#### REVIEW

# Health-related quality of life of living kidney donors: review of the short form 36-health questionnaire survey

# Ja Hyeon Ku

Department of Urology, Seoul Veterans Hospital, Seoul, Korea

#### Keywords

kidney transplantation, living donors, quality of life, questionnaires.

#### Correspondence

Ja Hyeon Ku MD, Department of Urology, Seoul Veterans Hospital, 6-2, Doonchon Dong, Kangdong Ku, Seoul 134-791, Korea. Tel.: 82 2 2225 1392; fax: 82 2 483 4260; e-mail: randyku@hanmail.net

Received: 9 August 2005 Accepted: 22 September 2005

doi:10.1111/j.1432-2277.2005.00231.x

# Introduction

Kidney transplantation is the ultimate goal and the best treatment for most patients with end-stage renal disease. The shortage of cadaver kidneys for transplantation means that many individuals must wait for long periods to receive the benefits of transplantation. Organ shortage and steadily growing waiting time for a cadaver kidney transplant have forced the medical community to look for alternatives, such as living kidney donation. Living kidney donation offers several potential benefits, including better result for the recipient, greater convenience for the recipient, better access to transplantation for the recipient, and reduced financial burden to society [1–6].

Although the benefits of living donor organs for recipients are well documented, available data examining quality of life (QOL) issues of living donors are currently limited. The psychological long-term effects of kidney donation have been studied and a boost in self-esteem has been documented as a factor increasing the sense of well-being in QOL of living donors [7–11]. However, some limitations exist concerning: (i) sample size, (ii) the response rate, and (iii) validity of the applied psychological instruments – the applied psychological instruments

#### Summary

Kidney transplantation is the ultimate goal and the best treatment for most patients with end-stage renal disease. Organ shortage and steadily growing waiting time for a cadaver kidney transplant have forced the medical community to look for alternatives, such as living kidney donation. However, available data examining health-related quality of life (QOL) issues of living donors are currently limited. In addition, little information regarding factors associated with health-related QOL in living kidney donors is currently available and this issue remains controversial. This review article aims to summarize the data regarding health-related QOL of living kidney donors by using the Medical Outcomes Study Short Form.

often included only a few dimensions and a few number of items.

Standardized instruments should be part of this process, as they help donors to focus on the issues, help ensure a comprehensive assessment, provide a basis for serial monitoring, and permit auditing that can be reported in a universally interpretable way. The Medical Outcomes Study Short Form (SF-36) was developed to survey health status in the United States [12]. Experience to date suggests that the SF-36 can be adapted for use in other countries with relatively minor changes to the content of the form, providing support for the use of these translations in multinational clinical trials and other studies [13]. We review the studies evaluating health-related QOL of living kidney donors by using the SF-36 (Table 1) [14–24].

#### Medical outcomes study short Form

The SF-36 includes one multiple item scale that assesses eight health concepts: (i) limitations on physical functioning because of health problem (10 items); (ii) limitations in usual activities because of physical health problems (role-physical: four items); (iii) bodily pain (two items);

