Pretransplant Physical Functioning and Kidney Patients' Risk for Posttransplantation Hospitalization/Death: Evidence from a National Cohort

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Patient physical functioning level is an indicator of medical fitness that may predict outcomes after kidney transplantation. A small study of patients at a single center found a correlation between patient-rated physical functioning pretransplantation and the number of emergency hospital visits posttransplantation. In a national multicenter cohort, the association of incident dialysis patients' physical functioning scores with their risk for posttransplantation all-cause hospitalization/death was investigated using Cox proportional hazards analysis. The study cohort included patients who participated in the Dialysis Morbidity and Mortality Study (DMMS) Wave 2 and received a first transplant no more than 24 mo after treatment start. Updated patient information was available in the 2004 United States Renal Data System Standard Analysis Files. Higher pretransplantation physical functioning score was found to be a significant predictor of transplant recipients' reduced risk for hospitalization/death. Patients in the Cox model who were aged 55+ had increased risk for hospitalization/death. Gender, race, diabetic ESRD, and cardiovascular comorbidity were NS predictors. A potential explanation for the ability of the Medical Outcomes Study Short-Form 36 physical functioning measure to predict risk for posttransplantation morbidity/mortality is that physical activity/exercise behavior is likely to be closely associated with an individual's physical functioning level, and pretransplantation activity levels may be indicative of lifestyle habits that continue to influence patient behavior posttransplantation. More research investigating patients' pre- and posttransplantation physical functioning levels in relation to transplant outcomes would be valuable.

Clin J Am Soc Nephrol 1: 837–843, 2006. doi: 10.2215/CJN.01341005

Growing literature documents the association of patient-reported health status with patient morbidity and mortality outcomes, but this topic has received little attention in studies of renal patients pre- and posttransplantation. In a large cohort of patients who were on hemodialysis, DeOreo (1) found that patient-reported physical summary scores on the Medical Outcomes Study Short-Form 36 (SF-36) (2) predicted patients' subsequent hospitalization and survival, after controlling for potentially confounding sociodemographic and clinical variables. Similar findings were reported for other large hemodialysis patient cohorts by Mapes *et al.* (3) and by Lowrie *et al.* (4). Evidence linking patient-reported health status and subsequent patient outcomes suggests that patient assessments of their physical health status may provide information about physical resilience and reserve that is not otherwise captured by clinical data. It is possible that patient-reported health status may be a useful indicator of medical fitness for kidney transplantation.

The SF-36 physical functioning scale (Table 1), one component of the SF-36 physical summary score, measures the extent to which an individual believes that his or her health limits typical daily physical activities (2). An exploratory study that was conducted at a single hospital in Connecticut examined posttransplantation hospitalization resource utilization of 44 kidney transplant recipients in relation to the SF-36 scores that patients reported pretransplantation (5). The authors found a significant correlation between patients' scores on the SF-36 physical functioning scale and the number of emergency hospital visits recorded for these patients within 6 mo after transplantation. As pretransplantation physical functioning scores decreased, patients' emergency visits posttransplantation increased ($r = -0.325$, $P < 0.05$). Given the limited scope of their study, the authors recommended that further investigation be conducted with a larger sample, a longer posttransplantation follow-up period, and multivariable analysis of outcomes.

We used data for a large, national cohort of chronic renal patients to investigate the relation between physical functioning scores that were reported by patients pretransplantation and these patients' risk for hospital readmission and mortality, while controlling for other potential outcome predictors. A special study that was conducted by the United States Renal

Received October 18, 2005. Accepted January 10, 2006.

Published online ahead of print. Publication date available at www.cjasn.org.

The interpretation and reporting of the data presented here are the responsibility of the authors and in no way should be seen as an official policy or interpretation of the United States government.

