Clinical Case Report

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Extraperitoneal robot-assisted laparoscopic retroperitoneal lymph node dissection for early-stage testicular nonseminomatous germ cell tumors

A case report and literature review

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Abstract

Rationale: Typically robot-assisted laparoscopic retroperitoneal lymph node dissection (R-RPLND) has been performed via a transperitoneal approach. Herein we report the first case of a novel R-RPLND using an extraperitoneal approach.

Patient concerns: A 38-year-old man presented with an enlarging right scrotal mass.

Diagnoses: Scrotal ultrasonography demonstrated a 5.5-cm solid mass of the right testis. The patient underwent right radical inguinal orchiectomy. Pathologic examination demonstrated a mixed germ cell tumor, predominately embryonal carcinoma with yolk sac tumor.

Interventions: Extraperitoneal R-PRLND was performed 3 weeks after the radical orchiectomy.

Outcome: The final pathologic examination showed a count of 19 lymph nodes, all of them negative. Normal antegrade ejaculation returned within 4 weeks postoperatively. No retroperitoneal recurrence or elevation of tumor marker levels were seen via surveillance imaging.

Lessons: Our study shows that extraperitoneal R-RPLND is a safe and feasible procedure using an extraperitoneal approach that provides minimal invasion and rapid recovery of patients.

Abbreviations: NSGCT = nonseminomatous germ cell tumor, RPLND = retroperitoneal lymph node dissection, R-RPLND = robot-assisted laparoscopic retroperitoneal lymph node dissection.

Keywords: laparoscopic, nonseminomatous germ cell tumor, retroperitoneal lymph node dissection, robotic, testicular cancer

1. Introduction

Since its initial report by Davol et al[1] in 2006, robot-assisted laparoscopic retroperitoneal lymph node dissection (R-RPLND) for clinical stage I nonseminomatous germ cell tumor (NSGCT) of the testis has been shown to be an accurate and reliable pathological staging method of the retroperitoneum by several investigators.[2] R-RPLND appears comparable to laparoscopic RPLND in terms of safety and perioperative outcomes.[3] Typically, R-RPLND has been performed via a transperitoneal approach. We describe a novel R-RPLND using an extraperitoneal approach that to our knowledge has not been previously described in the literature.

2. Case report

A 38-year-old man presented with an enlarging right scrotal mass. There was no significant past history or family history of testicular tumors. On examination, the right testis was enlarged and hard while the rest of the clinical examination was unremarkable. Scrotal ultrasonography demonstrated a 5.5-cm solid mass of the right testis, and tumor markers were significant for elevated alpha-fetoprotein (280.0 ng/mL; normal less than 20.0 ng/mL). The patient underwent right radical inguinal orchiectomy. Pathologic examination demonstrated a mixed germ cell tumor, predominately embryonal carcinoma with yolk sac tumor, and negative lymphovascular invasion (Fig. 1). A complete metastatic evaluation, including ultrasonography of the abdomen and retroperitoneum and computed tomography scans of the chest and the abdomen, was performed after radical orchiectomy and was negative. The patient was staged as clinical stage I American Joint Committee on -T1N0M0. After a detailed discussion of different management plans, including surveillance, primary chemotherapy, retroperitoneal lymph node dissection (RPLND), a robot-assisted laparoscopic RPLND was chosen by the patient. Complete informed consent was obtained.

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The authors report no conflicts of interest.