**Table 1.** Donor characteristics of studies using the short-form 36-item questionnaire.

				Donor cl	naracteristic	CS			
Reference	Country	Year	Study design	No.	Response rate (%)	Age [(range) years]	Gender (M/F; %)	Related/ unrelated (%)	Mean F/U duration (range)
Perry et al. [14]	USA	2003	Retro	L: 40	L: 67	L: 43	L: 46/54	L: -/-	L: 255 ± 165 days
				O*: 80	O*: 82	O*: 40	O*: 37/63	0*: <i>-</i> /-	O*: 240 ± 146 days
Johnson <i>et al</i> . [15]	USA	2003	Retro	524	60	41 (17–74)	39/61	92/8	-
Buell <i>et al</i> . [16]	USA	2005	Retro	L: 46	L: 46	L: 42	L: 38/62	L: -/-	L: –
				O: 21	O: 42	O: 46	O: 33/67	0: –/–	O: –
Fehrman-Ekholm <i>et al</i> . [17]	Sweden	2000	Retro	370	92	48.5 ± 11.3 (25–76)	45.1/54.9	99.7/0.3	12.5 ± 7.7 years (2–34)
Giessing et al. [18]	Germany	2004	Retro	106	90	53 (28–71)	32/68	72/28	75.3 ± 66.0 months (12-226)
Tanriverdi et al. [19]	Turkey	2004	Retro	D: 18	D: –	D: 43 (18-62)	D: 39/61	D: -/-	35.6 ± 29.3 months (1–120)
				C: 45	C: –	C: 33 (18–62)	C: 80/20		
Smith <i>et al</i> . [20]	Australia	2003	Pro	44	92	48 (26–72)	48/52	61/39	4 months
Smith <i>et al</i> . [21]	Australia	2004	Pro	Pre: 48	Pre: 94	Pre: 49 (26–72)	Pre: 46/54	Pre: -/-	12 months
				Post: 7	Post: 15	Post: 42 (26–56)	Post: 14/86	Post: –/–	
Isotani <i>et al</i> . [22]	Japan	2002	Retro	69	66	52 (24–70)	30/70	100/0	6.95 ± 4.34 years (0.3–14)
Chen <i>et al</i> . [23]	Taiwan	2004	Retro	17	-	41 (25–56)	47/53	-/-	-
Zargooshi [24]	Iran	2001	Retro	V: 300	V: 97.7	V: 33	V: 71/29	V: 3/97	V: 6 months‡ (6–132)
				C†: 100	C†: –	C†: –	C†: –/–		

\*Mini-incision.

†Nephrectomy for benign diseases.

‡Median.

Retro, retrospective; Pro, prospective; L, Laparoscopy; O, open; D, donors; C, controls; Pre, preoperative; Post, postoperative; V, vendors.

(iv) general health perception (six items); (v) vitality (energy and fatigue: four items); (vi) limitations on social functioning because of physical or emotional problems (two items); (vii) limitations on usual activities because of emotional problems (role-emotional: three items); (viii) general mental health (psychological distress and well-being: five items). The number of questions directed at each health concept ranged from 2 to 10, and the number of response options per question ranged from two (no or yes) to six (none, very mild, mild, moderate, severe, or very severe). Each of the dimension scores was expressed as a value between 0 and 100, with greater scores representing better health.

To define and assess health-related QOL across ethnic groups requires the development of outcome measures in non-English languages that are culturally appropriate for cross-ethnic studies. There exist differences in the levels of literacy, taboo subjects, and social desirability effects between cultures. Furthermore, certain features of the language, such as idioms, are very difficult to translate and make little sense within a different cultural context. The translation of Western outcome measures into other countries offers an unusual challenge due largely to contrasting cultural beliefs and practices about the body, health and illness, and social norms with regard to the articulation of disease and sickness [25–26]. Experience to date suggests that the SF-36 can be adapted for use in other countries with relatively minor changes to the content of the form, providing support for the use of these translations in multinational clinical trials and other studies [13].

#### Health-related QOL in living kidney donors

It remains unknown as to whether there are any differences between countries, races, or social groups, with regard to health-related QOL in living kidney donors. However, most studies have suggested that donating a kidney may be associated with psychological benefits for the donors and have shown generally excellent QOL in kidney donors. Table 2 summarized the results of healthrelated QOL of living kidney donors [14–24].

#### USA

Johnson *et al.* [15] described QOL of living kidney donors using a standardized and validated health survey QOL assessment tool, the SF-36. They sent a questionnaire to 979 American donors, and 60% responded. Donors scored better than the general US population in seven of eight categories and donors on average scored much better than those with the two disease states

Transplant International 18 (2005) 1309–1317 © 2005 European Society for Organ Transplantation

(congestive heart failure and depression). However, 12% recalled the experience as being stressful or extremely stressful, and that 4% regretted the donation. Overall, the vast majority of donors had a positive experience and would readily donate again if it were possible. Perry *et al.* [14] evaluated health-related QOL of patients who underwent laparoscopic and mini-incision open donor nephrectomy in retrospective fashion. The overall QOL for both open mini-incision and laparoscopic donor nephrectomy donors was comparable with or higher than age-matched general US population. Buell *et al.* [16] also examined QOL of laparoscopic and open living donor nephrectomy donors and found that the overall QOL for both open and laparoscopic donor nephrectomy donors was comparable with the general US population.

#### Sweden

Fehrman-Ekholm *et al.* [17] assessed the subjective health state of Swedish living donors. Each living donor was mailed and 370 (response rate: 92%) answered the questionnaire. According to the SF-36, the overall subjective health scores of the donors were satisfactory. Donors on all eight health scales scored higher than the age- and gender-adjusted general Swedish population. Less than 1% of the donors regretted the donation.

