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Perioperative and Long-Term Safety of Living Kidney Donors

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1. Introduction

Because securing the safety of living kidney donor is essential to the continued success of this procedure, in this chapter we will review articles which focused not only on recipient outcome but also on living kidney donor to clarify what is known and what should be known in this field.

2. Indication for living kidney donor

For the perioperative and long-term safety, medical indication for living kidney donor is substantial issue. However, criteria for living kidney donor has been often derived empirically on a temporary basis and might vary by country, region and institute. Here, we summarize newly-developed guideline for the indication of living kidney donation which is internationally accepted such as the consensus of Amsterdam forum guideline (Delmonico F. 2005) and OPTN/UNOS guideline (Table 1). Then they were compared with the results of survey of US transplant center concerning evaluating living kidney donors (Mandelbrot DA, et al. 2007).

2.1 Age

There is no description of age limitation of living kidney donor in Amsterdam forum guideline. However age younger than 18 years old is attributed to contraindication in OPTN/UNOS guideline. Half of the institute did not set the upper limit of age, although widely accepted upper limit is 65 years old and some other institute set the cutoffs of 55, 60, 70 and 75 years old (Mandelbrot DA, et al. 2007).

2.2 Obesity

Obesity was defined by a body mass index (BMI) of $>30 \text{ kg/m}^2$. All potential donors should have BMI determined at initial evaluation because of data suggesting an association between obesity and kidney disease. In most guideline, BMI above 35 kg/m^2 is thought to be contraindication especially when other comorbid conditions are present. And obese patients should be encouraged to lose weight before kidney donation and should not to donate if they have other associated comorbid conditions. According to the survey of US transplant centers, about one-half of programs use a BMI cutoff of 35 kg/m^2 , while 10%

exclude donors with BMI over 30 kg/m² and 20% exclude donors with BMI over 40 kg/m² (Mandelbrot DA, et al. 2007).

	Amsterudam Forum (2005)	OPTN/UNOS (2007)
Age	no description	<18 years old
Obesity	BMI>35kg/m ²	BMI>35kg/m ²
Renal function	GFR<80ml/min or 2SD below normal	CCr<80ml/min
Urinalysis abnormality	u-pro>300mg/day persistant microhematuria	u-pro>300mg/day
Hypertension	BP>140/90 by ABPM	BP>130/90(50yo), anti-HT medication≥3
Diabetes	FBS≥126 or 2hr BS≥200	2hr BS≥140
Dyslipidemia	no excluison	no description
History of malignancy	depend on kind of malignancy	recent malignancy

BMI: Body mass index, GFR: Glomerular filtration rate, SD: Standard deviation, CCr: Creatinine clearance, BP: Blood pressure, ABPM: Ambulatory blood pressure monitoring, FBS: Fasting blood sugar, BS: Blood sugar

Table 1. Contraindication for living kidney donor

2.3 Renal function

The first substantial issue is which measurement should be adapted to estimate renal function of potential living donors. Creatinine clearance calculated by 24-hour urine collections has been used most frequently, however, may under- or overestimate glomerular filtration rate (GFR) in patients with normal or near normal renal function. Estimated GFR values are easy way but not standardized in this population. These methods may be replaced or supplemented by inulin clearance in cases of borderline GFR determination although it is a complicated method. In most program, a GFR<80 ml/minute or 2 standard deviations below normal (based on age, gender, and BSA corrected to 1.73/m²) generally preclude donation (Delmonico F. 2005). According to the survey of US transplant center, few programs now have no specific cutoff, and no programs use 40 or 60 mL/min/1.73 m² as cutoffs (Mandelbrot DA, et al. 2007).

2.4 Proteinuria

Proteinuria should be assessed as a standard part of the donor work up. Dipstick measurements of proteinuria are not enough in the assessment of a prospective living donor. According to the survey of US transplant center, most programs use a 24-hour urine

collection for protein. Some programs rely on a spot urine protein to creatinine ratio, and almost one-half of programs now use urinary albumin as a screen. As for cutoff level of proteinuria, more than 300 mg/24-hour of urineprotein is widely accepted as a contraindication to donation. Microalbuminuria determination is also recommended, although its value as an international standard of evaluation for kidney donors has not been determined (Delmonico F. 2005).

