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TIPS & TRICKS

Robotic-assisted laparoscopic radical nephrectomy using the Da Vinci Si system: how to improve surgeon autonomy. Our step-by-step technique

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Abstract Herein, we describe several steps to improve surgeon autonomy during a Left Robotic-Assisted Laparoscopic Radical Nephrectomy (RALRN), using the Da Vinci Si system. Our kidney cancer program is based on 2 community hospitals. We use the Da Vinci Si system. Access is obtained with the following trocars: Two 8 mm robotic, one 8 mm robotic, bariatric length (arm 3), 15 mm for the assistant and 12 mm for the camera. We use curved monopolar scissors in robotic arm 1, Bipolar Maryland in arm 2, Prograsp Forceps in arm 3, and we alternate throughout the surgery with EndoWrist clip appliers and the vessel sealer. Here, we described three steps and the use of 3 robotic instruments to improve surgeon autonomy. Step 1: the lower pole of the kidney was dissected and this was retracted upwards and laterally. This maneuver was performed using the 3rd robotic arm with the Prograsp Forceps. Step 2: the monopolar scissors was replaced (robotic arm 1) with the robotic EndoWrist clip applier, 10 mm Hem-o-Lok. The renal artery and vein were controlled and transected by the main surgeon. Step 3: the superior, posterolateral dissection and all bleeders were carefully coagulated by the surgeon with the EndoWrist one vessel sealer. We have now performed 15 RALRN following these steps. Our results were: blood loss 300 cc, console time 140 min, operating room time 200 min, anesthesia time 180 min, hospital stay 2.5 days, 1 incisional hernia, pathology: (13) RCC clear cell, (1) chromophobe and (1) papillary type 1. Tumor Stage: (5) T1b, (8) T2a, (2) T2b. We provide a concise, step-by-step technique for radical nephrectomy (RN) using the Da Vinci Si robotic system that may provide more autonomy to the surgeon, while maintaining surgical outcome equivalent to standard laparoscopic RN.

Keywords Radical nephrectomy · Kidney cancer · Oncology · Minimally invasive surgery · Laparoscopic nephrectomy · Robotic nephrectomy

Introduction

The benefit of partial nephrectomy (PN) vs radical nephrectomy (RN) remains controversial in light of the phase 3 European Organization for the Research and Treatment of Cancer (EORTC) trial [1]. In that publication, PN seems to be significaly less effective than RN in terms of overall survival (OS) [1]. In another study, a meta-analysis of PN vs. RN for localized renal tumors was done and found that PN correlated with a 19 % risk reduction in all causes mortality, a 29 % risk reduction in cancer-specific mortality and a 61 % risk reduction for development of severe chronic kidney disease [2]. Certainly, the management of small kidney cancers in the last 10 years has changed, performance of RN has decreased over time (from 69.0 to 42.5 %), and the use of nephron-sparing surgery (partial nephrectomy and ablation) has increased

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(from 21.5 to 49.0 %) [3]. Therefore, PN for T1a renal mass is the recommended surgical approach and RN for renal mass >T1b [4]. Herein, we describe several steps to improve surgeon autonomy during a Left Robotic-Assisted Laparoscopic Radical Nephrectomy (RALRN).

Surgical technique/tips and tricks

Patient position and trocars placement

A Foley catheter is introduced. Patient is placed in 75°, right lateral decubitus position (left side up) **(Video)**, with careful identification of any point of pressure. All points of pressure are protected. The surgical table is flexed, 2–3 cm above umbilicus, 1.5 cm incision is done and careful dissection to the rectus muscle fascia is carried out. This is followed by the insertion of the Veress needle through the muscle fascia. Saline test is done through the Veress needle, confirming appropriate placement. Pneumoperitoneum of 15 mmHg is created, followed by placement of the 12-mm port. A 30° robotic camera looking upward is then advanced through this port to facilitate placement of the other trocars. All other ports are placed under direct visualization. Three 8 mm robotic ports are placed, one subcostal, one above the iliac crest and one 8 cm below the camera port. A 15 mm port for the assistant is placed between the camera and the subcostal port **(video)**. After placing the ports, the Da Vinci Robotic Surgical System is docked to the ports in standard fashion from behind the patient. We use the Monopolar scissor (robotic arm 1), Bipolar Maryland (robotic arm 2) and the Prograsp (robotic arm 3).