#### Germany

Giessing *et al.* [18] evaluated the impact of kidney donation on German donor's QOL. They sent questionnaires to donors who could be contacted and analyzed answers of 106 donors (response rate: 90%). Most donors had an equal or better QOL than the healthy population (subjects aged more than 14 years and living in the general East and West German population). For three items (physical functioning, role-physical, and general health), kidney donors had a significantly better score than references. For another four items (bodily pain, vitality, social functioning, and mental health), donors scored better than references, but the differences were not significant. The score for 'emotional role' was worse for the study population than for references, but the difference was not significant.

# Turkey

Tanriverdi *et al.* [19] investigated health-related QOL and mood in Turkish renal transplant donors and control. The majority of living kidney donors did not experience negative consequences with respect to personal health, family relationships, or energy level and were comfortable with their choice to donate. Donor subjects had lower depression scores on the Beck Depression Inventory than the controls. This might be explained by a highly positive experience with kidney donation and enhanced self-esteem and self-regard related to this act. However, most donors experienced anxiety (based on the Beck Anxiety Inventory) after the transplantation procedure. This is understandable, possibly being associated with worry about the survival of the transplanted kidney, the outcome of the operation in terms of ability to recover and/or reenter the work force, and risks of living with a single kidney.

# Australia

There are few prospective psychosocial outcome studies on living kidney donors. Smith et al. [20,21] conducted psychosocial assessment and monitoring of living kidney donors prospectively. Psychological assessment of living kidney donors was performed preoperatively and at 4 and 12 months postoperatively. Preoperatively, both physical function [SF-36 Physical Component Summary (PCS) score] and psychosocial function [SF-36 Mental Component Summary (MCS) score] were significantly higher than community (state of Victoria) norms. MCS scores decreased between the preoperative period and 4-month postoperative period, and remained significantly lower 12 months postoperatively. At 4 and 12 months postoperatively, MCS was no longer significantly higher than the Victorian norms. PCS scores showed no significant decrease across the time points although there were significant decreased (between preoperatively and 12 months postoperatively) for the scales of 'bodily pain', 'general health' and 'vitality'. PCS remained significantly higher than the Victorian norms at 4 and 12 months postoperatively. Interestingly, MCS of donors who developed adjustment disorder and anxiety disorder were significantly lower than those without psychiatric disorder. These findings justify the recommendation that donors need to be educated about the extent of psychosocial impairment that might occur in the postoperative period.

#### Japan

Isotani *et al.* [22] conducted a psychosocial follow-up of Japanese living kidney donors. The mean SF-36 scores of 69 donors (response rate: 66%) were not significantly different from those of the general US population and US donors. In response to the question, 'If possible, would you make the same choice again?' Ninety-seven percentage of donors said they would agree to donate and 3% believed that donating had had a negative impact on their health. Most (84%) believed the donation involved only a minor financial burden. In Japan, the cost of the operation of a living kidney donation is not borne by the donor, but is included in the cost to the recipient. It is

