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Original Article

The perioperative outcomes between renal hilar and non-hilar tumors following robotic-assisted partial nephrectomy (RAPN)

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Abstract

Background: The aim of this study was to compare the perioperative outcomes between renal hilar tumors and non-hilar tumors after robotic-assisted partial nephrectomy (RAPN).
Methods: A retrospective review of consecutive patients who underwent RAPN from December 2009 to September 2015 at our institution was recruited. Perioperative outcomes including demographic characteristics, perioperative, pathological and renal function outcomes were compared between the hilar group (n = 30) and non-hilar group (n = 170).
Results: In characteristics, hilar group was younger (52.4 vs. 58 years, $p = 0.04$) and had less body mass index (23.7 vs. 25.4 kg/m^2, $p = 0.018$). Hilar group had larger tumor size (4.8 vs. 3.7 cm, $p = 0.009$), higher Preoperative Aspects and Dimensions Used for an Anatomical (PADUA) score (10.7 vs. 8.5, $p < 0.001$) and higher RENAL (radius, exophytic/endophytic properties of the tumor, nearness of tumor deepest portion to the collecting system or sinus, anterior/posterior description and the location relative to polar lines) score (9.0 vs. 7.4, $p < 0.001$). Hilar tumor was associated with longer operative time (293.6 vs. 240.5 min, $p = 0.001$) and warm ischemia time (39.9 vs. 21.8 min, $p < 0.001$). But there was no statistically difference in estimated blood loss (EBL), postoperative stay and complication rate. For pathological outcomes, there was no difference of positive margin rate and pathological T stage between these groups. For renal function outcomes, hilar tumor patients had no difference of the change of creatinine and estimated glomerular filtration rate (eGFR) at postoperative 6 and 12 month as compared with non-hilar tumor patients.
Conclusion: For renal hilar tumor, RAPN could provide acceptable results of perioperative, pathological and renal function outcome as compared with non-hilar tumor group. Thus RAPN is a safe and effective nephron-sparing surgery technique for renal hilar tumors.

Keywords: Kidney neoplasms; Nephrectomy; Robotics

1. Introduction

In the past decades, the incidental diagnosis of renal tumor has been increased significantly due to wide use of abdominal image modalities.[1] Since radical nephrectomy is an independent risk factor for patients developing newly chronic kidney disease,[2] partial nephrectomy (PN) has become the standard care in the treatment of renal tumor less than 4 cm and selected tumor up to 7 cm.[3] As compared laparoscopic PN (LPN) with

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open PN, laparoscopic approach could provide comparable surgical, pathological and renal function outcomes.[4]

Renal hilar tumor was defined as a tumor located in the renal hilum, abutting the renal vessels, and/or renal pelvis seen on preoperative computerized tomography.[5,6] Due to more difficult to approach, laparoscopic partial nephrectomy need more surgical skills to achieve precise parenchyma resection and renal reconstruction.[6,7] Gill et al. showed the technical feasibility of laparoscopic PN for renal hilar tumor, but higher complication rate was still noted in hilar tumor even in experienced surgeon.[8] Previous literature had proved that RAPN had better operative outcomes as compared with laparoscopic PN.[9,10] Thus we hypothesized robotic approach could facilitate resection of these difficult lesions. The aim of this study was to analyze the perioperative outcomes between renal hilar tumor and non-hilar tumor following RAPN.

2. Methods

2.1. Data collection

We retrospectively reviewed charts of 204 consecutive patients who underwent RAPN from December 2009 to September 2015 at our institution. All operation was performed by three experienced robotic surgeons of our institution. Institutional review board approval was obtained before initiating the study.

All three surgeons agreed on hilar tumor definition that was consistent to literature, but these patients were separated into hilar and non-hilar tumor by one major surgeon. There were no specific exclusion criteria for RAPN in our institution. For hilar tumor cases, patients received RAPN if parenchymal reconstruction is technically feasible and safe unless clinically renal vein invasion (cT3 disease) which received radical nephrectomy alternatively. Three patients with bilateral renal tumors and one hilar tumor case who was converted to open radical nephrectomy due to grossly renal vein thrombus were excluded for analysis. Patients were classified as hilar (n = 30) or non-hilar (n = 170) tumor for analysis.

