelberg
Number of donors	1800	402	200
Number of ESRD	7	1	1
Percentage	0.4%	0.2%	0.5%

In a recent study of the transplantation centre in Frankfurt (Germany), GFR was 101 ± 24 ml/min before uninephrectomy and decreased to 74 ± 19 ml/min after a median observation time of 11 years post-nephrectomy [11], indicating that renal function is preserved over more than a decade. In another study, the decrement of the GFR is similar ($\Delta -29$ and 30 ml/min, respectively) in normotensive and hypertensive kidney donors [12].

In contrast, a different study showed an increased donor risk when the GFR was below 80 ml/min [13], and it is safe to assume that a GFR in the lower range (<80 ml/min) is a contraindication for living kidney donation.

Even though reduced glomerular filtration is a risk factor for the chronic loss of residual renal function, earlier reports document stable GFR in patients with a reduction of renal mass of more than 50% [14]. In this context it is significant that uninephrectomy in childhood has no influence on long-term renal function (of the growing kidney) after more than two decades [15].

Not only renal function itself is an important aspect, the chance of developing renal disease after living kidney donation should also be considered. The risk of developing renal disease within a family of a potential recipient is higher than it is for the general population [16]. In this context it is notable that the most common type of glomerulonephritis (e.g. IgA glomerulonephritis) is associated with chromosome 6q22-23 [17]. Autopsy studies revealed IgA deposits in 2.8% of patients [18].

Proteinuria after living kidney donation

In the past few years it has been shown that proteinuria *per se* is not only a marker of kidney disease but also a maker of progression of renal failure. Several studies have documented an acceleration of progression of renal failure when protein excretion was significantly increased [19,20].

A meta-analysis of 1230 patients showed only a minor increase of protein excretion of 76 mg/24 h/decade [10]. In our own experience we have seen an incidence of 19% of proteinuria (>300 mg/24 h) in 118 patients after uninephrectomy [4]. In a Turkish study, four out of 102 patients had a protein excretion of more than 0.1 g/24 h [21]. In a large Swedish study covering 402 living kidney donors from 1964 to 1995, ~3% developed significant proteinuria (i.e. above 1 g/l) after a median follow-up of 12 years [8]. In contrast, a previous abstract noted a prevalence of proteinuria >150 mg/d in 65 out of 125 living kidney donors [11].

Blood pressure after living kidney donation

Uninephrectomy is associated with an increase in blood pressure [22]. It is therefore important to screen all living kidney donors for increase of blood pressure

after uninephrectomy. In a survey on 402 patients, Fehrman-Ekholm *et al.* [8] found a prevalence of hypertension in 38% of patients after uninephrectomy. However, when these results were adjusted for age there was no increase in the prevalence of hypertension after uninephrectomy. In a meta-analysis Kasiske *et al.* [10] found in 1896 patients with unilateral nephrectomy an increase of systolic blood pressure of 2–3 mmHg, which rose further by 1 mmHg per decade of follow-up. Diastolic blood pressure was 3 mmHg higher after nephrectomy without any further increase. In our own patient population, 32 out of 118 patients had increased blood pressure profiles as assessed by 24 h blood pressure measurements [4]. In a previously published abstract, systolic blood pressure decreased in hypertensive kidney donors after living kidney donation (150 ± 3 vs 139 ± 3 mmHg) while diastolic blood pressure remained nearly unchanged [12].

Conclusions

The benefit of living kidney transplantation surpasses by far the potential risks. If careful work-up of the donor is done, short-term and long-term risks are minimal and the outcome of living kidney donation is generally excellent. We believe that it is important to encourage this therapeutic option, which is a possible answer to the current dilemma of an insufficient supply of renal allografts. Follow-up visits of donors are not just advisable, they are necessary. One solution could be a donor registry like the one Scandiatransplant is preparing [5].

Conflict of interest statement. None declared.

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