	areu quairty or ille	: III IINIIIA VIAIIEA AC							
	SF-36								
Reference	PF	RP	ВР	GH	VT	SF	RE	HM	Results
Perry <i>et al.</i> [14]	L: 97.2 ± 6.0 O*: 92.7 ± 11.9	L: 94.7 ± 18.4 0*: 86.5 ± 27.5	L: 95.4 ± 10.4 O*: 81.2 ± 15.0	L: 89.7 ± 11.1 O*: 86.0 ± 15.8	L: 80.1 ± 16.6 O*: 72.5 ± 21.7	L: 93.6 ± 13.7 O*: 86.6 ± 22.4	L: 97.9 ± 9.4 0*: 84.4 ± 29.1	L: 83.5 ± 13.5 O*: 81.8 ± 18.2	Comparable quality of life for both open and laparoscopic nephrectomy
Johnson e <i>t al.</i> [15]	92	0	75	82	67	26	8	80	donated with the generation of (i) Better scores than the general US population in seven categories (ii) Much better scores than
[2]] / c + c    c, G	0 2 -	- yo	C0 	- - - -	3 62 -	- - -	C 0 -		the disease states (congestive heart failure and depression)
puell <i>et al.</i> [10]	L: 93.8 O: 94.0	L: 80.7 O: 88.1	L: 63.7 O: 81.6	L: 81.5 O: 83.1	L: 03.5 0: 69.5	L: 67.2 O: 90.5	L: 89.4 0: 85.7	L: 81.1 O: 84.8	Comparable quality of me for both open and
									laparoscopic nephrectomy donors with the general US population
Fehrman-Ekholm <i>et al.</i> [17]	I	I	I	I	I	I	1	I	Higher scores of all domains than the age- and
									gender-adjusted general Swedish population
Giessing <i>et al.</i> [18]	1	1	1	1	1	I	1	I	<ul> <li>(i) Equal or better scores than the healthy population (subjects aged more than 14 years and living in the</li> </ul>
									general East and West German population) (ii) Slightly higher scores than the healthy population (PF, RP, and GH)
Tanriverdi <i>et al.</i> [19]	D: 75.3 ± 23.4 C: 92.0 ± 13.7	D: 68.1 ± 42.7 C: 83.9 ± 28.3	D: 75.7 ± 29.3 C: 82.2 ± 19.5	D: 73.7 ± 19.7 C: 67.4 ± 16.7	D: 73.9 ± 15.8 C: 55.9 ± 20.6	D: 80.6 ± 21.5 C: 69.4 ± 22.7	D: 68.5 ± 40.4 C: 66.7 ± 38.9	D: 73.8 ± 15.5 C: 61.8 ± 19.3	No negative consequences with respect to personal health, family relationships, or energy level

Table 2. Health-related quality of life in living kidney donors

Transplant International 18 (2005) 1309–1317 © 2005 European Society for Organ Transplantation

Smith <i>et al.</i> [20]	I	I	I	I	I	I	I	I	(i) Preoperative: higher physical function (PCS score) and psychosocial function
									(MCS score) than community (state of Victoria) norms (ii) Postoperative (4 months): significantly decrease of PCS and MCS, but not below the Victorian norm
Smith <i>et al.</i> [21]	Pre: 94.4 ± 6.8 Post†:92.9 ± 9.5	Pre: 96.9 ± 15.1 Post†: 90.6 ± 25.1	Pre: 87.5 ± 17.5 Post†:80.6 ± 22.7	Pre: 83.7 ± 12.7 Post†:79.3 ± 16.4	Pre: 77.6 ± 12.6 Post†:68.9 ± 19.4	Pre: 95.4 ± 9.5 Post†: 89.9 ± 21.2	Pre: 98.6 ± 6.7 Post†: 93.1 ± 22.8	Pre: 82.6 ± 13.5 Post†: 78.4 ± 16.1	<ul> <li>(i) Preoperative scores:</li> <li>54.7 ± 6.0 (MCS),</li> <li>54.9 ± 5.2 (PCS)</li> <li>(ii) Postoperative scores</li> </ul>
									(4 months): 50.9 ± 8.6 (MCS), and 53.1 ± 7.6 (PCS) (iii) Postoperative scores (12 months): 51.5 ± 9.1 (MCS), 53.4 ± 5.3 (PCS)
									(iv) Preoperative: higher PCS and MCS scores than the Victorian State norms (v) Postoperative (4 and (v) Postoperative (4 and higher MCS than the Victorian norms
lsotani <i>et al.</i> [22]	90.9 ± 11.4	88.9 ± 26.5	85.9 ± 18.1	75.2 ± 19.0	72.2 ± 20.6	92.1 ± 16.3	88.4 ± 27.3	83.1 ± 15.7	<ol> <li>No significant difference from the general US population and US donors (ii) Slightly higher than the general US population in some categories (PF, RP, BP GH VT and MH)</li> </ol>
Chen <i>et al.</i> [23]	84.4 ± 4.4	84.0 ± 4.7	78.4 ± 8.0	81.5 ± 5.9	83.2 ± 3.7	83.9 ± 5.9	79.9 ± 4.1	78.6 ± 2.3	<ul> <li>(i) Low quality of life changes</li> <li>(ii) Low quality of life changes and risks after donation</li> <li>(ii) Worst scores of bodily pain and merital health</li> </ul>
Zargooshi [24]	V: 35.2 ± 7.5 C‡: 77.3 ± 12.5	V: 62.5 ± 9.3 C‡: 87.4 ± 11.1	V: 48.0 ± 11.0 C‡: 82.7 ± 9.4	V: 30.1 ± 10.9 C‡: 80.9 ± 13.7	V: 34.8 ± 7.7 C‡: 83.9 ± 15.4	V: 64.9 ± 8.2 C‡: 82.1 ± 16.8	V: 37.9 ± 4.5 C‡: 69.3 ± 9.9	V: 43.4 ± 13.5 C‡: 75.0 ± 17.2	Significant lower scores on all SF-scales compared with controls
*Mini-incision. †12 months									

