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Published in:
Dialysis & Transplantation

DOI:
10.1002/dat.20494

Self-Rated Health After Kidney Transplantation and Change in Graft Function

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OBJECTIVE: The aim of this study was to explore the relationship between self-rated health (SRH) in patients after kidney transplantation (KT) as well as graft function over time.

METHODS: The sample consisted of 42 patients who were examined in the 3rd month (T1) and the 12th month after KT (T2). Sociodemographic data and data on glomerular function (GF) (Cockroft-Gault) were collected. Patients completed the SF-36 questionnaire measuring SRH. Linear regression was used to identify predictors of SRH at T2. Age, gender, change in GF, and SRH at T1 were set as the independent variables.

RESULTS: SRH and GF improved slightly over time. The first model, consisting of age, gender, SRH at T1, and GF at T2, explained 49.9% of the variance in SRH at T2; GF at T2 did not significantly contribute to the model. The second model, consisting of age ($\beta = -0.26$, 95% CI 1.087;−0.035, $p \leq 0.05$), change in GF between T2 and T1 ($\beta = 0.31$, 95% CI 9.267;63.643, $p \leq 0.01$), and SRH at T_1 ($\beta = 0.5$, 95% CI 0.247;0,68, $p \leq 0.001$), explained 54.6% of the variance in SRH at T2.

CONCLUSIONS: Although SRH after transplantation is not associated with absolute levels of GF, there is a significant association with the change in GF over time.

In evaluating outcomes in patients with end-stage kidney disease, the assessment of perceived health status (PHS) becomes as important as morbidity and mortality.[1] Among the different types of treatment for chronic kidney disease—hemodialysis (HD), peritoneal dialysis (PD), and kidney transplantation (KT)—KT is the best choice in terms of longer survival, lower morbidity, and lower cost.[2,3] Furthermore, patients with end-stage kidney disease after KT indicate better self-ratings of their health compared with HD and PD.[1,4]

Health-related quality of life, perceived health status, and self-rated health (SRH) are all umbrella terms that encompass the correlations among an understanding of the physical, psychological, and also social domains, and that also protect these correlations. These terms have been defined in different ways over the years.[1] Substantial evidence has been presented in support of the hypothesis that SRH has a relationship to mortality that is independent of the patient's level of objective health status.[5] That is, independent of the patient's objective health status, asking a relatively simple question on how someone rates his or her health in general helps identify persons at risk, irrespective of their clinical status.[5]

Benjamins et al.,[6] in a longitudinal sample of 689,710 respondents, found that SRH has a significantly predictive power for mortality risk. Burstrom et al.[7] analyzed data on mortality rates and risk ratios of death during a 22-year follow-up study among 170,223 respondents, and their results show a strong association between "poor or fair" SRH and an increased risk of mortality. SRH is a personal understanding of someone's own position in life and is a subjective, valid, and reliable factor associated with mortality and morbidity[1, 5-11]; worse SRH is connected with higher morbidity and mortality.

SRH has been included in many population-level studies as a conversational way to open the topic of health status when it is to be covered in the interview in more detail.[8] The determinants of SRH are sociodemographic characteristics (age, education, employment, and socioeconomic status), social support (family and living status), health-promoting behavior (physical activity), and chronic health problems, including comorbidity. Poor SRH is more pronounced among people of higher age, women, the less educated, and the unemployed with low socioeconomic status; furthermore, poor SRH is associated with a lack of social support, higher functional disability, lower physical activity, and the existence of multiple chronic conditions.[11]

Glomerular function is a physical factor reflecting survival and vitality of the kidney, but surprisingly there is only limited evidence of its association with SRH.[4,12-15] Fujisawa et al.[12] administered the Short Form Health Survey (SF-36) to 117 renal transplant patients who had undergone KT and examined which items affected their

DOI: 10.1002/dat.20494

perceived health status (PHS) after KT. They showed that the most important factor affecting health-related quality of life was the current serum creatinine level.[12] Also, in 2006 Rosenberger et al.[4] explored predictors of PHS in 138 respondents after KT. They found that better kidney function is associated with better perceived health status, but only in the younger population.[4] In addition, in 2008 Saracino et al.[16] confirmed that loss of renal function is associated with the deterioration of health-related quality of life in KT patients.

Therefore, the aim of this study was to explore the relationship between SRH in patients after KT and their graft function. We studied not only the association of the absolute level of glomerular function with SRH, but also the impact of a change in glomerular function over time on SRH.

