ELSEVIER

Urologic Oncology: Seminars and Original Investigations 30 (2012) 482–486

UROLOGIC ONCOLOGY

Original article

Kidney function following nephrectomy: Similitude and discrepancies between kidney cancer and living donation

Marc-Olivier Timsit, M.D.[a,b,*], Kien N. Nguyen, M.D.[a,b], Yannick Rouach, M.D.[a,b], Caroline Elie, M.D.[a,c], Alexandre Loupy, M.D., Ph.D.[a,d], Catherine Fournier, R.N.[d], Christophe Legendre, M.D., Ph.D.[a,d], Arnaud Mejean, M.D., Ph.D.[a,b]

[a] *Université Paris Descartes, Paris, France*
[b] *Department of Urology and Renal Surgery, Necker Division, Hôpital Européen Georges Pompidou, AP-HP, Paris, France*
[c] *Department of Biostatistics, Necker Hospital, AP-HP, Paris, France*
[d] *Division of Nephrology and Transplantation, Necker Hospital, AP-HP, Paris, France*

Received 4 March 2010; received in revised form 9 April 2010; accepted 12 April 2010

Abstract

Objectives: The reported long-term safety of kidney donation is inconsistent with the impairment of kidney function observed following nephrectomy for renal cell cancer. We aimed to investigate if indication for nephrectomy (kidney cancer vs. living donation) was an independent risk factor for kidney function deterioration.

Materials and methods: Between 1985 and 2008, 124 patients with localized renal cell carcinoma who meet the criteria used for living donation, underwent radical nephrectomy (group 1) at our institution. Group 1 was retrospectively compared with 124 consecutive living donor nephrectomies (group 2) performed from 2004 to 2008. Kidney function evaluation was performed preoperatively and at 1, 2, 3, and 4 years postoperatively with calculation of estimated glomerular filtration rate through the Modification of Diet in Renal Disease (MDRD-eGFR) and the adjusted Cockroft and Gault (CG-eGFR) formula. Multivariate logistic regression included patients' characteristics and indication for nephrectomy as predictors of kidney function deterioration.

Results: Mean decrease in MDRD-eGFR was 30.4% and 32.4% in groups 1 and 2 ($P = 0.30$). Prevalence of chronic kidney disease (CKD), defined by MDRD-eGFR < 60 mL/min/m^2, varied from 42.3% to 71% in group 1 and from 41.6% to 56% in group 2 at different time points ($P = 0.073$). Prevalence of CKD at 4 years defined by MDRD-eGFR < 45 mL/min/m^2 was significantly increased in group 1 compared with group 2 (16.2% and 5.3%, $P < 0.005$, respectively). Linear regression analysis showed only baseline kidney function and patient age predicted a significant decrease in postoperative kidney function ($P < 0.001$ and $P = 0.04$).

Conclusions: Renal cell carcinoma is not an independent risk factor for kidney function impairment following nephrectomy. Selected kidney cancer patients with few morbidities face the same deterioration of meanly 30% of kidney function compared with living donors, but their lower baseline function results in an increased risk for CKD.

Keywords: Creatinine; Creatinine clearance; Kidney cancer; Kidney transplantation; Living donor; Nephrectomy; Renal function

1. Introduction

Because of raised awareness of chronic kidney disease (CKD) following radical nephrectomy, and its association with decreased overall survival [1], surgical management of renal cell carcinoma has evolved deeply in the past decade. Thus, elective nephron-sparing surgery became the gold standard treatment of renal tumors of 4 cm or less [2] and more than an option in localized renal masses of 4 to 7 cm [3].

On the other hand, the ever-increasing organ shortage has led to encourage living donation as a source of kidneys for transplantation [4], the preferred therapeutic option for patients with end-stage renal disease. Indeed, the superior results achieved with transplantation using kidney from living-compared with deceased donors is associated with satisfying donors outcome following nephrectomy [5,6].

The long-term safety of kidney donation is somewhat inconsistent with the impaired kidney function observed

* Corresponding author. Tel.: +33-1-44495352; fax: +33-1-44495338.
E-mail address: marc-olivier.timsit@nck.aphp.fr (M.-O. Timsit).

1078-1439/$ – see front matter
http://dx.doi.org/10.1016/j.urolonc.2010.04.005

after radical nephrectomy; it has been widely reported that the high selection of healthy individuals as donors [6,7] might explain the low impact of kidney removal among this population compared with cancer patients. However, in kidney cancer patients, it remains unclear if it is the renal cell carcinoma itself, the associated morbidities, or another condition that are responsible for the long-term adverse events in terms of renal outcome.