\*Nephrectomy for benign diseases. PF, physical functioning; RP, role-physical; BP, bodily pain; GH, general health; VT, vitality; SF, social functioning; RE, role-emotional; MH, mental health; PCS, Physical Component Summary; MCS, Mental Component Summary; MCS, Mental Component Summary; Laparoscopy; O, open; D, donors; C, controls; Pre, preoperative; Post, postoperative; V, vendors.

unclear why the authors compared the SF-36 scores to those of the general US population and not of the general Japanese population although normative data for Japanese population have been published.

#### Taiwan

Chen et al. [23] reported QOL in Taiwanese living kidney donors. In the SF-36 questionnaire, the scores of 'bodily pain' and 'mental health' were the worst, possibly from the long operative wound at open nephrectomy. Most donors are concerned about cosmetic problems and painrelated scar formation. It may explain why two of their young female donors underwent wound revision for cosmetic reasons 1 year after operation. One donor was depressed because of graft loss by her son. These findings explain why the 'mental health' score was low in their series. However, QOL changes after donation were low and the SF-36 scores were comparable with those of the other general population. Because the public health insurance system in Taiwan can give the donors sufficient support to face the future medical problems, it may play an important role in the high scores of other items of SF-36.

#### Iran

Paid, living unrelated renal vendors constitute >90% of kidney donors in Iran. Zargooshi [24] reported QOL of Iranian vendors. In this study, 307 vendors (response rate: 97.7%) completed a questionnaire. Iranian kidney vendors had significantly lower scores on all SF-scales compared with controls. They responded that if they had another chance 85% would definitely not vend again, and 76% strongly discouraged potential vendors from repeating their error. In addition, high rates of self-reported *de novo* depression and anxiety after vending, and generally negative effects of vending on health and life existed. This study is the first study that provided information regarding vendor QOL.

# Factors associated with health-related QOL in living kidney donors

Little information regarding factors associated with health-related QOL in living kidney donors is currently available and this issue remains controversial. Table 3 lists the factors associated with health-related QOL of living kidney donors [14–16,18,20–22].

### Donor's gender

Johnson *et al.* [15] performed logistic regression analysis to determine risk factors for those who would not donate

again (if it were possible) and for those who found the overall experience very stressful. Of several variables including age, sex, highest level of education, relationship to the recipient, perioperative complications, and recipient survival, female donors (odds ratio, 1.8) were more likely to find the overall experience very stressful although it was not statistically significant (P = 0.1). However, Giessing et al. [18] suggested that donors mostly reported a better QOL than the general population, independent of gender. When analyzed according to gender, male donors had better scores for six of eight items although they scored significantly higher only for the item 'general health'. Female donors scored better in seven of eight items, with significant differences for 'physical function', 'physical role', 'bodily pain', and 'general health'. In addition, in Japanese donors, donor SF-36 scores did not show any significant difference between men and women [22].

#### Donor's age

Giessing et al. [18] suggested that life-long psychologic counseling should be offered to help cope with the impact of organ donation on donors' QOL for younger donors as kidney donation had an overall negative impact on QOL for donors aged 31-40 years at the time of the study. Their scores were worse for all eight items compared with the general German population, but differences were significantly only for the items 'bodily pain' and 'vitality'. Fehrman-Ekholm et al. [17] also reported a decline in QOL of younger Swedish donor. Twenty-three percent thought that the nephrectomy had been troublesome. A higher percentage of young donors had felt that the postoperative period was difficult. On the contrary, Isotani et al. [22] showed that donors aged <50 years scored better than older donors. Therefore, conclusions must be made cautiously and can only be tentative. A longitudinal study would be necessary to support this speculation.