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ISSN: 1555-9041/104-0837

Table 1. Physical functioning scale[a]

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?	Yes, limited a lot.	Yes, limited a little.	No, not limited at all.
Vigorous activities, such as running, lifting heavy objects, or participating in strenuous sports	1	2	3
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
Lifting or carrying groceries	1	2	3
Climbing several flights of stairs	1	2	3
Climbing one flight of stairs	1	2	3
Bending, kneeling, or stooping	1	2	3
Walking more than a mile	1	2	3
Walking several blocks	1	2	3
Walking one block	1	2	3
Bathing or dressing yourself	1	2	3

[a]Sources: Medical Outcomes Study Short-Form 36 (SF-36) health survey (2) and KDQOL-SF (http://www.gim.med.ucla.edu/kdqol).

Data System (USRDS) obtained health status information from patients near dialysis treatment start, in a national sample of patients who initiated treatment for renal failure. Our analysis uses the physical functioning scores that were reported at dialysis start by patients in that special study, as well as information about these patients' subsequent transplant status, hospitalization, and survival that is available in the database that is maintained by the USRDS Coordinating Center.

Materials and Methods

Study Design and Participants

Our data source was the Dialysis Morbidity and Mortality Study (DMMS) Wave 2, a prospective inception cohort study of patients (Medicare and non-Medicare) who initiated ESRD therapy in 1996 to 1997 (6). Incident patients were defined by receipt of any type of peritoneal dialysis (PD) or in-center hemodialysis (HD) at least once weekly for the first time. Patients were excluded when they were receiving intermittent dialysis treatment because of fluid overload or heart failure or when they were on home HD, when they had a previous transplant, or when they were younger than 18 yr. Patients who were treated by or training for PD on day 60 of ESRD and patients who were treated by HD on day 60 of ESRD were recruited. All enrolled patients provided written informed consent.

The 799 dialysis units that were included in the DMMS Wave 2 were a random selection of 25% of the units in the United States on the Master List of Medicare Approved Dialysis Facilities as of December 31, 1993; all new dialysis units that opened after January 1, 1994, also were included. The USRDS Coordinating Center (then located at the University of Michigan) directed the study. All eligible incident PD patients were included, and 20% of eligible HD patients were included by selecting only those with social security numbers that ended with 2 or 9. A total of 4024 patients were enrolled in the study March 1996 to December 1997. A total of 3614 patients had a nonduplicate, nonzero identification number and available demographic data; had not received a transplant at the time of first ESRD service; and had not received their first ESRD service before 1996 or after 1997.

Our study uses DMMS Wave 2 data for 3601 patients for whom updated patient characteristics and transplant information were available on the 2004 USRDS Core Standard Analysis File. Of these patients, 366 (10.2%) received a first kidney transplant within 24 mo after they started ESRD therapy and are the focus of this study.

Measures and Data Collection

DMMS Wave 2 data collection instruments are available in the Researcher's Guide to the USRDS Database at http://www.usrds.org/research.htm. A patient questionnaire that was distributed to enrolled patients included scales from the Kidney Disease Quality of Life-Short Form (KDQOL-SF) instrument (http://www.gim.med.ucla.edu/kdqol/). Patients were asked to complete the questionnaire within 30 d of the study start date, *i.e.*, the date that treatment modality was defined at approximately day 60 of ESRD, and to return the questionnaire in a sealed envelope identified only by study identification number. The protocol specified that patients should be asked to self-complete the patient questionnaire at the dialysis unit, but patients who were unable to complete the questionnaire because of reading or vision impairments could receive assistance from a dialysis unit staff member or a family member.

The KDQOL-SF includes eight generic measures of health status, one of which is the physical functioning scale (Table 1). This scale is identical to the physical functioning scale that is included in the SF-36 instrument. The physical functioning scale includes 10 items and measures the extent to which the patient's health limits typical daily activities, including climbing stairs, lifting or carrying groceries, and performing moderate and vigorous physical activities. The program that was used to calculate KDQOL-SF scores, which range from 0 to 100, is available at http://gim.med.ucla.edu/kdqol/. A higher score indicates a better rating of functioning. The physical functioning measure had an internal consistency reliability estimate of 0.91 in the DMMS Wave 2 data.