Bowel mobilization

The peritoneum is incised from the sigmoid to the splenic flexure lateral to the white line of Toldt. The colon is then reflected medially to expose left ureter, gonadal vessels and aorta. Care is taken not to dissect into Gerota's fascia.

Step 1

Identification of the ureter and gonadal vein (surgeon autonomy improved)

A plane of dissection is created medial to the ureter, with careful identification of the gonadal vein. The lower pole of the kidney is dissected and this is retracted upwards and laterally. This maneuver is done using the 3rd robotic arm, with the Prograsp Forceps. This keeps the surgeon in control of the retraction and dissection with minimal participation by the assistant **(Video)**. During standard laparoscopic surgery, this maneuver is performed by the assistant, hence the surgeon continues the dissection with 2 instruments.

Step 2

Dissection of the upper pole with vascular control (autonomy improved)

The renal hilum is carefully dissected to isolate the renal vessels. The renal vein and artery are identified, isolated and skeletonized free of the hilar fat. A plane of dissection is created above the superior pole of the kidney. The adrenal gland is included in the final specimen. The plane of dissection is carried laterally to completely free the superior pole of the kidney. Care is taken not to strip the perinephric fat from the renal surface. We replace the monopolar scissors (robotic arm 1) with the robotic EndoWrist clip applier, 10 mm Hem-o-Lok. The renal artery is cut between hem-o-lock clips (2 on the patient side and one on the specimen side). The renal vein is controlled and divided in the same fashion **(Video)**. Additional hemostasis is achieved by use of Hem-o-Lock clips as needed. *This step gives more autonomy to the surgeon*. With standard robotic approach, the vein is controlled with the ENDO-GIA stapler by the assistant.

Step 3

Posterior-lateral kidney dissection and specimen retrieval (surgeon autonomy improved)

The adrenal gland and the kidney inside the Gerotas's fascia are now dissected off the posterolateral wall and all bleeders are carefully coagulated with the EndoWrist one vessel sealer. *This robotic instrument facilitates this step and gives complete control to the surgeon* **(Video)**. Previously, the Harmonic Shears was used through the assistant port. The ureter and periureteric fat is divided after placing Hem-o-Lock clips. The remainder of the attachments of the specimen is freed and the specimen is placed in a large laparoscopic specimen bag. This is placed through the assistant port. The specimen within the retrieval bag is transferred to the pelvis and removed through an extended incision in the port for the 3rd robotic arm (more cosmetic).

Results

Our practice is based on 2 community hospitals, associated with Florida State University College of Medicine, where medical students have elective rotations in Urology. We

Table 1 Demographic, clinical, pathological and operative outcome of the study population

	Robotic nephrectomy
Number cases	15
Age, years, median	64 (60–71)
BMI Kg/m^2, median	29.3 (25.8–33)
Gender (%)	
Male	10 (67)
Female	5 (33)
Race	
White	13 (90)
Nonwhite	2 (10)
Laterality	
Left	9 (60)
Right	6 (40)
Histology (%)	
Clear cell	13 (87)
Chromophobe	1 (6.5)
Oncocytoma	0
Papillary type 1	1 (6.5)
Papillary type II	0
Fuhrman grade (%)	
I or ll	11 (70)
III or IV	4 (30)
T stage (%)	
la	0
lb	5
IIa	8
IIb	2
EBL, ml, median	300 (150–425)
Conversion to open	1
Anesthesia time, min, median	180
Operating room time, min, median	200
Console time, min, median	140
Length of stay, days, median	2.5
Assistant, number of cases	
A	9
B	4
C	2