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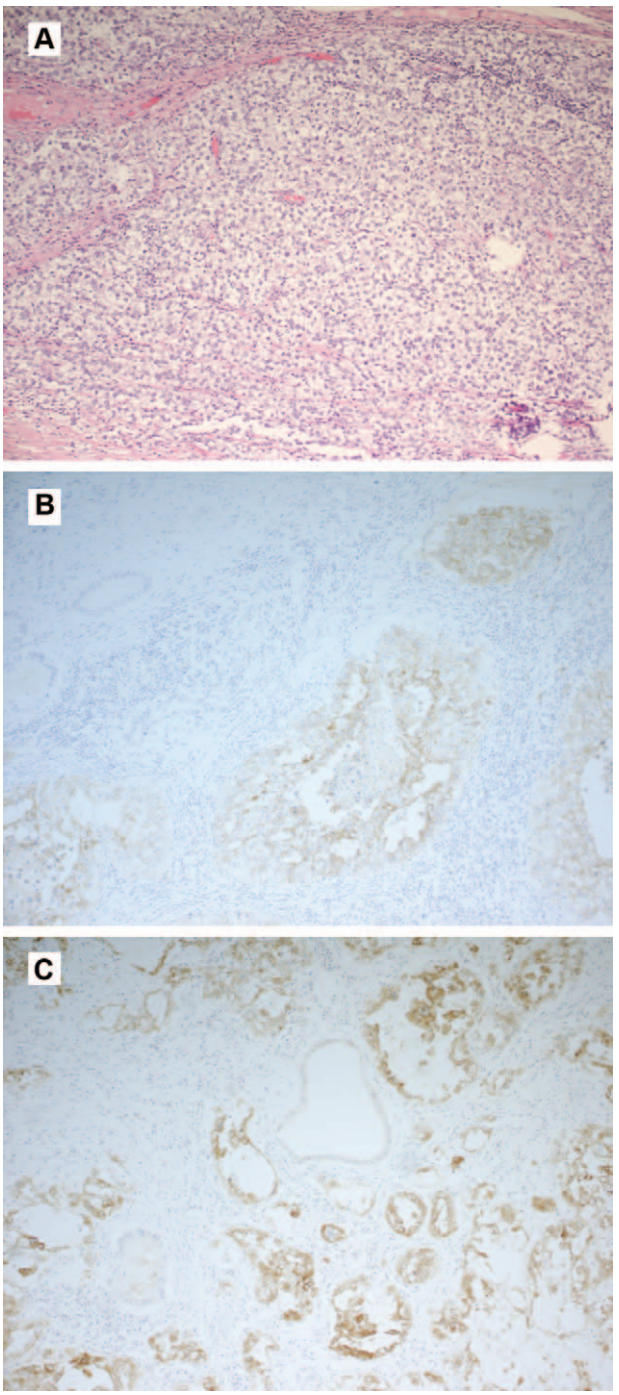

Figure 1. Pathologic examination demonstrated a mixed germ cell tumor, predominately embryonal carcinoma with yolk sac tumor. A, Tumor cells showing a spindled morphology, with pleomorphic nuclei and numerous atypical mitoses (hematoxylin and eosin stain; magnification, ×100). B, Immunohistochemical staining for CD30 was positive (magnification, ×100). C, Immunohistochemical staining for GPC-3 was positive (magnification, ×100).