2.5 Hematuria

Isolated microscopic hematuria may not be a contraindication to donation. Red blood cells (RBCs) with glomerular origin have a dysmorphic appearance observed by phase-contrast microscopy and automated RBC analysis. Patients with persistent microscopic hematuria should not be considered for kidney donation unless urine cytology and a complete urologic work up are performed. If urological malignancy and stone disease are excluded, a kidney biopsy may be indicated to rule out glomerular pathology such as IgA nephropathy.

2.6 Hypertension

Hypertension has been considered to be a contraindication in potential renal transplant donors. Some patients with easily controlled hypertension who meet other defined criteria may represent a low-risk group for development of kidney disease and may be acceptable as kidney donors. Hypertension exclusion criteria have become more flexible compared with previous survey (Bia MJ, et al. 1995). In recent survey, while 47% of programs exclude donors on any antihypertensive medication, 41% exclude donors if they are taking more than one medication, and 8% exclude donors taking more than two medications (Mandelbrot DA, et al. 2007). Blood pressure criteria tend to be looser if the donor is older, or if end organ damage is ruled out.

2.7 Diabetes

Diabetes is associated with an increased risk of postsurgical complications and future development of renal failure compared to the general population. Therefore, individuals with a history of diabetes or fasting blood glucose ≥ 126 mg/dl on at least two occasions or 2-hour glucose with OGTT ≥ 200 mg/dl are thought to be contraindication for living kidney donation in Amsterdam forum guideline. OPTN/UNOS guideline adapts more strict cutoff level where 2hr BS ≥ 140 are considered to be contraindication for living kidney donation.

According to the survey of US transplant center, almost one-half of programs exclude donors based on elevated fasting blood glucose (FBG), but various cutoffs are used to define 'elevated' (from >100 mg/dl to >120 mg/dl). Most programs exclude based on abnormal oral glucose tolerance test or Type II diabetes.

2.8 Dyslipidemia

Dyslipidemia should be included along with other risk factors in donor risk assessment, but dyslipidemia alone does not generally exclude kidney donation.

2.9 History of malignancy

Living kidney donors should be screened by standard medical guidelines to exclude malignancy. A prior history of malignancy may only be acceptable for donation if prior treatment of the malignancy does not decrease renal reserve or place the donor at

increased risk for end stage renal disease (ESRD) and if prior treatment of malignancy does not increase the operative risk of nephrectomy. The history of melanoma, renal or urological malignancy, choriocarcinoma, hematologic malignancy, lung cancer, breast cancer and monoclonal gammopathy generally precludes living donation (Pham, PC, et al 2007).

3. Being donor with medical abnormality

Due to the extreme shortage of organ donors worldwide, the indications for live kidney donation have been expanding in terms of medical status, and now include patients with mild hypertension, older age, and mild decline of renal function. Individuals with isolated medical abnormalities (IMAs) are undergoing living donor nephrectomy more frequently. Knowledge of health risks for these living donors is important for donor selection, informed consent and follow-up. One systematical review with living kidney donors with preexisting IMA showed perioperative outcomes for donors with and without IMAs were similar (Young A, et al 2008). However, few studies reported longer term rates of hypertension, proteinuria or renal function. Studies were frequently retrospective and without a comparison group. Centers may accept some IMA donors considering the small risk of ESRD developing as result of the IMA (Bia MJ, et al. 1995). Some long-term follow-up study of IMA donors will be described below.

3.1 Being donor having hypertension

When seeing the relatively short-term outcomes of hypertensive donors, white subjects with moderate, essential hypertension and normal kidney function have no adverse effects regarding blood pressure, GFR, or urinary protein excretion during the first year after living kidney donation. Although further studies are essential to confirm long-term safety, these data suggest that selected hypertensive patients may be accepted for living kidney donation (Textor SC, et al. 2004).

