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Predictive factors of hemorrhagic complications after partial nephrectomy

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Abstract

Objectives: To identify the predictive factors of hemorrhagic complications (HC) in a contemporary cohort of patients who underwent partial nephrectomy (PN).

Materials and methods: Records of 199 consecutive patients who underwent PN between 2008 and 2012 at our institution were retrospectively analyzed. HC was defined as a hematoma requiring transfusion, an arterio-veinous fistula, a false aneurysm or a post-operative decrease of hemoglobin >3 g/dl. Patients with or without HC were compared using Wilcoxon and Fisher exact tests for continuous and categorical variables, respectively. We performed a univariate and multivariate analysis with a logistic regression model using the occurrence of an HC as the dependent variable.

Results: 54% of the patients were male with a median age of 61 (22–86) years. Median BMI was 26 (18–47) kg/m^2. Surgery was done open, laparoscopically or with robotic assistance in 106, 54 and 39 cases, respectively. Global complication rate was 40% including 21.6% HC. There were more complex tumors (75.6% vs. 66.5%, $p = 0.04$) and median length of stay was increased (11 days compared to 7 days, $p < 0.0001$) in case of a HC. In univariate analysis, imperative indication ($p = 0.08$), RENAL score ($p = 0.07$), operating time ($p = 0.07$) and operative blood loss > 250 ml ($p = 0.002$) were statistically relevant. In multivariate analysis, only operative blood loss >250 ml was identified as a predictive factor of HC ($p = 0.0007$).

Conclusion: Patients who underwent a procedure with estimated blood loss >250 ml should be carefully monitored in the postoperative course.

Keywords: Partial nephrectomy; Hemorrhage; Complications; RENAL score

Introduction

Nephron sparing surgery (NSS) is the optimal management of small localized renal cell carcinomas (RCC).[1–3] Partial nephrectomy (PN) provides oncological outcomes similar to that of radical nephrectomy (RN)[4–6] with better preservation of renal function.[7,8] However, PN remains underused and mostly performed in tertiary care centers.[9,10]

A possible explanation for this lack of diffusion is the potential morbidity of PN.[5,11–13] In many studies, complication rates of PN lie between 10 and 50%, according to tumor complexity.[14–16] The most frequent complications of PN are hemorrhagic[17] (ie: blood loss, perirenal hematoma, arterio-venous fistula and false aneurysm). These hemorrhagic complications (HC) can lead to a need for transfusion, embolization and/or reoperation that can raise morbidity, increase length of hospital stay and delay return to normal activities.

Our objective was to evaluate predictive factors of HC after PN in a contemporary cohort of patients operated both open and laparoscopically.

Abbreviations: NSS, nephron sparing surgery; RCC, renal cell carcinoma; PN, partial nephrectomy; RN, radical nephrectomy; HC, hemorrhagic complication; RS, RENAL Score; MDRD, modification of diet in renal disease.

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Materials and methods

This was a retrospective study of 199 patients who underwent PN at our institution for a renal tumor between January 2008 and March 2012. After informed consent, all their records were prospectively entered into a specific RCC database. All cases were done consecutively. Patients were mostly operated by two surgeons. Operative technique (open, laparoscopic with or without robotic assistance) was decided by the surgeon based on his experience and tumor complexity. Data regarding patient demographics, tumor characteristics, and surgical outcomes were reviewed. Comorbidities were graded using Charlson index. The presence of anticoagulant therapy (either vitamin K antagonists or antiplatelet agent) was noted. Tumor complexity was evaluated with the RENAL nephrometry score (RS)[18] and tumors were classified as: low complexity (RENAL score between 4 and 6), moderate complexity (RENAL score between 7 and 9) and high complexity (RENAL score $>$ 9 or hilar tumors).

Patients were operated either open or laparoscopically with or without robotic assistance. The open access was performed extraperitoneally through a flank incision. The tumor was dissected free from the perirenal fat. Most of the time, tumor resection was performed under pedicle clamping. The resection margin was assessed macroscopically as we do not routinely ask for frozen examination. A 2.0 running suture on the resection bed was made to ensure hemostasis and closure of the collecting system. Renal reconstruction was achieved with interrupted 0 sutures. All laparoscopic interventions were performed transperitoneally. The principles of tumor resection were the same as with the open access. For all operation, hemostatic agents were used at the surgeon's discretion if needed. We studied the use of the following hemostatic agents: gelatin matrix with human thrombin (Floseal®), cellulose surgical bolster (Surgicel®) and biological surgical glue (Bioglue®). All drugs could have been used separately or combined.

Surgeon's experience was appraised considering that an experienced surgeon had performed more than 20 PN with a specific surgical approach (for example, even if a surgeon had performed more than 20 laparoscopic PN, we considered that he was still unexperienced in his first 20 robotic cases).

Complications that occurred within one month after surgery were classified using the Clavien–Dindo system. We distinguished minor (grade I and II) from major complications (grade III–V). HC were defined as the occurrence of a perirenal hematoma requiring transfusion, an arterio-venous fistula, a false aneurysm or a decrease of hemoglobin $>$3 g/dl.

Statistical analysis

We compared patients with or without HC using the Wilcoxon test for continuous variables and the Fisher exact test for categorical variables. We performed a univariate and multivariate analysis with a logistic regression model using the occurrence of a HC as the dependent variable.

Results

Patients data

Demographics are shown in Table 1. 108 patients were male. Median age was 61 (22–86) years old. Median BMI was 26 (18–47) kg/m^2. Median Charlson comorbidity index was 4 (0–11). Median baseline GFR was 86 (31–268) ml/min/1.73 m^2 and 26 patients had chronic renal disease (defined as MDRD $<$ 15 ml/min). 34 patients were receiving anticoagulants before surgery.

Pathological data

Tumor characteristics are summarized in Table 1. Median tumor size was 35 mm (10–110). 24 patients underwent imaging guided renal biopsy before surgery. On final pathologic exam, 165 tumors were malignant. According to RENAL score, 60, 83 and 46 tumors were classified as low, moderately and highly complex, respectively.

Operative and perioperative data

Details are summarized in Table 2. The indication was elective in 166 cases. 106 PN were done open, 54 by laparoscopy and 39 with robotic assistance. The surgeon was considered experimented in 142 procedures. Median

Table 1
Patient and tumor characteristics.

Variables	
Gender: male, *n* (%)	108 (54)
Median age, years (range)	61 (22–86)
Median BMI, kg/m^2 (range)	26 (18–47)
Median Charlson Index (range)	4 (0–11)
Charlson index, *n* (%)	
0–1	50 (25)
2	39 (20)
3	39 (20)
≥4	71 (35)
Chronic renal disease at surgery, *n* (%)	26 (13)
Median baseline MDRD, ml/min (range)	86 (31–268)
Anticoagulant treatment before surgery, *n* (%)	34 (17)
Preoperative biopsy, *n* (%)	24 (12)
Malignant tumors, *n* (%)	165 (82.9)
Histology, *n* (%)	
Clear cell	122 (74)
Papillary	23 (14)
Chromophobe	15 (9)
Other	5 (3)
Median tumor size, mm (range)	35 (10–110)
Fuhrman grade, *n* (%)	
1	14 (9)
2	95 (58)
3	51 (32)
4	3 (1)
RENAL score, *n* (%)	
Low complexity	60 (32)
Intermediate complexity	83 (44)
High complexity	46 (24)