Patients and Methods

Sample and Procedures

A group of 88 incident KT recipients from the eastern region of the Slovak Republic were invited to participate 3 months (T1) after transplant surgery. Data collection took place from February 2006 to January 2009 in Kosice. All patients with a functional graft who agreed to participate were included. The only exclusion criterion was the inability to answer questions during the interview due to severe dementia or mental retardation; thus, at the start (T1) three patients were excluded, and at follow-up 12 months after transplantation (T2) two more patients were excluded because they had had a stroke. Patients completed a questionnaire measuring SRH and sociodemographic variables at T1 and T2. All participants were interviewed by trained personnel. Medical data were retrieved from medical records.

The local Ethics Committee approved the study. Only patients who signed informed consent prior to the study were included.

Measures

SRH was measured using the first question of the SF-36, which was originally designed for use in population surveys as a generic indicator of health status.[6,17-18] The SF-36 is considered a valid questionnaire, with eight subscales: physical functioning, social functioning, physical role limitations, emotional role limitations, mental health, vitality, pain, and general health perception.[12,19-23] All of the items as well as all of the eight subscales are coded and transformed into a scale of 0 (poor health) to 100 (excellent health) in which they are presented as the standard SF-36, scores between 0 and 100, with higher scores indicating better health status.[19] In addition, the single item question of the SF-36 on SRH can also be computed in this way. The validity and reliability of the SF-36 have been confirmed in patients with renal disease, including those who have had KT.[12,20-22] Skalská et al. validated the questionnaire in the Czech population.[22] The reason for only reporting the first item instead of a broader description of perceived health status in patients after KT is that SRH has been generally used in health studies as a reliable indicator of mortality and morbidity.[6,17-18]

Demographic data included age, gender, education, occupation, family status, and living status. Information about serum creatinine, weight, comorbidity, immunosuppression treatment, and primary diagnosis of kidney failure were retrieved from medical records. Glomerular function was calculated using the Cockroft-Gault formula.

Statistics

Frequencies, means, medians, minimum, maximum, and standard deviations were calculated for the sample description. Next, the Wilcoxon signed-rank test and the sign test were used to detect changes in glomerular function and SRH. Finally, stepwise linear regression was performed in order to identify predictors of SRH at T2; independent variables were age, gender, education, occupation, family status, living status, primary diagnosis of kidney failure, comorbidity, SRH at T1, glomerular function at T2, and change in glomerular function over time. Sociodemographic and medical factors were set as independent variables, including glomerular function at T2 in the first model. The second model analyzed the change in glomerular function between T2 and T1 (ΔGF) instead of the absolute level of glomerular function. SPSS 16.0 (SPSS, Chicago, Ill.) was used for statistical analyses.

Results

From the initial 88 patients, 3 were excluded, 14 refused to participate, 13 provided incomplete questionnaires, and 6 refused to participate after initially consenting. Thus, 52 patients were analyzed at T1 (a response rate of 61.2%). At follow-up, 2 more ➲

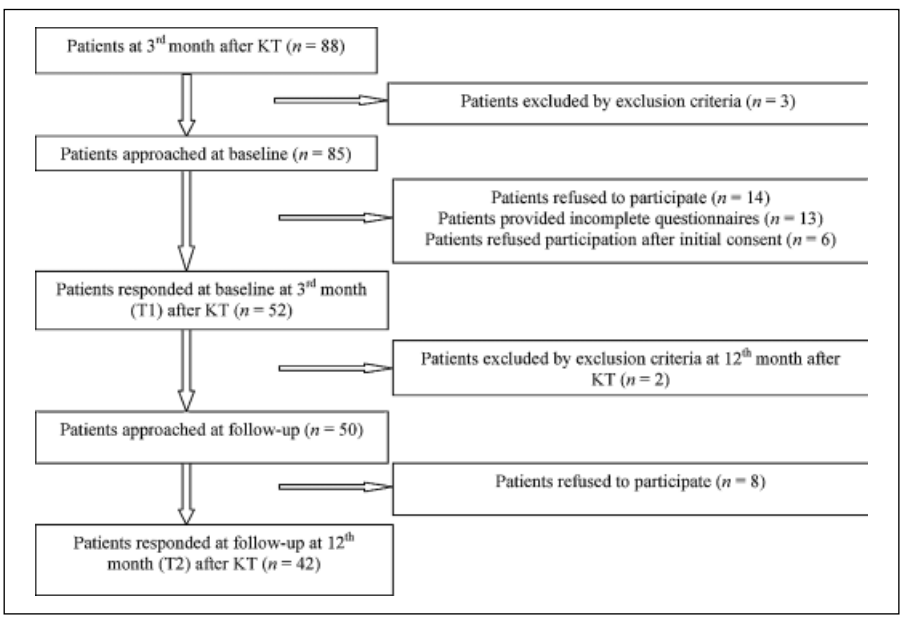

FIGURE 1. *Flow chart diagram of study participants. KT, kidney transplantation.*

Table I. Characteristics of the sample at baseline (3 months) and at follow-up (12 months).