One more study confirmed the long-term safety of hypertensive donors. When 674 live kidney donors were divided into two groups, survival rates in hypertension (HT)-group (N=54) by 20 years were equivalent as compared with non-HT group (N=620). Prevalence of renal dysfunction and ESRD were not increased in HT-group, while prevalence of HT and HT with medication was increased (Okamoto M. unpublished data). Those results demonstrated that those who have HT were able to donate their kidney safely with little major long-term morbidity by strict evaluation and careful postoperative follow-up.

3.2 Being donor having proteinuria

There were one long-term follow-up study of 70 renal outcome 25 years after donor nephrectomy in US single center (at the Cleveland Clinic). By this analysis patients with mild or borderline proteinuria before donation (0.160 g /24 hour) may represent a subgroup at particular risk for the development of significant proteinuria (>0.8 g /24 hour) 20 years or greater after donation (Goldfarb DA, et al. 2001).

3.3 Being donor having glucose intolerance

There were one report concerning long-term outcome of living kidney donors who donated kidneys having glucose intolerance (GI). In this study, 444 donor nephrectomies were divided into GI group and non-GI group according to the results of 75g-oral glucose

tolerance test (75g-OGTT). Survival rates in the GI group up to 20 years were equivalent to those in the non-GI group. None of the patients with diabetes mellitus (75g-OGTT: DM pattern, n=27) had developed severe diabetic complications or ESRD at a mean follow-up point of 88 ± 71 (range, 14-225) months. These results suggested that individuals who have GI without diabetic complication may be able to donate their kidney safely with little major morbidity if strict evaluation is performed before transplant (Okamoto M, et al. 2010).

3.4 Transplant outcomes from isolated medical abnormality (IMA) donors

According to the meta-analysis of 12 studies, recipients of kidneys from older donors had poorer 5-year patient and graft survival than recipients of kidneys from younger donors. However, few transplant outcomes were described for other IMA, namely, obesity, hypertension, reduced GFR, proteinuria and hematuria. This disconnect between donor selection and a lack of knowledge of recipient outcomes should give transplant decision-makers pause and sets an agenda for future research (Iordanous Y, et al. 2009).

4. Perioperative issue in living kidney donation

The first major concern regarding living kidney donation is the incidence of perioperative deaths and serious surgical complications. Although it is considered to be a relatively safe procedure, risk of death for the donor is generally estimated as being around 0.02-0.03%. Perioperative mortality and complications of donor nephrectomy including pulmonary embolism, pneumothorax, and less seriously, wound infection, unexplained fever and urinary tract infection will be described below.

4.1 Perioperative mortality

Donor safety is of paramount importance in living donor transplantation. Yet, living donor deaths actually occur (Ratner LE, et al. 2010). According to the survey of 171 United States kidney transplant centers, two donors (0.02%) out of 10,828 living donors died from surgical complications between 1999 and 2001 (Matas AJ, et al. 2003). However, in separate report from the various transplant center, there are little report of a donor death (Siebels M, et al. 2003, Jones KW, et al. 1997, Johnson EM, et al. 1997, Blohme I, et al. 1992).

4.2 Possible surgical complication

There are some surgical complication specific to living donor nephrectomy. Special care must be taken to prevent them.

4.2.1 Deep vein thrombosis/pulmonary embolism

Deep vein thrombosis/pulmonary embolism are most serious complication following living donor nephrectomy. Actually one specified death was caused by pulmonary embolism (Matas AJ, et al. 2003). We reported one case of pulmonary embolism which was diagnosed in relatively early period and successfully recovered with anti-coagulant therapy and transient mechanical ventilation (Ushigome H, et al. 2003). It is very important for surgeons to realize that this can develop in any case of living donor nephrectomy. Every effort should be made to prevent it by enough hydration, intermittent pneumatic compression (IPC) and, if necessary, prophylactic anti-coagulant therapy.

4.2.2 Pneumothorax

Pneumothorax also occurs because of anatomical reason, which sometime needs pleural drainage. The report from US single center (University of Minnesota) described 13 (1.5%) pneumothoraces (6 required intervention, 7 resolved spontaneously) among 871 living donor nephrectomies (Johnson EM, et al. 1997).