Despite ongoing recommendations, radical nephrectomy is still performed in the great majority of patients presenting with small renal masses [8] in the elective situation of normal contra lateral kidney with normal baseline kidney function. This unfavorable observation likely results from willing to use laparoscopic approach (laparoscopic partial nephrectomy is technically more challenging than laparoscopic radical nephrectomy), but also from the general opinion that healthy individuals, such as living donors, will not develop CKD following nephrectomy. This commonly cited analogy led us to focus on kidney cancer patients who met the criteria for living donation, except for the cancer itself.

The present study therefore aimed to assess mid-term kidney function and risk for CKD following nephrectomy in two cohorts: living donors and renal cancer patients with few associated morbidities. Our goal was also to investigate, through a multivariate analysis, if nephrectomy, independent of its indication, was deteriorating kidney function similarly in kidney cancer patients and living donors.

2. Materials and methods

Between 1985 and 2008, 602 patients underwent open or laparoscopic radical nephrectomy for localized sporadic renal cell carcinoma at our institution. Among them, 124 (group 1) had normal contra-lateral kidney, were free of recurrence at last follow-up, and otherwise met criteria for renal donation at our institution regarding age, medical history, and associated morbidities (Table 1). To perform the comparison, 124 consecutive laparoscopic living donor nephrectomies performed from 2004 to 2008 at our center were retrospectively reviewed (group 2). Because of missing data regarding renal outcome after more than 1-year postoperatively, 11 patients were subsequently excluded. Group 2 therefore incorporated 113 patients.

Surgical technique consisted of anterior approach for open radical nephrectomy; after year 2003, most radical nephrectomies for localized renal cell carcinoma were performed through trans-abdominal laparoscopy. Laparoscopic living donor nephrectomy was performed for either right or left kidney, depending on their relative functional value and the number of arteries.

Patients' baseline characteristics were collected including age, gender, body mass index, history of hypertension or diabetes mellitus, and use of tobacco. Kidney function evaluation was performed preoperatively and at 1, 2, 3, and 4 years postoperatively with calculation of estimated glomerular filtration rate (GFR) through the Modification of Diet in Renal Disease (MDRD-eGFR) equation [9] and the body surface area adjusted Cockroft and Gault (CG-eGFR) formula using actual body weight. In addition, pre-donation and 1 year post-donation GFR in group 2 was measured through iohexol clearance [10] as a standard of care at our institution.

Table 1
Standards contra-indication for living donation at our institution

Contra-indications to living donation
Age <18 years
Uncontrolled hypertension
Type 1 diabetes
Proteinuria >300 mg/L
Gross hematuria
GFR < 80 mL/min
Thrombophilia
Inherited stone disease
HIV, HBV, HCV infection
Any chronic medical condition
Tuberculosis infection
Parasite
Psychotic disorders
Body mass index >40

Elevated body mass index >40 and psychotic disorders may be relative contra-indications and require further evaluation. HBV and HCV infections may be considered with specific derogative authorization.

GFR = glomerular filtration rate; HIV = human immunodeficiency virus; HBV = hepatitis B virus; HCV = hepatitis C virus.

Categorical variables were reported as absolute numbers or percentages and were compared using 2×2 contingency tables and χ^2 tests. At each interval, eGFR was compared among groups using ANOVA and SAS software followed by Student's *t*-test for continuous variables. Incidence of CKD (defined by eGFR $<$ 60 mL/min/1.73m^2 or eGFR $<$ 45 mL/min/1.73m^2) was compared in both groups using Fischer's exact test. *P* values of 0.05 or less were considered to indicate statistical significance. Linear regression multivariate analysis using MDRD-eGFR or CG-eGFR as the dependant variables and incorporating patients' characteristics, and indication for nephrectomy was performed using the same software.

3. Results

Patients' characteristics in both groups are reported in Table 2. Patients in group 1 were significantly older (57.9 and 48.5 y in group 1 and 2, respectively, $P < 0.01$) with more frequent history of diabetes mellitus (8.9% vs. 0.9%, $P = 0.005$) and hypertension (25% vs. 13.3%, $P = 0.023$). Preoperative body mass index was similar in both groups, as well as tobacco use. Baseline MDRD-eGFR as well as CG-eGFR was superior in group 2 rather than in group 1 (78.8 and 80.5 vs. 89.7 and 96.2, respectively, $P < 0.001$). The mean decrease in MDRD-eGFR was –30.4% and