Impact of Kidney Disease Outcomes Quality Initiative Guidelines on the Prevalence of Chronic Kidney Disease After Living Donor Nephrectomy

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Abbreviations and Acronyms

BMI = body mass index

CKD = chronic kidney disease

eGFR = estimated glomerular filtration rate

ESRD = end stage renal disease

GFR = glomerular filtration rate

HALDN = hand assisted laparoscopic donor nephrectomy

KDOQI = Kidney Disease Outcomes Quality Initiative

MDRD = Modification of Diet in Renal Disease

NKF = National Kidney Foundation

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Nothing to disclose.

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Purpose: We evaluated the prevalence of chronic kidney disease stage 3 or worse based on the National Kidney Foundation Kidney Disease Outcomes Quality Initiative guidelines after living kidney donation at a single institution.

Materials and Methods: The collected data of 86 consecutive patients who underwent uneventful donor nephrectomy between 1987 and 2008 were evaluated retrospectively. Estimated glomerular filtration rate was determined using the Modification of Diet in Renal Disease from serum creatinine levels collected before and after surgery in kidney donor followup clinics. Chronic kidney disease was defined as an estimated glomerular filtration rate of less than 60 ml/minute/1.73 m^2 according to the Kidney Disease Outcomes Quality Initiative guidelines. Cox regression analyses were then used to determine the impact of predictors on the development of chronic kidney disease.

Results: All donors (mean age 41.2, SD 9.9 years) had a mean preoperative estimated glomerular filtration rate of 88.7 ml/min/1.73 m^2 (SD 16.3). Median followup was 6.4 years (range 0.9 to 21.0). Progression to stage 3 or worse chronic kidney disease was seen in 24.4% (95% CI 15.2–33.7) of patients. There were 2 patient deaths secondary to cancer and none required dialysis. Multivariable analysis showed that preoperative estimated glomerular filtration rate less than 82 ml/minute/1.73 m^2 was an independent risk factor for post-donation chronic kidney disease. For every 1 ml/minute/1.73 m^2 increase in baseline estimated glomerular filtration rate, the hazard of postoperative chronic kidney disease was reduced by 7% (HR 0.93, 95% CI 0.89–0.97, p = 0.001).

Conclusions: Kidney Disease Outcomes Quality Initiative stage 3 chronic kidney disease or worse occurs in 24.4% of kidney donors. Long-term prospective studies and closer followup of donors are needed to identify its implications, given the associated risk of cardiovascular diseases with chronic kidney disease in the general population.

Key Words: kidney failure, chronic; living donors; nephrectomy

KIDNEY transplantation is now the treatment of choice for patients with ESRD. The superior patient and graft survival achieved with living donor kidney transplantation compared to deceased donor kidney transplantation, coupled with the shortage of deceased organ donors, make living donor kidney transplantation the most optimal option for renal replacement therapy offered to patients with ESRD.[1]

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While the benefits of living donor transplantation are proven for the recipient, the consequences for the donor are not so clear cut and have been reported with cautious optimism.[2] The initial loss of renal function is addressed in part by a vigorous compensatory response of the remaining kidney, including a 30% to 40% increase in GFR. Thus, mean GFR has been found to be in the order of 70% to 75% of the value before nephrectomy.[3]

Based on recent large scale database studies, the risks of ESRD,[4] perioperative and long-term mortality for donors do not appear to be increased compared to the general population.[5,6] However, current guidelines from the NKF KDOQI™ published in 2002 defined CKD as an eGFR lower than 60 ml/minute/1.73 m^2 (using the MDRD formula) or by the presence of markers of kidney damage (such as albuminuria or abnormal imaging studies) for 3 months or more.[7] The clinical implication of this new guideline was in turn defined by Go et al,[8] who reported that in the general population CKD stage 3 or worse was associated with an increased risk of hospitalization, cardiovascular events and death. With its potential clinical implications in this study we evaluated the prevalence of CKD based on the NKF KDOQI guidelines after living kidney donation at a single institution.