4.2.3 Bleeding

Bleeding is the most common cause of reoperation especially laparoscopic nephrectomy. According to the survey of United States kidney transplant centers, 26 donors (0.24%) out of 10,828 living donors needed reoperation because of bleeding (Matas AJ, et al. 2003). By a report of Swedish single center through a retroperitoneal approach, there were 5 cases (1.02%) of postoperative haemorrhage requiring reoperation out of 490 living donor nephrectomies (Blohme I, et al. 1992).

4.2.4 Incisional hernia

Incisional hernia can occur as in other laparotomic surgery and needs reoperation. According to the survey of United States kidney transplant centers, 22 donors (0.20%) out of 10,828 living donors needed reoperation because of hernia (Matas AJ, et al. 2003).

4.2.5 Femoral nerve compression

Femoral nerve compression may occur because it exists on the psoas muscle and it can be compressed by would retractor.

4.2.6 Wound infections, hematomas or seromas

Wound infections, hematomas or seromas happen most frequently after living donor nephrectomy as a minor complication. They usually resolve without major operation.

4.2.7 Pneumonias, atelectasis and urinary tract infections

Pneumonias and atelectasis also happens as a complication of general anesthesia. They tend to occur at an opposite site of nephrectomy because of lateral recumbent position. Urinary tract infections also happen as in other surgical procedure due to insertion of urethral catheter.

4.3 Risk factors for perioperative complications

Transplant professionals should avoid possible risk for living kidney donors. A couple of report analyzed the risk factor for them. According to analysis of live donors drawn from a mandated national registry of 80 347 live kidney donors in the United States between 1994 and 2009, surgical mortality was higher in men than in women (RR=3.0), in black vs. white and Hispanic individuals (RR=3.1), and in donors with hypertension vs. without hypertension (RR=27.4) (Segev DL, et al. 2010). The report from US single center (University of Minnesota) described that the analysis, by logistic regression, among 871 living donor nephrectomies identified significant risk factors for perioperative complications were male gender (vs. female), pleural entry (vs. no pleural entry), and weight > or = 100 kg (vs. < 100 kg) (Johnson EM, et al. 1997).

5. Long-term follow-up of living kidney donor -Survival, renal function, complication

The long-term consequences after kidney donation are not fully understood. However, most long-term follow-up studies of living kidney donors find no decrease in long-term survival. And most of the data suggested that the donors had normal renal function, with an incidence of hypertension comparable to that expected in the age-matched general population, while other demonstrated that donor nephrectomy is associated with mild proteinuria and hypertension. The Long-term follow-up study of living kidney donor concerning survival rate, renal function and various complications will be described including our Japanese experiences (Table 2).

Author	year	Subject	Tx done	No.	retrieval rate	HT	ESRD	die	Survival rate
Najarian JS	1992	single center	1963–1970	135	NA	32%	not stated	15	NA
Fehrman–Ekholm I	1997	single center	1964–1994	459	93%	35%	not stated	41	29% better
Fehrman–Ekholm I	2001	single center	1964–1995	451	77%	38%	1	49	NA
Goldfarb DA	2001	single center	1963–1975	180	38%	48%	2	24	NA
Ramcharan T	2002	single center	1963–1979	773	60%	similar	5	84	NA
Ellison MD	2002	UNOS registry		NA	NA	NA	56	NA	NA
Thiel GT	2005	national registry	1993–2005	737	85%	35%	0	9	NA
Gossmann J	2005	single center	1973–2001	152	93%	30%	0	7	NA
Ibrahim HN	2009	single center	1963–2007	3698	NA	32%	11	268	Similar to NP
Okamoto M	2009	single center	1972–2006	601	80%	30.1%	4	55	better than NP

No.: total number of donor, HT: hypertension, ESRD: end-stage renal disease, UNOS: United Network for Organ Sharing, NA: not accessed, NP: Normal population

Table 2. Report of long-term outcome after living kidney donation

5.1 Long-term survival following living kidney donation

Most long-term follow up studies of living kidney donors find no decrease in long-term survival. By analysis of 430 previous living kidney donors in Swedish single center, the survival rate of 20 years was 29% better than the expected survival rate calculated by using national registers. They concluded that the better survival among donors is probably due to the fact that only healthy persons are accepted for living kidney donation (Fehrman-Ekholm I, et al. 1997). 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 with the general population (Okamoto M, et al. 2009). The study of larger numbers of donors as many as 3698 who donated kidneys during the period from 1963 through 2007 for a longer follow-up period in US single institute (University of Minnesota) also ascertained that the survival of kidney donors was similar to that of controls who were matched for age, sex, and race or ethnic group (Ibrahim, HN, et al. 2009). The overall evidence suggests that living kidney donors have survival similar to that of non-donors.