Covariate information in this study comes from a medical questionnaire that was completed by dialysis unit personnel who abstracted data from medical records, billing records, dialysis logs, patient rosters, hospital records, and personal physician records as information sources. Age, diabetic ESRD, cardiovascular comorbidity, body mass index (BMI), and smoking history information were recorded in the medical questionnaire; for ascertainment of race, the patient also was a source of information. Cardiovascular comorbidity was defined by documentation of any of the following conditions in the patient's

medical records: Coronary heart disease/coronary artery disease, acute myocardial infarction, cardiac arrest, cerebrovascular accident/stroke, peripheral vascular disease, and congestive heart failure. For this study, vintage was defined as time from initiation of dialysis to receipt of first transplant.

For patients who were on HD, the number of treatments that were missed and the number of treatments that were shortened by 10 min or more during the past 4 wk were recorded by dialysis personnel on the medical questionnaire. For patients who were on PD, the number of treatments that were missed and the number of treatments that were shortened during the past 2 wk were reported by automated PD patients, and the number of exchanges that were missed during the last 7 d were reported on the patient questionnaire by continuous ambulatory PD patients. In this study, we defined "good" dialysis compliance history as no episodes of missed or shortened dialysis treatments/exchanges, the definition also used by Thomas *et al.* (7). Hospital readmissions posttransplantation were identified from Medicare claims data, using International Classification of Diseases, Ninth Revision codes to determine diagnoses associated with hospitalization events.

Statistical Analyses

Baseline characteristics of patients who received a first kidney transplant no more than 24 mo after treatment start (n = 366) and patients who were placed on the waiting list but did not receive a transplant during the same period (n = 409) were compared by t test (continuous variables) and χ^2 analysis (categorical variables). The association of physical functioning scores with age and clinical and laboratory variables was investigated by t test and Pearson correlations. The association of physical functioning score and other predictor variables (age, gender, race, diabetic ESRD, cardiovascular comorbidity, and vintage) with hospitalization, including hospitalization/death, occurring within 6 mo or more after kidney transplantation was examined in a univariable Cox regression model. Multivariable Cox proportional hazards regression analysis was used to investigate the association of transplant recipients' baseline physical functioning score with risk for posttransplantation hospitalization, including hospitalization/death, controlling for covariates.

Results

Patients' baseline characteristics are described in Table 2, by patient transplant status within 24 mo of treatment start. Patients who received transplants reported a higher physical functioning score at treatment start than did those who were placed on the waiting list but did not receive a transplant within 24 mo (62.3 ± 24.5 *versus* 54.7 ± 25.8). In addition, transplant recipients were younger, less likely to be black and more likely to be white, more likely to begin treatment on PD than on HD, and less likely to have ever smoked, but they were more likely than patients who remained on the waiting list to have skipped or shortened a dialysis treatment. There was no difference in gender, diabetic ESRD, history of cardiovascular comorbidity at treatment start, or average BMI between transplant recipients and patients who remained on the waiting list. Of the 366 transplant recipients, 234 (64%) received a kidney from a deceased donor and 129 (35%) received a kidney from a living donor; donor source for three patients was not identified in the database.

The association of pretransplantation physical functioning scores with patient age and clinical variables is reported in Table 3 for patients who received transplants. Mean physical functioning scores were higher among patients who were younger than 55 yr; patients who did not have diabetic ESRD; and patients who did not have coronary heart disease or coro-

Table 2. Baseline characteristics of DMMS Wave 2 dialysis patients who received a first kidney transplant and patients who were placed on the waiting list but did not receive a transplant within 24 mo of ESRD treatment start[a]