BMI body mass index, *EBL* estimated blood loss

have now performed 18 robotic PN and 15 RALRN (this is our study group) during the last 18 months. We have 3 physician assistants helping us during the surgery, they have laproscopic skills (general surgery and gynecology) but not urology experience. Our results in this initial cases were (Table 1): blood loss 300 cc, console time 140 min, operating room time 200 min, anesthesia time 180 min, hospital stay 2.5 days, 1 incisional hernia, pathology: (13) RCC clear cell, (1) Chromophobe and (1) papillary type 1. Stage: (5) T1b, (8) T2a, (2) T2b. *We have 3 different assistant and patients' outcomes were similar regardless of their skills* (Table 1). All cases were done by 1 surgeon (Hugo H. Davila); he has done about 200 laparoscopic and robotic surgeries during the last 5 years of practice.

Discussion

We started the robotic program in Kidney Cancer 18 months ago. Therefore, most of the first assistants have never performed a RALRN. Therefore, it has been very important to maintain the main surgeon autonomy; hence he controls 3 robotic arms plus the camera and has access to 5 different robotic instruments. This makes the surgeon almost completely independent from the first assistant, who only provides minimal traction and suction during the cases. Certainly, the cost of robotic surgery is higher than standard laparoscopic surgery [5]. We know that RN can be safely done with a standard Laparoscopic approach [5]. This may require a very skilled assistant who needs to go through the learning curve and training that sometimes is very difficult to find outside university or academic hospitals [6].

Conclusion

Therefore, herein we present 3 easy steps using the Da Vinci Si robotic system that may provide more autonomy to the surgeon, maintaining surgical outcome equivalent to the standard laparoscopic RN. In addition, this may allow the surgeon to prepare the surgical assistant and team for more complex urologic cases such as partial nephrectomy, pyeloplasty, sacrocolpopexy, prostatectomies and ureteral re-implantation among others. The cost of robotic surgery is the main limitation of this approach and this needs to be considered by the surgeon and institution.

Compliance with ethical standards

Conflict of interest Hugo H. Davila, Raul E. Storey and Marc C. Rose declare no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Van Poppel H, Da Pozzo L, Albrecht W, Matveev V, Bono A, Borkowski A, Colombel M, Klotz L, Skinner E, Keane T, Marreaud S, Collette S, Sylvester R (2011) A prospective, randomised EORTC intergroup phase 3 study comparing the oncologic outcome of elective nephron-sparing surgery and radical nephrectomy for low-stage renal cell carcinoma. Eur Urol 59(4):543–552
2. Kim SP, Thompson RH, Boorjian SA, Weight CJ, Han LC, Murad MH, Shippee ND, Erwin PJ, Costello BA, Chow GK, Leibovich BC (2012) Comparative effectiveness for survival and renal function of partial and radical nephrectomy for localized renal tumors: a systematic review and meta-analysis. J Urol 188(1):51–57
3. Huang WC, Atoria CL, Bjurlin M, Pinheiro LC, Russo P, Lowrance WT, Elkin EB (2015) Management of small kidney cancers in the new millennium: contemporary trends and outcomes in a population-based cohort. JAMA Surg 150(7):664–672. doi:10.1001/jamasurg.2015.0294
4. Campbell SC, Novick AC, Belldegrun A, Blute ML, Chow GK, Derweesh IH, Faraday MM, Kaouk JH, Leveillee RJ, Matin SF, Russo P (2009) Guideline for Management of the clinical T1 renal mass. J Urol 182(4):1271–1279
5. Yang DY, Monn MF, Bahler CD, Sundaram CP (2014) Does robotic assistance confer an economic benefit during laparoscopic radical nephrectomy? J Urol 192(3):671–676
6. Cabral JF, Braga I, Fraga A, Castro-Henriques A, Príncipe P, Silva-Ramos M (2015) From open to laparoscopic living-donor nephrectomy: changing the paradigm in a high-volume transplant center. Transplant Proc 47(4):903–905