5.2 Hypertension following living kidney donation

Hypertension is thought to be one of major concerns following living kidney donation. However, a couple of study demonstrated no increase of hypertension after living donor nephrectomy. By a 15-year experience on 162 living donors in Italy, Long-term incidence of hypertension in living donors was similar to the general population (Sansalone CV, et al. 2006). Furthermore, the analysis of 402 donor nephrectomy 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 (Fehrman-Ekholm I, et al. 2001).

On the other hands, some study demonstrated increase of hypertension after living donor nephrectomy. Another analysis of 75 donors, in US single center (University of Missouri), showed that the prevalence of hypertension was significantly increased compared with age/sex matched data from epidemiological studies of the general population, especially in those over the age of 55 years (Saran R, et al. 1997). Also, in a live kidney donor cohort with a 93% retrieval rate of the 152 donors, mean blood pressure had increased from $125 \pm 15/79 \pm 11$ to $134 \pm 19/81 \pm 9$ mmHg ($p < 0.01$) which remained significantly below normal. (Gossmann J, et al. 2005). One Meta-analysis showed kidney donors may have a 5 mmHg increase in blood pressure within 5 to 10 years after donation over that anticipated with normal aging (Boudville N, et al. 2006). Future controlled, prospective studies with long periods of follow-up will better delineate the risk of hypertension following living kidney donation.

5.3 Proteinuria following living kidney donation

Most reported data suggested that proteinuria increased in living kidney donor population, although 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 microalbuminuria was found in 22.6% of the donors (Schostak M, et al. 2004). Another study showed, in a live kidney donor cohort with a 93% retrieval rate of the 152 donors, fifty six percent of donors developed proteinuria (>150 mg/day), but only 10% had albuminuria (Gossmann J, et al. 2005). By analysis of 402 outcome after donor nephrectomy in Sweden, significant proteinuria ($> \text{or} = 1.0$ 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 GFR (Fehrman-Ekholm I, et al. 2001).

One Meta-analysis, which analyzed a total of 5048 donors from forty-eight 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/day and concluded that kidney donation results in small increases in urinary protein. (Garg AX, et al. 2006).

5.4 Renal function following living kidney donation

Renal function is the greatest concerns at a long time after living kidney donation. In a report from Saudi Arabia of 25 living kidney donors, total kidney function measured as creatinine clearance showed significant drop by 36% of the pre donated value. However, remaining kidney clearance increased by an average of 34% of the pre donated level 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% (Shehab AB, et al. 1994). Other investigator shows 25% decrease of GFR with mean time after uninephrectomy of 11 years. (Gossmann J, et al. 2005), and 27% decrease of with mean patient follow-up of 25 years (Goldfarb DA, et al. 2001).

In a Swedish study, the average estimated GFR (12 years after donation) was $72 \pm 18\%$ 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 (Fehrman-Ekholm I, et al. 2001). These results demonstrated that although living kidney donor lose GFR by 15-25%, they usually do not show the accelerated loss of renal function if they do not have risk factor for chronic renal disease (CKD). One unique study examined renal function >20 years after donation by comparing that with siblings. They showed no significant difference in serum creatinine (1.1 ± 0.01 vs 1.1 ± 0.03 mg/dl), blood urea nitrogen (17 ± 0.5 vs 17 ± 1.2 mg/dl) and creatinine clearance (82 ± 2 vs 89 ± 3.3 ml/min) between 57 donors (mean age 61 ± 1) and 65 siblings (mean age 58 ± 1.3) (Najarian JS, et al. 1992).

5.5 ESRD in previous donor

Although the Swiss Organ Living Donor Health Registry showed no ESRD in 737 living kidney donors between 1993 and January 2005 (Thiel GT, et al. 2005), there were considerable reports of ESRD of previous kidney donor as below.