Variable	Received Transplant (n = 366)	Placed on Waiting List but Did not Receive Transplant (n = 409)	P
Age at enrollment (yr; mean [SD])	43.0 (12.9)	48.4 (12.6)	<0.0001
Male (%)	57.4	53.8	0.32
Race (%)			<0.0001
Native American	1.1	1.0	
Asian	3.6	6.1	
black	14.5	28.9	
white	80.9	63.3	
other	0.0	0.7	
HD (%)	29.0	37.5	0.01
Diabetic ESRD (%)	37.2	35.8	0.69
Cardiovascular comorbidity[b] (%)	29.7	35.5	0.10
BMI (kg/m^2; mean [SD])	26.0 (6.4)	26.7 (8.1)	0.37
Ever smoked (%)	32.3	40.2	0.03
Ever skipped or shortened dialysis treatment(s) (%)	60.1	50.8	0.03
Physical Functioning Scale score, (mean [SD])	62.3 (24.5)	54.7 (25.8)	0.0004

[a]BMI, body mass index; DMMS, Dialysis Morbidity and Mortality Study; HD, hemodialysis.
[b]Cardiovascular comorbidity, history of one or more of the following: coronary heart disease/coronary artery disease, congestive heart failure, cerebrovascular disease, peripheral vascular disease, acute myocardial infarction, cardiac arrest.

Table 3. Transplant recipients' mean PF scores pretransplantation, by patient characteristics

Patient Characteristics	Mean (SD) PF Score	*P*
Age		0.009
18 to 55 yr (n = 208)	64.1 (24.3)	
≥55 yr (n = 55)	54.4 (24.0)	
Diabetic ESRD		<0.0001
no (n = 162)	67.8 (21.8)	
yes (n = 99)	52.0 (25.4)	
CHD/CAD history		0.03
no (n = 216)	64.1 (23.6)	
yes (n = 39)	54.8 (24.9)	
CHF history		0.0001
no (n = 214)	65.1 (23.4)	
yes (n = 40)	49.1 (25.3)	
CVD history		0.10
no (n = 219)	62.8 (24.4)	
yes (n = 17)	52.6 (25.3)	
PVD history		0.003
no (n = 233)	63.8 (24.1)	
yes (n = 22)	48.1 (19.7)	
Cardiovascular comorbidity[b]		<0.0001
no (n = 155)	66.3 (23.1)	
yes (n = 82)	53.4 (24.8)	
Cancer		0.53
no (n = 247)	62.2 (24.5)	
yes (n = 6)	68.5 (18.1)	
BMI		0.35
20 to 25 (n = 45)	60.0 (24.1)	
other (n = 56)	64.7 (25.6)	
Taking EPO in first 60 d		0.07
yes (n = 214)	63.1 (24.7)	
no (n = 32)	54.7 (22.2)	
Smoking history		0.29
never smoked (n = 160)	63.7 (25.4)	
ever smoked (n = 88)	60.3 (22.1)	
Dialysis compliance history		0.07
never missed/shortened (n = 91)	58.5 (25.0)	
ever missed/shortened (n = 154)	64.2 (23.6)	

[a]BMI, body mass index; CHD/CAD, coronary heart disease/coronary artery disease; CHF, congestive heart failure; CVD, cerebrovascular disease; EPO, erythropoietin; PF, physical functioning; PVD, peripheral vascular disease.

[b]Cardiovascular comorbidity, history of one or more of CHD/CAD, CHF, CVD, PVD, acute myocardial infarction, or cardiac arrest.

nary artery disease, congestive heart failure, or peripheral vascular disease. Mean physical functioning scores did not differ significantly by patients' BMI or smoking history. There was a trend for patients who had missed or shortened dialysis treatments to have higher physical functioning scores than patients who had never missed or shortened dialysis treatments. In addition to data shown in Table 3, baseline physical functioning scores were positively associated with baseline serum albumin (r = 0.20, P = 0.002) and negatively associated with predialysis systolic BP (r = −0.15, P = 0.02). There was a borderline association between physical functioning scores and serum creatinine (r = 0.13, P = 0.05). There was no correlation between physical functioning scores and serum phosphorus (r = −0.05, P = 0.42) or between physical functioning scores and hemoglobin (r = 0.05, P = 0.48), but as Table 3 indicates, the physical functioning scores of patients who received and those who did not receive erythropoietin (EPO) during the first 60 d of dialysis was borderline significant, with patients who received EPO reporting higher physical functioning scores.