# **Time since donation**

Johnson *et al.* [15] demonstrated that QOL in the US donors was independent of time since donation; they found no difference in mean SF-36 scores between those who had donated <1 year, 1–5 years, or >5 years before responding to the surgery. Giessing *et al.* [18] also found that time of follow-up (time passed since donation) did not differ between the donors scoring better or worse than the general German population. Donor SF-36 scores also did not show any significant difference according to time since donation in Japanese donors [22]. However, in prospective studies conducted in Australia, MCS of the

Table 3. Factors associated with health-related quality of life in living kidney donors.

Reference	Factors
Perry et al. [14]	Surgical technique: significant higher in the laparoscopy group than in mini-incision
	group in three domains (PF, BP, and RE)
Johnson et al. [15]	(i) The since donation: no significant difference according to time since donation
	(II) Relationship with the recipient: best scores – parents who donated to offspring, worst scores – donors unrelated to the recipient
Buell <i>et al</i> . [16]	Surgical technique: no significant difference between laparoscopic and open donor nephrectomy groups
Giessing et al. [18]	(i) Gender: male donors – significantly higher than the references in one domain (GH),
	female donors – significantly higher than the references in four domains (PF, RP, BP, and GH)
	(ii) Age: donors aged 31 and 40 years – significant lower than the references in two domains (BP and VT)
	(iii) Time since donation: no significant difference according to time of follow-up
	(iv) Relationship with the recipient: no significant difference according to kinship with the recipient
	(v) Surgical technique: no significant difference according to applied surgical technique (laparoscopic versus open)
	(vi) Perioperative complications: donors with postoperative complications – significant lower
	than the references in four domains (PF, SF, RE, and MH), donors whose recipient had faced a complication-significant lower than the references in three domains (BP, VT, and SF)
Smith <i>et al.</i> [20]	Outcomes for the recipient: no significant difference according to whether or not their recipient's transplant had failed
Smith <i>et al</i> . [21]	(i) Time since donation: significant decrease of MCS (4 and 12 months) and three domains
	(BP, GH and VT: 12 months), but not PCS (4 and 12 months)
	(ii) Relationship with the recipient: no significant difference according to relationship with recipient
	(iii) Outcomes for the recipient: association with the emotional state of the recipient rather
	than the physical state (as measured by length of stay, creatinine level, graft failure, and PCS)
lsotani <i>et al</i> . [22]	(i) Gender: no significant difference between men and women
	(ii) Age: higher in donors aged $<$ 50 years than in older donors
	(iii) Time since donation: no significant difference according to time since donation
	(iv) Relationship with the recipient: no significant difference according to relationship with recipient
	(v) Outcomes for the recipient: no correlation with the outcomes for the recipients after donation

PF, physical functioning; RP, role-physical; BP, bodily pain; GH, general health; VT, vitality; SF, social functioning; RE, role-emotional; MH, mental health; PCS, Physical Component Summary; MCS, Mental Component Summary.

SF-36 in living kidney donors fell significantly postoperatively [20,21]. These findings suggest that donors should be alerted to possible psychosocial impairment and monitored postoperatively.

# Relationship with the recipient

Johnson *et al.* [15] reported that when analyzed by donor-recipient relationship, parents who donated to offspring had the best scores and donors unrelated to the recipient, the worst; however, all scores are still the same or better than for the US general population. In logistic regression analysis, relatives other than first degree were more likely to say they would not donate again, if it were possible, or to find the overall experience very stressful. However, for both German [17] and Japanese [22] donors, donor SF-36 scores did not show any significant difference according to relationship with recipient. Furthermore, a prospective study also revealed no influence of kinship with the recipient on donor scores [21].

# Surgical technique

Evolution of surgical techniques in transplantation has made kidney living donation a more attractive option for patients and their potential donors. Laparoscopic live donor nephrectomy allows for kidney retrieval form the donor by multiple but smaller incisions. The advantages of laparoscopic donor nephrectomy include decreased hospital stay, decreased convalescence, less pain, a quick return to normal daily activities and greater patient acceptance [27–29]. In addition, the availability of the laparoscopic technique has brought forth more people willing to donate, thus, increasing the pool of potential donors [28,29].