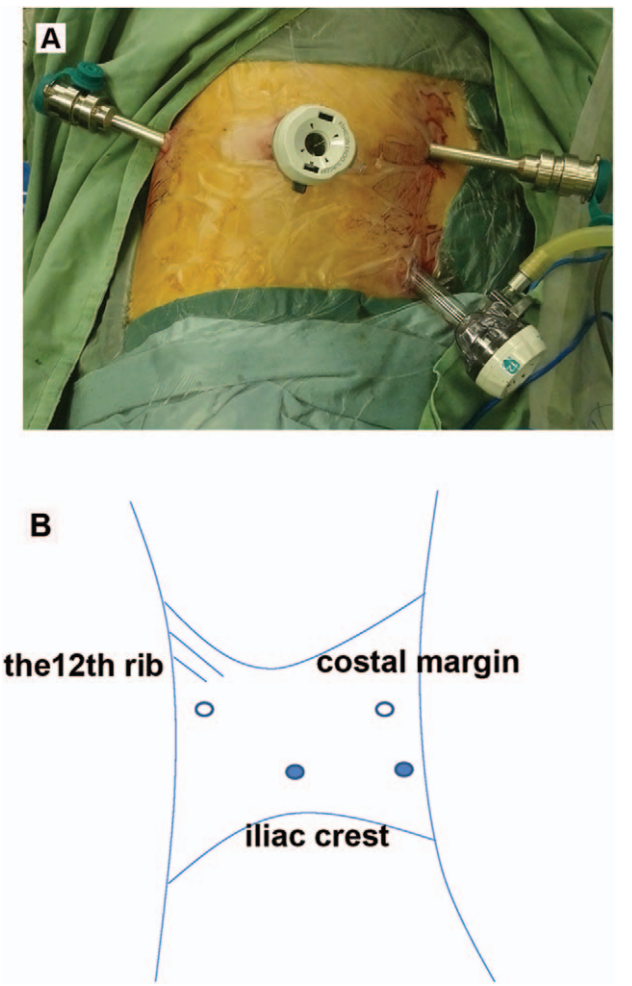

Figure 2. Port placement for R-RPLND using an extraperitoneal approach. A, Patient positioning for right dissection. B, Trocar locations. Two 12-mm ports were placed and used as a camera port and an assistant port. Two 8-mm ports were placed for the remaining robotic arms. Open circles represent 8-mm ports, and closed circles 12-mm ports. R-RPLND = robot-assisted laparoscopic retroperitoneal lymph node dissection.

Extraperitoneal R-PRLND was performed 3 weeks after the radical orchiectomy. After induction with general anesthesia and urethral Foley catheter placement, the patient was placed in the flank position with the ipsilateral side up and secured to the operating table. A 4-port balloon-dissecting extraperitoneal laparoscopic approach was used. A 2-cm transverse skin incision was first made above the iliac crest in the midaxillary line. After blunt dissection with the index finger, a homemade balloon dissector was inserted into the retroperitoneal space and dilated using air to expand the operative space. Under guidance with the index finger, other 3 trocars were placed as follows: an 8-mm robotic trocar below the 12th rib in the posterior axillary line, a 8-mm robotic trocar below the 12th rib in the anterior axillary line, and a 12-mm trocar at the level of iliac crest in the anterior axillary line. A 12-mm trocar was inserted into the 2-cm incision as a robotic camera port (Fig. 2). After pneumoperitoneum was achieved with carbon dioxide, a da Vinci (Intuitive Surgical, CA) robot was then docked.

On entering the extraperitoneal space, the retroperitoneal fat was freed with a harmonic scalpel. The extraperitoneal space was created by pushing the peritoneum medially until the inferior vena cava, aorta, and surrounding adipose and lymphoid tissue were exposed. In our procedure, great attention was needed to make a large retroperitoneal space without injuring the peritoneum. The boundaries of the dissection were the same as those described by Weissbach and Boedefeld[4] for the open procedure.

Dissection started from the surface of the psoas muscle to free the lateral and anterior aspects of the vena cava. The right ureter,