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 subsequently listed for cadaveric 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. (Ellison MD, et al. 2002). In analysis of 402 donor nephrectomy in Sweden, no donor died in 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 (Fehrman-Ekholm I, et al. 2001). In Mexican experience, they present four kidney donors who developed ESRD thereafter, three becoming kidney recipients (Gracida C, et al. 2001). Other two case reports described kidney donors who developed ESRD (Ladefoged J, et al. 1992, al Shohaib S, et al. 1995). By analysis of 464 outcomes after donor nephrectomy at University of Minnesota, 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 (Ramcharan T, et al. 2002).

One study carefully investigated the association between postoperative clinical courses and changes in renal function in eight donors who developed chronic kidney disease (CKD) stage 5 or ESRD. According to their findings, except for one donor who developed ESRD caused by a traffic accident, 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 (Kido R, et al. 2009). However, the overall evidence suggests that their risk of ESRD is not increased.

6. Ethical issue and quality of life (Q.O.L.) in living kidney donation

Most published reports have indicated healthy psychological status and improved quality of life (Q.O.L.) in living kidney donors. However, there have been some reports of depression and disrupted family relationships after kidney donation. The reasons of negative results were mainly related to poor outcome of the kidney recipient, or long-lasting major pain or disappointment about medical handling before and after organ donation. Ethical issue and Q.O.L. in living kidney donation will be described.

6.1 Ethical issue in living kidney donation

Not only medical aspect but also ethical aspect is very important part to continue living kidney transplantation. The general public's concerns of living kidney donation is the length of a hospital stay, out-of-pocket expenses, size and appearance of a scar, and the donor risk of developing kidney failure (Boulware LE, et al. 2002). In this respect, it is quite important process to inform prospective donor of these issues. Especially, a long-term medical risk with potential living donors is a vital aspect of informed consent. According to a survey of 203 practitioners in 35 countries, risks of hypertension, proteinuria or kidney failure requiring dialysis were frequently discussed (usually over 80% of practitioners discussed each medical condition). However, many practitioners do not believe these risks are increased after donation, with surgeons being less convinced of long-term sequelae compared with nephrologists. Thus, transplant professionals vary in the long-term risks they communicate to potential donors. (Housawi AA, et al. 2007).

Moreover, the expansion of living donor kidney transplantation to include significant numbers of donors with little to no preexisting relationship to the candidate has caused concern in the medical community regarding as donor psychological status, motivation, knowledge about donation and the potential for undue pressure to donate under some circumstances. (Dew MA, et al. 2007). Another rare but delicate issue in living-related kidney donation is discovering misattributed paternity. In a survey, the prevalence of misattributed paternity ranges between approximately 0.25% and 0.5% of all living kidney donations. Opinions about revealing this information were quite variable by practitioners (Young A, et al. 2009).

6.2 Quality of life (Q.O.L.) in living kidney donation

Same as medical risk, Q.O.L. in living kidney donors is substantial issue to continue this procedure. According to the experience in 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 months by a comparable percentage (44%). Forty-six percent had a very good and 33% a good feeling after the kidney donation. The relationship to the recipient had intensified in most cases. Ninety-one percent would again decide in favor of a donation (Schostak M, et al. 2004). By another survey, majority of living kidney donors had an excellent Q.O.L. As a group, they scored higher than the national norm on the SF-36, a standardized Q.O.L. health

questionnaire. However, 4% were dissatisfied and regretted the decision to donate. Further, 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. Further, donors who had perioperative complications and female donors were more likely to find the overall experience more stressful (Johnson EM, et al. 1999).

Women considering kidney donation frequently ask whether a nephrectomy will impact their ability to have children (Nevis IF, et al. 2009). 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 (0.7% vs. 2.7%), gestational hypertension (0.6% vs. 5.7%), preeclampsia (0.8% vs. 5.5%), prematurity (4.0% vs. 7.1%) and fetal loss (11.3% vs. 19.2%). The authors reported that these incidences of adverse events observed in donors were similar or better than expected levels for the general population (Ibrahim H et al. 2009). Therefore, pregnancy after kidney donation is not necessarily contraindication although it is better to avoid.