	3 months (n = 52)		12 months (n = 42)	
	No. or mean	% or SD	No. or mean	% or SD
Age (mean ± SD)	46.9	13.2	49.6	12.2
Gender				
Male	32	61.5	27	64.3
Female	20	38.5	15	35.7
Education				
Elementary	26	50.0	23	54.8
Secondary	25	48.1	18	42.8
University	1	1.9	1	2.4
Occupation				
Employed	11	21.6	10	24.5
Disability	30	58.8	24	58.5
Unemployed/retired	10	19.6	7	17.0
Family status				
Single	8	15.4	6	14.3
Married	42	80.8	34	81.0
Widowed	2	3.8	2	4.8
Living				
Alone	2	3.8	2	4.8
Together	50	96.1	42	95.2
Self-rated health				
Poor (0)	5	9.6	3	7.1
Fair (25)	17	32.7	12	28.6
Good (65)	22	42.4	17	40.5
Very good (85)	6	11.5	10	23.8
Excellent (100)	2	3.8	0	0
Mean ± SD	46.4	26.7	51.7	26.5
Glomerular function (mean ± SD)	1.0	0.27	1.11	0.29
Comorbidity				
Coronary artery disease	24	46.2	19	45.2
Hypertension	44	84.6	38	90.3
Renal osteodystrophy	27	52	23	54.8
Diabetes mellitus	12	23.1	10	23.8
Other comorbidity: 1	15	28.8	13	31.0
Other comorbidity: ≥ 2	9	17.3	7	16.7
Immunosuppression treatment				
CsA+MMF+P	40	76.9	35	83.3
Tac+MMF+P	10	19.2	7	16.7
Tac+MMF	2	3.8	0	0
Primary diagnosis of kidney failure				
Glomerulonephritis	28	55.8	22	52.4
Tubulointerstitial nephritis	12	23.1	12	28.5
Polycystic kidneys adult type	2	3.8	1	2.4
Diabetic nephropathy	9	17.3	7	16.7

CsA, cyclosporin A; MMF, mycophenolate mofetil; P, prednisone; Tac, tacrolimus.

were excluded and 8 refused further participation, meaning 42 patients remained (a response rate of 84.0%). Statistically, nonrespondents did not differ significantly from participants by either age or gender. See *Figure 1* for more detailed information.

The mean age of participants at T1 was 46.9 ± 13.2, and age at T2 was 49.6 ± 12.2 years. The mean SRH at T1 (45.7 ± 28.8) did not differ significantly from SRH at T2 (51.7 ± 26.5). The mean glomerular function significantly improved from 1.0 ± 0.27 mL/s at T1 to 1.11 ± 0.29 mL/s at T2 ($p \leq 0.001$). See *Table I* for more detailed information.

The associations among family status, living status, education, and occupation, as well as the primary diagnosis of kidney failure and SRH at T2 in both models were not significant. The first regression model, consisting of age, gender, SRH at T1, and the current glomerular function at T2, explained 49.9% of the variance in SRH at T2. Age and SRH at T1 contributed significantly to this model, but the current glomerular function at T2 did not. The second regression model, consisting of age, gender, SRH at T1, and ΔGF (glomerular function at T2 minus glomerular function at T1), explained 54.6% of the variance in SRH at T2. The ΔGF contributed significantly to this model ($\beta = 0.308$, $p \leq 0.01$), while age contributed less but remained significant, and SRH at T1 contributed similarly as in model 1. See *Table II* for more detailed information.

Discussion

The aim of this study was to explore the relationship between SRH in patients after KT and their graft function. We studied not only the association of the absolute level of glomerular function with SRH, but also the impact of a change in glomerular function over time on SRH. We found that perceived health status at follow-up is influenced not by the success of the transplantation shortly after transplant surgery, but rather by the change in glomerular function (ΔGF) over time. In our first model of SRH at 12 months after KT, the absolute level of glomerular function was set as an independent variable. In this model the absolute level of GF did not

Table II. Regression models of predictors of SRH at T2 in Model 1 with GF and in Model 2 with ΔGF

Model	Variable	B (SE)	β	95% CI
1	Constant	41.764 (22.32)		−3.501; 87.028
	Age	−0.799 (0.26)	−.365*	−1.328; −0.270
	Gender	5.321 (6.62)	0.098	−8.102; 18.745
	SRH at T1	0.443 (0.11)	0.481***	0.214; 0.671
	GF at T2	20.051 (10.10)	0.213	−2.238; 42.341
	Adjusted R^2	49.9%		
2	Constant	47.416 (18.32)*		10.256; 84.576
	Age	−0.561 (0.26)	−0.257*	−1.087; −0.035
	Gender	5.616 (6.20)	0.103	−6.968; 18.199
	SRH at T1	0.463 (0.11)	0.503***	0.247; 0.680
	ΔGF	36.455 (13.41)	0.308**	9.267; 63.643
	Adjusted R2	54.6%		