In univariable analyses of the association of age, gender, race, diabetic ESRD, cardiovascular comorbidity, physical functioning score, and vintage with hospitalization/death among transplant recipients, only age, vintage, and physical functioning score were significantly associated with these events (Table 4). A multivariable Cox proportional hazards regression analysis to predict transplant recipients' risk for hospitalization/death included 263 patients; 108 patients had hospitalization events, five with death and six with graft failure. Higher physical functioning score pretransplantation was associated with a lower hazard for hospitalization/death (Table 5). In addition, patients who were 55 yr or older had increased risk for an event, and there was a trend for increasing vintage (time since ESRD treatment start to transplantation) to be associated with increased risk for hospitalization/death.

Table 6 shows the *first* diagnoses listed in Medicare claims as reasons for transplant recipients' first posttransplantation hospitalization events. The reasons were varied, with the most frequently listed code being "complications of kidney transplant," which may indicate rejection episodes. The first diagnoses listed for the remaining hospitalization events were distributed among circulatory, endocrine, respiratory, digestive, genitourinary, nonspecific symptom, and infection and musculoskeletal diagnoses.

Discussion

The mean pretransplantation physical functioning score of DMMS Wave 2 transplant recipients (62.3 ± 24.5) was similar to

Table 4. P values for posttransplantation hospitalization/death as based on univariable Cox regression model

Variable	Risk Ratio	*P*
Age ≥ 55 yr	1.86	0.004
Male gender	0.90	0.60
White race	0.96	0.86
Diabetic ESRD	1.36	0.12
Cardiovascular comorbidity	1.28	0.23
Pretransplantation PF score	0.99	0.01
Vintage	1.51	0.04

Table 5. Multivariable Cox proportional hazards model predicting posttransplantation hospitalization/death in DMMS Wave 2 kidney transplant recipients[a]

Variable	Hazard Ratio	*P*	95% CI
Age ≥ 55 yr	1.62	0.03	1.05 to 2.49
Pretransplantation PF score	0.99	0.04	0.98 to 1.00
Vintage	1.40	0.10	0.94 to 2.10

[a]CI, confidence interval.

the mean physical functioning score (64.0 ± 28.3) reported within 3 mo before kidney transplantation by the 44 patients who were studied by Houle *et al.* (5). The mean physical functioning score that was reported in a study of patients in Spain was higher (74.2 ± 24.0), but that mean was derived from scores of 72 patients with a functioning transplant as well as scores of 213 patients who were on the waiting list for a kidney transplant (8). Our study indicated that a higher level of physical functioning reported near the start of ESRD treatment was associated with reduced risk for a "bad event," *i.e.*, hospital readmission, graft loss, and death, in the period after kidney transplantation. Because pretransplantation physical functioning scores were missing for 100 DMMS Wave 2 transplant recipients, these patients could not be included in the Cox analysis. Patients who were missing physical functioning scores were no more likely to have a posttransplantation hospitalization or death event than patients for whom physical functioning scores were available ($P = 0.42$), however.