To date, there have been only few published studies that have assessed and compared QOL of laparoscopic donor nephrectomy versus open donor nephrectomy. Chen *et al.* [23] found that the problems that most concerned the Taiwanese donors were cosmetic and painrelated scar formation. Perry *et al.* [14] reported the first study that compared health-related QOL between laparoscopic and open living donor nephrectomy donors by using a standardized and validated questionnaire. Healthrelated QOL was significantly higher in the laparoscopy group than in mini-incision group in three domains that measure 'bodily pain', 'physical functioning' and 'emotional role functioning'. The scores in the other five categories generally favored the laparoscopy group but did not achieve statistical significance. However, Buell *et al.* [16] did not find that there were significant differences identified between laparoscopic donor nephrectomy and open donor nephrectomy groups with respect to SF-36 health survey. Giessing *et al.* [18] also showed that applied surgical technique (laparoscopic versus open) did not differ between the donors scoring better or worse than the general German population.

#### **Perioperative complications**

Donor and recipient complications had a significant impact on German donors' QOL [18]. Donors with postoperative complications had worse scores on all SF-36 items. The significance level was reached for 'physical functioning', 'social functioning', 'emotional role', and 'mental health'. Also, donors whose recipient had faced a complication scored worse for all items except for 'physical function', with significantly worse QOL for the items 'vitality', 'social functioning', and 'bodily pain'. However, donors' willingness to donate again (93.4%) or recommend living donor kidney transplanation (92.4%) was high, irrespective of complications. Johnson *et al.* [15] also suggested that donors who experienced perioperative complications were more likely to find the overall experience very stressful.

#### Outcomes for the recipient

Giessing et al. [18] reported that German donors' QOL strongly depends on the QOL of the recipients after kidney transplantation, which is reflected by the close association of donor's QOL and recipient's outcome. In their study, the risk of negative effects on the donor was up to 10 times higher in cases in which the recipient demonstrated graft loss and died. Johnson et al. [15] also found that in logistic regression analysis, the US donors whose recipient died within 1 year of transplant were more likely to say they would not donate again, if it were possible, or to find the overall experience very stressful. However, others found no association of graft function and donors' QOL [20-22], and thus, the results of the different studies remain controversial. In a prospective study, there was no significant difference in postoperative MCS of donors grouped according to whether or not their recipient's transplant had failed [20]. In the subsequent study, Smith *et al.* [21] suggested that it was the emotional state of the recipient rather than the physical state (as measured by length of stay, creatinine level, graft failure, and PCS) that was associated with donor psychosocial outcome. In Japanese donor, the outcomes for the recipients after donation did not correlate with the donor SF-36 scores [22].

## Conclusions

The results of methodically appropriate studies provided evidence that donor QOL is at least comparable with that of the general population. Some studies even indicated a higher QOL or well-being of kidney donors compared with healthy people. However, most studies evaluating the impact of kidney donors' QOL have limitations such as small cohort size, retrospective nature, unmatched references, or low response rates. The retrospective nature of the majority of living donor studies is a significant limitation. The retrospective, cross-sectional study design required patients to recall specific information during their recuperation period following their surgery date. Therefore, the study results may bear some degree of recall bias. Furthermore, retrospective studies have shown that although the majority of donors report that the experience of donation was positive, some were troubled and some even regretted having donated.

Nonetheless, these studies suggest hypotheses which require evaluation in well-designed prospective studies. Differences in educational, cultural, and socioeconomic backgrounds may influence QOL in living kidney donor. Therefore, in the future studies, it should be considered that there are many differences in terms of religions, cultures, customs, environments, and other factors influencing on QOL among the countries. These future prospective studies will contribute to our knowledge of factors that influence health-related QOL of a living kidney donor. Also, studies on a larger cohort will facilitate identification of risk factors for dysfunction, which in turn may lead to the establishment of valid screening procedures.

#### References

- Kasiske BL, Bia MJ. The evaluation and selection of living kidney donors. *Am J Kidney Dis* 1995; 26: 387.
- Fehrman-Ekholm I, Elinder CG, Stenbeck M, Tyden G, Groth CG. Kidney donors live longer. *Transplantation* 1997; 64: 976.
- 3. Bia MJ, Ramos EL, Danovitch GM, *et al.* Evaluation of living renal donors. The current practice of US transplant centers. *Transplantation* 1995; **60**: 322.
- Taghavi R. Does kidney donation threaten the quality of life of the donor? *Transplant Proc* 1995; 27: 2595.