Patient demographic data collected included age, gender, body mass index (BMI), American Society of Anesthesiologists score (ASA score), and laterality. Maximal tumor size on preoperative image either CT or MRI scan, RENAL (radius, exophytic/endophytic properties of the tumor, nearness of tumor deepest portion to the collecting system or sinus, anterior/posterior description and location relative to the polar line) nephrometry score[11] (classified into low 4−6, intermediate 7−9, and high 10−12 complexity groups) and PADUA (Preoperative Aspects and Dimensions Used for an Anatomical) nephrometry score.[12]

The operative outcomes including operation time, warm ischemia time (WIT), renal hilar clamp rate, estimated blood loss (EBL), perioperative transfusion rate, collecting system repair rate, and post-operative hospital stay. Dindo-Clavian classification was used to categorize complications as minor (I ~ II) and major (III ~ IV) complications. Pathological reports including histology, malignancy rate, nuclear grade, lymphovascular invasion (LVI), margin status and pathological T stage were collected.

For functional outcome, creatinine level was collected at pre-operative, post-operative 3, 6 and 12 months. Estimated glomerular filtration rate (eGFR) were collected at the same time point and calculated according to the Modification of Diet in Renal Disease (MDRD) study equation.[13,14]

2.2. Surgical technique

In our institution, we do not routinely insert ureter catheter unless renal tumor was close or attach to ureter proved by preoperative image. We perform all RAPNs using a 5 ports transperitoneal approach with the patient in a 60° modified flank position depending tumor location. The surgical table is mildly flexed and positioned in a slight Trendelenburg position. The abdomen is insufflated to 12 mmHg via Veress needle at the lateral border of the rectus muscle and 2 cm above umbilicus level which later serves as a 12-mm camera port. Unlike previous RAPN technique,[15−17] we used three 8-mm ports for manipulation. These ports are placed at the lateral border of the rectus muscle below the costal margin, 3−5 cm cephalad to the inguinal ligament at ipsilateral lower quadrant abdomen and anterior axillary line at umbilicus level for monopolar curved scissor, Maryland bipolar forceps and ProGrasp forceps, respectively (Fig. 1). Port configuration can adjust according to tumor location to optimize working angle. The robot is positioned over the patient's back to have the camera oriented in line with the kidney.

For RAPN technique, the strategy is related to tumor characteristics and the kidney anatomy. Initial steps of the procedure including bowel mobilization, hilar identification and dissection to exposure renal vein and artery. We open Gerota's fascia in an area that is far away from the tumor to find the capsule. Peri-renal fat was dissected along the plane for adequately exposure the tumor and kidney mobilization. A laparoscopic ultrasound probe controlled by bedside assistance or a drop-in robotic ultrasound probe can be used by activating the Tilepro multi-input display. This intracorporeal ultrasound

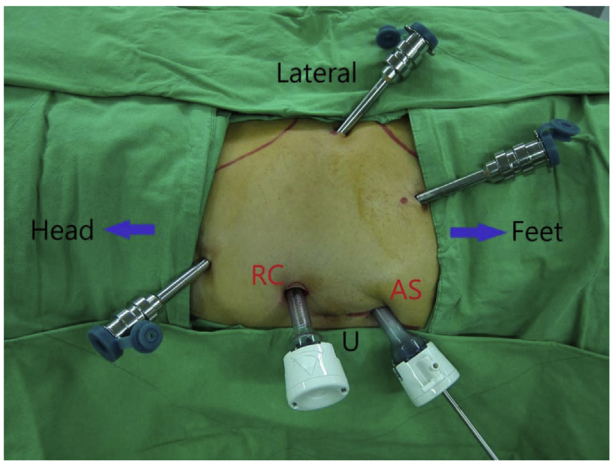

Fig. 1. Trocar placement for left RAPN. U: umbilicus; AS: assistance port; RC: robotic camera.

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