As also was true in the study by Houle *et al.* (5), we found no association between patients' pretransplantation physical functioning scores and their initial length of stay (LOS) immediately posttransplantation. The average initial LOS posttransplantation of DMMS Wave 2 patients for whom LOS data were available ($n = 141$) was 8.3 ± 5.5 d; the range was 3 to 43 d, with a median of 6 d. There was no correlation between patients' pretransplantation physical functioning scores and their initial LOS posttransplantation (Spearman $\rho = -0.04$). Houle *et al.* (5) reported that the initial LOS posttransplantation of the 44 patients whom they studied was 8.1 ± 3.4 d, with a range of 4 to 17 d. Although Houle *et al.* did not find an association between pretransplantation physical functioning scores and LOS posttransplantation, they did find a significant modest negative correlation (−0.33) between charges that were associated with admission for kidney transplantation and patients' pretransplantation physical functioning score (5). We did not investigate charges that were associated with the transplant event in our study, given the incomplete initial LOS data that were available in the data set, but the possibility that patients with higher levels of pretransplantation physical functioning incur lower total charges at the time of transplantation merits further investigation.

Kidney transplant recipients who were younger than 55 yr, did not have diabetic ESRD, and did not have a history of cardiovascular comorbidity at ESRD treatment start reported higher physical functioning scores pretransplantation. Physical functioning scores also were positively associated with serum albumin and negatively associated with systolic BP at ESRD treatment start. Physical functioning scores and hemoglobin were not correlated. Most of the transplant recipients in our analysis received EPO during the first 60 d they were on dialysis, however, and the difference between the physical functioning scores of patients who received EPO and those who did not receive EPO during the first 60 d on dialysis was borderline significant, with patients who received EPO reporting higher physical functioning scores (Table 3). The average recorded hemoglobin of patients who were treated with EPO during the first 60 d was lower than the average hemoglobin of patients who were not treated with EPO during the first 60 d (10.7 ± 3.3 *versus* 11.9 ± 3.8; $P = 0.07$), which helps to explain the lack of a correlation between physical functioning scores and hemoglobin levels near the start of ESRD treatment among transplant recipients in our study.

Patients whose medical record data indicated that they had skipped or shortened dialysis treatments were more, rather than less, likely to receive a first transplant (Table 2). Table 3 indicates that there was a trend for patients who had missed or shortened dialysis treatments to have higher physical functioning scores than patients who had never missed or shortened dialysis treatments (64.2 ± 23.6 *versus* 58.5 ± 25.0; $P = 0.07$). The latter finding is consistent with previous studies, and it has been suggested that patients who perceive their physical health as good may believe that this allows them to "get away" with treatment noncompliance (1,9). In addition, Thomas *et al.* (7) noted that medication compliance, which is difficult to quantify, is likely to be a more critical compliance indicator when evaluating patients' suitability for transplantation than are behavioral indicators of dialysis treatment nonadherence.

A potential limitation of our study is the time interval between patient reporting of physical functioning status and receipt of a kidney transplant. On average, patients in our study population received a transplant approximately 1 yr after treatment start (mean 1.07 yr; median 1.05 yr; range 0.02 to 1.98 yr), and physical functioning scores were reported by patients approximately 2.2 mo after treatment start. Patient vintage (time from treatment start to transplantation) was controlled, however, in the Cox analysis that investigated the association of pretransplantation physical functioning score with posttransplantation risk for hospitalization/death. In addition, when the patients who had not yet received a transplant by the time of the 9- to 12-mo follow-up data collection in the DMMS Wave 2 supplied a second rating of their physical functioning, the correlation between the two physical functioning scores reported by these patients was 0.57 ($P < 0.0001$), suggesting stability over time in patients' assessment of their physical functioning status.

A possible explanation for the ability of the SF-36 physical functioning measure to predict risk for posttransplantation morbidity/mortality is that physical activity/exercise behavior is likely to be closely associated with an individual's physical functioning level (10–13). O'Hare *et al.* (12), who studied dialysis patients who were surveyed in the DMMS Wave 2, found

Table 6. First listed diagnosis for hospital readmissions of 101 kidney transplant recipients[a]