- Najarian JS, Chavers BM, McHugh LE, Matas AJ. 20 years or more of follow-up of living kidney donors. *Lancet* 1992; 340: 807.
- Melchor JL, Gracida C. Kidney transplantation with living donors: better long-term survival. *Transplant Proc* 1999; 31: 2294.
- Westlie L, Fauchald P, Talseth T, Jakobsen A, Flatmark A. Quality of life in Norwegian kidney donors. *Nephrol Dial Transplant* 1993; 8: 1146.
- Evans RW, Hart LG, Manninen DL. A comparative assessment of the quality of life of successful kidney transplant patients according to source of graft. *Transplant Proc* 1984; 16: 1353.
- Gouge F, Moore J Jr, Bremer BA, McCauly CR, Johnson JP. The quality of life of donors, potential donors, and recipients of living-related donor renal transplantation. *Transplant Proc* 1990; 22: 2409.
- Spital A, Kokmen T. Health insurance for kidney donors: how easy is it to obtain? *Transplantation* 1996; 62: 1356.
- Toronyi E, Alfoldy F, Jaray J, et al. Attitudes of donors towards organ transplantation in living related kidney transplantations. *Transpl Int* 1998; 11(Suppl. 1): S481.
- Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care* 1992; 30: 473.
- Bullinger M, Alonso J, Apolone G, *et al.* Translating health status questionnaires and evaluating their quality: the IQOLA Project approach. International Quality of Life Assessment. J Clin Epidemiol 1998; 51: 913.
- Perry KT, Freedland SJ, Hu JC, *et al.* Quality of life, pain and return to normal activities following laparoscopic donor nephrectomy versus open mini-incision donor nephrectomy. *J Urol* 2003; 169: 2018.
- 15. Johnson EM, Anderson JK, Jacobs C, *et al.* Long-term follow-up of living kidney donors: quality of life after donation. *Transplantation* 1999; **67**: 717.
- 16. Buell JF, Lee L, Martin JE, *et al.* Laparoscopic donor nephrectomy vs. open live donor nephrectomy: a quality of life and functional study. *Clin Transplant* 2005; **19**: 102.
- 17. Fehrman-Ekholm I, Brink B, Ericsson C, Elinder CG, Duner F, Lundgren G. Kidney donors don't regret:

follow-up of 370 donors in Stockholm since 1964. *Transplantation* 2000; **69**: 2067.

- Giessing M, Reuter S, Schonberger B, *et al.* Quality of life of living kidney donors in Germany: a survey with the Validated Short Form-36 and Giessen Subjective Complaints List-24 questionnaires. *Transplantation* 2004; 78: 864.
- 19. Tanriverdi N, Ozcurumez G, Colak T, *et al.* Quality of life and mood in renal transplantation recipients, donors, and controls: preliminary report. *Transplant Proc* 2004; **36**: 117.
- Smith GC, Trauer T, Kerr PG, Chdban SJ. Prospective psychosocial monitoring of living kidney donors using the SF-36 health survey. *Transplantation* 2003; 76: 807.
- 21. Smith GC, Trauer T, Kerr PG, Chdban SJ. Prospective psychosocial monitoring of living kidney donors using the Short Form-36 health survey: results at 12 months. *Transplantation* 2004; **78**: 1384.
- 22. Isotani S, Fujisawa M, Ichikawa Y, *et al.* Quality of life of living kidney donors: the short-form 36-item health questionnaire survey. *Urology* 2002; **60**: 588.
- Chen CH, Chen Y, Chiang YJ, Wu CT, Chen HW, Chu SH. Risks and quality-of-life changes in living kidney donors. *Transplant Proc* 2004; 36: 1920.
- Zargooshi J. Quality of life of Iranian kidney 'donors'. J Urol 2001; 166: 1790.
- Muller JH, Desmond B. Ethical dilemmas in a crosscultural context. A Chinese example. West J Med 1992; 157: 323.
- Mo B. Modesty, sexuality, and breast health in Chinese-American women. West J Med 1992; 157: 260.
- Flowers JL, Jacobs S, Cho E, *et al.* Comparison of open and laparoscopic live donor nephrectomy. *Ann Surg* 1997; 226: 483.
- Kuo PC, Johnson LB. Laparoscopic donor nephrectomy increases the supply of living donor kidneys: a centerspecific microeconomic analysis. *Transplantation* 2000; 69: 2211.
- Schweitzer EJ, Wilson J, Jacobs S, *et al.* Increased rates of donation with laparoscopic donor nephrectomy. *Ann Surg* 2000; 232: 392.