MATERIALS AND METHODS

Patients

A total of 86 patients who underwent living donor nephrectomy for transplantation between October 1987 and September 2008 at our institution were included in this analysis. A multidisciplinary team including transplant surgeons, transplant nephrologists, psychiatrist and medical social worker rigorously assessed all living donors preoperatively. Following its publication, assessment of our living kidney donors adhered to the Amsterdam Forum.[9] Although 47 (55%) of these patients donated before the Amsterdam Guidelines publication, they were assessed along institutional guidelines that mirrored those of the Amsterdam Forum. In addition, all living kidney donors proceeded to donation after review and approval by the institutional ethics review committee. Preoperative imaging included abdominal pelvic computerized tomographic angiogram with 3-dimensional reconstruction of the renal hilum. Donor nephrectomy was performed using an open technique via a flank incision or HALDN technique via a midline handport as previously described.[10] Postoperatively all living donors were followed up long-term at a post-transplant kidney donor clinic. Donors were seen 6 weeks after surgery, then 6 months later and annually thereafter unless otherwise clinically indicated.

At each clinic and at any unscheduled additional hospital visits living kidney donors had a complete history and physical examination, including body weight (kg), height (m) and BMI (kg/m^2). Laboratory tests done were serum electrolytes including serum creatinine (umol/l), fasting glucose and lipid profile, and urine microscopic examination. Proteinuria was assessed with 24-hour urinary collection for total protein and spot urine protein-to-creatinine ratio. Proteinuria was defined as 24-hour urinary collection for total protein greater than 300 mg/24 hours, and/or spot urine protein-to-creatinine ratio 0.3 mg/mg or greater. The creatinine measurement method in our hospital laboratory was standardized to isotope dilution mass spectrometry.

For the purposes of this study an institutional review board approved database was established. All preoperative, intraoperative and postoperative data were collected retrospectively from all available computerized and medical records. The MDRD formula, GFR (ml/minute/1.73 m^2) = $186 \times (\text{serum creatinine})^{-1.154} \times (\text{Age})^{-0.203} \times (0.742$ if female) $\times$ (1.212 if African-American), was used to calculate eGFR preoperatively and at each of the postoperative clinic visits.[11] eGFR was calculated from the NKF web based calculator at http://www.kidney.org/professionals/KDOQI/gfr_calculator.cfm.

CKD was defined as an eGFR less than 60 ml/minute/1.73 m^2 based on the 2 most recent serum creatinine levels which were taken at least 3 months apart as per KDOQI guidelines.[7] The time to CKD was calculated in days from donor nephrectomy to the second eGFR measurement. Followup duration was defined as months from donor nephrectomy to the study period (September 2009). If patients were not seen in clinic within 3 months of the study period they were contacted by telephone as appointment reminders and to ensure there were no major health events.

Statistical Analysis

The demographic and clinical characteristics of the entire cohort were summarized using frequencies and percentages for categorical variables, and means and standard deviations for continuous covariates which were all approximately normally distributed. We compared the renal function parameters at nephrectomy vs 1 year after donation using the paired t test.

The bivariate associations between specific risk factors and time to postoperative CKD using the log rank test were compared. The risk factors analyzed included gender, ethnicity, age at donation, BMI, hypertension, hyperlipidemia, surgical approach and operative time. The effect of these risk factors was quantified using the hazard ratio estimate and its associated 95% CI. Cox proportional hazards regression analysis was further implemented to account for the joint effect of risk factors that were identified as significant predictors of time to postoperative CKD via the log rank test.

The area under the receiver operating characteristic curve was also estimated for preoperative eGFR which was identified by the Cox model as a significant risk factor for postoperative CKD. A suitable cutoff for preoperative eGFR was obtained at the optimal sensitivity and specificity of the ROC curve. The Kaplan-Meier curve for the time to postoperative CKD was plotted for each subgroup of subjects defined by this cutoff. All statistical analyses were generated using STATA® software, version 11. Statistical evaluations were assessed assuming a 2-sided test at the conventional 0.05 level of significance.