First Listed Diagnosis	*n*
Viral enteritis NOS[b]	1
Candidal esophagitis	2
Diabetes type 1 with renal manifestations, uncontrolled	2
Diabetes type 1 with neurologic manifestations, uncontrolled	1
Diabetes type 2 with peripheral circulatory disorders, uncontrolled	1
Hypovolemia	4
Hyperpotassemia	1
Other and unspecified coagulation defects	1
Pseudotumor cerebri	1
Malignant hypertension	1
Hypertensive heart disease with heart failure	2
Hypertensive renal disease unspecified with renal failure	1
Acute myocardial infarction of anterolateral wall, initial episode of care	1
Coronary atherosclerosis of native coronary artery	1
Atrial fibrillation	1
Atrial flutter	2
Cardiac dysrhythmias, unspecified	1
Atherosclerosis of the extremities with gangrene	2
PVD, unspecified	1
Arterial embolism of the lower extremity	1
Venous thrombosis of other specified veins	2
Venous thrombosis of unspecified site	1
Internal hemorrhoids with other complication	1
Other noninfectious disorders of lymphatic channels	4
Acute frontal sinusitis	1
Pneumococcal pneumonia	1
Bacterial pneumonia unspecified	1
Pneumonia, organism unspecified	1
Reflux esophagitis	2
Esophageal hemorrhage	1
Chronic gastric ulcer with hemorrhage	1
Other specified gastritis without hemorrhage	1
Other and unspecified noninfectious gastroenteritis	1
Acute pancreatitis	1
Lower nephron nephrosis	1
Acute renal failure, unspecified	1
Impaired renal function, unspecified	1
Pyelonephritis NOS	1
Cyst of kidney, acquired	1
Vascular disorders of kidney	1
Urinary tract infection, site not specified	1
Backache, unspecified	1
Pain in limb	1
Polycystic kidney, autosomal dominant	1
Other convulsions	1
Pyrexia of unknown origin	2
Other chest pain	1
Abdominal pain, right upper quadrant	1
Ascites	1
Proteinuria	1
Complications as a result of renal dialysis device, implant and graft	1
Complications of kidney transplant	29
Complications affecting other specified body systems	1
Hematoma complicating a procedure	1
Seroma complicating a procedure	1
Postoperative wound disruption	1
Other postoperative infection	1
Other specified complications of procedures	1
Other specified rehabilitation procedure	1

[a]Data not available for seven patients. NOS, not otherwise specified.

a marked difference in the baseline physical functioning scores of sedentary and nonsedentary patients (37.6 ± 28.0 *versus* 52.4 ± 27.1, respectively; $P < 0.001$). "Sedentary" was defined by O'Hare *et al.* as never or almost never doing any exercise. In addition to the potential benefits of physical activity for individuals' overall physical condition before transplantation, pretransplantation activity levels may be indicative of lifestyle habits that will continue to influence patient behavior posttransplantation, and several recent discussions have emphasized the valuable role that exercise can have in patients' posttransplantation medical regimen (14–16).

Patients are evaluated carefully before kidney transplantation. It has been argued, however, that more consistent use of validated quantitative criteria for assessing patients' medical "fitness" pretransplantation could yield improved posttransplantation outcomes (7,17). Our analysis of data from a national cohort, along with findings reported from a single center by Houle *et al.* (5), suggest that pretransplantation physical functioning scores are predictive of patients' risk for morbidity and health care resource use in the months after kidney transplantation. Some centers find it useful to ask patients to complete a self-administered questionnaire as part of the process of medical evaluation for renal transplantation to obtain information about personal and family demographics, patient involvement in discussions regarding transplantation options, and availability of a living donor (18,19). A physical functioning scale, whether this is the SF-36 10-item version (Table 1) or a shorter version, might be a useful addition to such a questionnaire, and more investigation of patients' physical functioning levels in relation to transplantation outcomes would be valuable (14).

Acknowledgments

This study was supported by National Institutes of Health contract N01-DK-1-2471.

The data were presented in part in poster form at the annual meeting of the American Society of Nephrology; October 31, 2004; St. Louis, MO.

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