*B, non-standardized coefficient; β, standardized β coefficient; CI, confidence interval; T1, 3 months after kidney transplantation; T2, 12 months after kidney transplantation; SRH, self-rated health; GF, glomerular function; ΔGF = (GF at T2) − (GF at T1). Significant p-values: *p < 0.05, **p < 0.01, ***p < 0.001.*

contribute significantly to the explanation of the variance in SRH. However, in the second model the change in GF over time contributed significantly to the explanation of the variance in SRH at 12 months after KT.

In accordance with our findings, Bohlke et al.[24] found in their 2008 study evaluating employment status and its predictors among KT recipients that the absolute level of creatinine did not contribute significantly to post-transplantation employment status. Economic productivity after a successful transplantation for patients after KT seemed to depend more on social determinants and less on the specific clinical situation of the patients.[24] In 2003 Karam et al. [25] asserted that respondents more than 10 years after kidney transplantation had unpleasant mental and general health perceptions, but their quality of life was quite similar to that of the general population in terms of social and role function.

In contrast, in 2005 Overbeck et al. [26] showed that patients after KT had better health-rated quality of life compared with other patients with end-stage renal disease on dialysis and suggested that after KT, patients with higher levels of serum creatinine on the day of questioning had a significantly greater impairment of their cognitive abilities. Rosenberger et al.,[27] however, pointed out that this finding might be caused by selection for the comparison and by not taking into account the fact that not all patients on dialysis are on a waiting list for transplantation, as there is no significant difference in health-rated quality of life (HRQoL) between those patients on the waiting list and those after KT.[27] In 2008, Saracino et al.[16] explained renal function by using creatinine clearance, which was estimated using the modification of diet in renal disease (MDRD) formula. Their study demonstrated a direct correlation between better creatinine clearance and better HRQoL (physical function, role physical, vitality, and general health) among patients after KT. In addition, they found that a loss of renal function was associated with a deterioration of HRQoL in patients after KT.[16] Fujisawa et al.[12] found a significant positive correlation between serum creatinine and HRQoL. However, their study population was younger than ours. Our previous research found that kidney function is a predictor of self-perceived health status, but only in a younger subpopulation.[4] In the current study, age was a significant predictor of SRH at T2, but its influence decreased in the presence of a change in glomerular function over time.

Serum creatinine was identified as one of the other clinical measures that was a significant predictor of SRH in a longitudinal study of a community-based sample consisting of 4,065 respondents.[28] We were able to identify three studies on the relationship between serum creatinine or kidney function and the SRH of patients after successful KT, and all of these were cross-sectional in design.[12,16] We did not find any other longitudinal studies on the relationship between the change in the absolute level of creatinine or kidney function over time and SRH, PHS, or HRQoL. This study is thus the first longitudinal study using the relationship between measurements of patients' graft function and subjective well-being to identify a change in graft function over time in order to provide a significant predictor for SRH.

Strengths and Limitations

The strength of this study is its longitudinal design, which enabled us to explore the role of the change over time of some variables and to compare them with their absolute levels. The limitations of this study are the number of participants and a fair response rate; however, there were no differences in age and gender between respondents and non-respondents. In contrast, all patients originating from one major transplant center in Slovakia over a number of years were asked to participate in the study to prevent selection bias. Our future research should focus on educating patients better in order to prevent a lower response rate at baseline. In addition, we need early recognition of the issues on the questionnaire that are problematic for patients during the individual investigation. We must be able to explain the meaning of our research better, in order to improve patients' motivation to participate.

Recommendations

Results must be verified in a larger sample to allow for generalization. In addition, we only studied patients shortly after transplantation; therefore, prolonging the study to a period longer than 12 months is necessary. We could then verify whether the progress of subjective SRH remains dependent on the change in glomerular function, or whether this applies only during the ➲

or whether this applies only during the period shortly after KT. Furthermore, the relationships among psychological, physical, and medical determinants associated with SRH should be studied.

Conclusions

Although SRH 12 months after transplantation is not associated with absolute levels of glomerular function, there is a significant association with change in glomerular function over time. Improvement of the function of the transplanted kidney is connected with an improvement in SRH. When a patient is being treated, a positive or negative change in glomerular function may have consequences for the patient's SRH and well-being.

Disclosures

This work was supported by the Science and Technology Assistance Agency under contract no. APVV-20-038305. D&T

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