7. Financial Issue in living kidney donation

Many nations have programs that help living donors with their financial costs while donors in other regions of the world are without support. Moreover some living kidney donors encounter difficulties obtaining life insurance, despite the surveys of insurance companies reporting otherwise.

7.1 Reimbursement for living kidney donation

The financial risk of living donation is theoretically well covered by different insurances. However, some of the donors had to cover some expenses by themselves (Wolters HH, et al. 2003). It is proposed to reimburse donor risk by a package of specific benefits (life insurance, health insurance and a small amount of cash) to minimize hazard and ensure donor interests. It will fund medical follow-up and enable data collection so that long-term risk can be accurately assessed (Gaston RS, et al. 2006).

One international research network examined legislation and programs that facilitate reimbursement, focusing on policy mechanisms, eligibility criteria, program duration and types of expenses reimbursed. According to their results, among 40 countries, reimbursement is expressly legal in 16, unclear in 18, unspecified in 6 and expressly prohibited in 1. Donor reimbursement programs exist in 21 countries; 6 have been enacted in the last 5 years. Lost income is reimbursed in 17 countries, while travel, accommodation, meal and childcare costs are reimbursed in 12 to 19 countries. Ten countries have comprehensive programs, where all major cost categories are reimbursed to some extent. These programs differ in operation and scope. Donors in other regions of the world are without support (Sickand M, et al. 2009). Effort should be taken to establish reimbursement system to facilitate living kidney donation where this procedure is performed.

7.2 Life insurance after living kidney donation

Being an organ donor may affect one's ability to obtain life, disability and health insurance. According to a systematic review, almost all companies would provide life and health insurance to living organ donors, usually with no higher premiums. However, concern about insurability was still expressed by 2%–14% of living organ donors in follow-up

studies, and 3%–11% of donors actually encountered difficulties with their insurance (Yang RC, et al. 2007).

In another study, researchers contacted offices of life insurance companies in five major cities in Canada to obtain life insurance for fictitious living kidney donors and paired controls. As a result, all donor and control profiles received a quote, with no significant difference in the premium quoted. More time was spent on the phone for donor compared to control profiles, although difference was small. Age, gender, family history of kidney disease and new-onset hypertension had no further effect on donor insurability in regression analysis. They found no evidence that kidney donors were disadvantaged in the first step of applying for life insurance (Yang RC, et al. 2009).

8. Conclusion

Because securing the safety of donor is essential to the continued success of living kidney transplantation, we have reviewed important issues, namely, indication, donation with medical abnormality, perioperative problem, long-term follow-up, ethical issue, Q.O.L. and financial issue in living kidney donation. The background quite differ by region, therefore, it seems to be difficult to build a international standard. Regular follow-up of kidney donors is recommended in order to manage their complications effectively and to detect health problem early in those who may develop it. National registry is necessary to enable data collection so that long-term risk can be accurately assessed.

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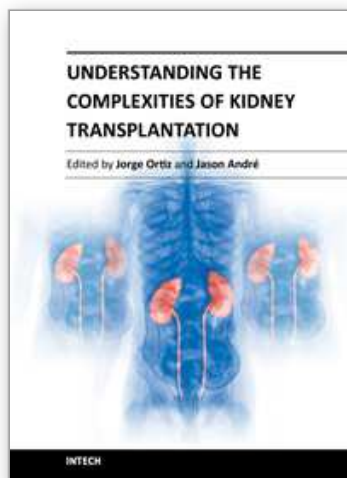
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Kidney transplantation is a complex field that incorporates several different specialties to manage the transplant patient. This book was created because of the importance of kidney transplantation. This volume focuses on the complexities of the transplant patient. In particular, there is a focus on the comorbidities and special considerations for a transplant patient and how they affect kidney transplant outcomes. Contributors to this book are from all over the world and are experts in their individual fields. They were all individually approached to add a chapter to this book and with their efforts this book was formed. Understanding the Complexities of Kidney Transplantation gives the reader an excellent foundation to build upon to truly understand kidney transplantation.

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