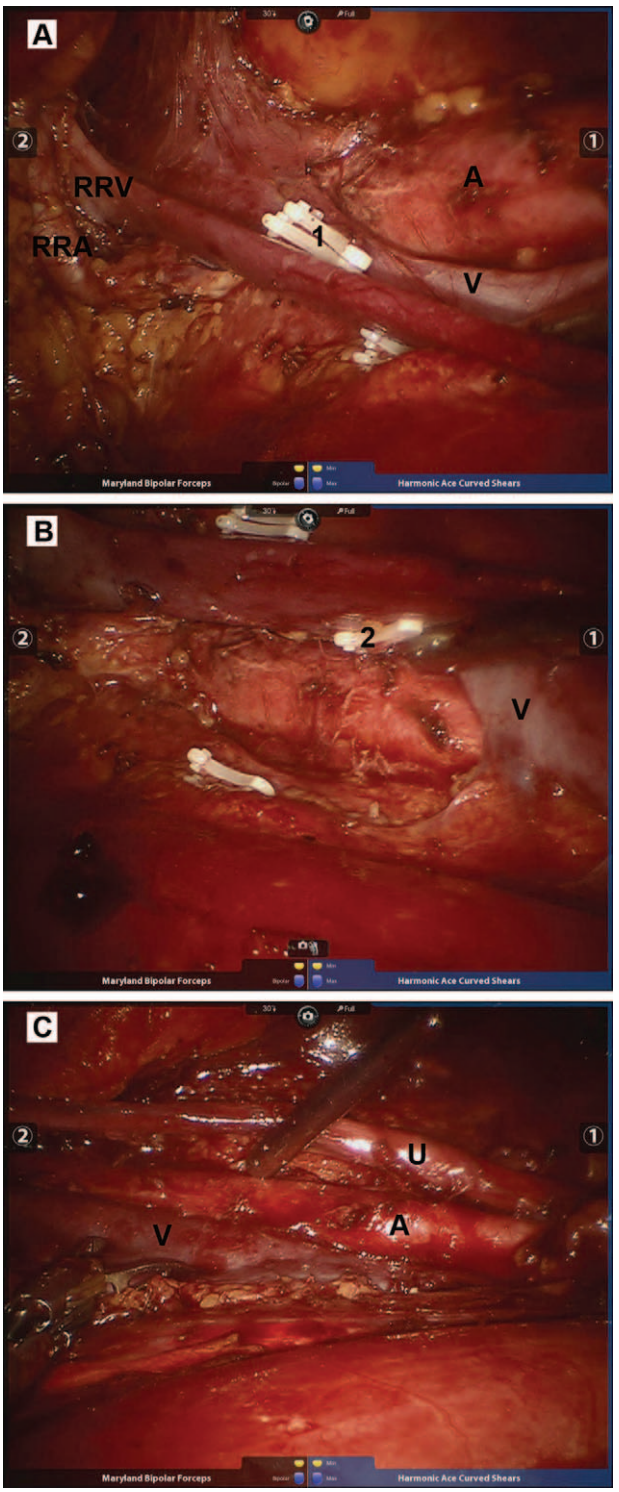

Figure 3. Surgical video screenshots of the extraperitoneal R-RPLND. A and B, The boundaries of lymph node dissection. RRV = right renal vein, RRA = right renal artery, A = abdominal aorta, V = vena cava inferior, U = ureter. 1. Lumbar vein (clipped and transected) and 2. Gonadal vein (clipped and transected). C, Final aspect of right extraperitoneal R-RPLND. R-RPLND = robot-assisted laparoscopic retroperitoneal lymph node dissection.

which was the right lateral limit of dissection, was identified. Paracaval dissection was done from the right renal hilum to the right common iliac artery bifurcation. The retrocaval tissue behind the IVC was then removed to access the interaortocaval tissue between aorta and IVC. Preaortic lymphatic tissue was dissected from the left renal vein to the inferior mesenteric artery. With the help of three-dimensional (3D) view and magnification, the main postganglionic nerves and sympathetic ganglia were also identified and preserved. Finally, we could see the skeletonised IVC, exposed aorta, right ureter, and renal vessels (Fig. 3). The gonadal vessels were identified and dissected from the vena cava till the internal inguinal ring. The silk suture, which was used to ligate the vessels and cord during orchidectomy, facilitates easy identification and removal of this structure. At the end of the procedure, all tissue specimens were retrieved with an endoscopic bag and extracted from the extraperitoneal cavity through the 12 mm assistant port.

The R-RPLND was completed successfully in a totally extraperitoneal manner. Intraoperatively, there were no gross lymphadenopathy and no complications. The total operating time was 195 minutes. Estimated blood loss was 50 mL and no blood transfusion or open conversion was necessary. Postoperatively, the patients recovered uneventfully. He resumed physical activity and oral intake on postoperative day 1. The patient was discharged on postoperative day 3. The final pathologic examination showed a count of 19 lymph nodes, all of them negative. Normal antegrade ejaculation returned within 4 weeks postoperatively. At the time of writing this report, the patient has completed 3 months of follow-up. No retroperitoneal recurrence or elevation of tumor marker levels were seen via surveillance imaging.

3. Discussion

Testicular cancer represents the most common solid malignancy among young men in the United States with an estimated 8430 newly diagnosed cases in 2015.[5] The majority of testicular tumors originate from the germ cell. Approximately 60% of all testicular germ cell tumors are NSGCT. The management of clinical stage I NSGCT remains controversial. Currently, acceptable treatment options include surveillance, adjuvant chemotherapy, and RPLND.[6,7] Each of these treatments has its merits and disadvantages. All of which have reported disease-specific survival rates near 100%. Therefore, RPLND is an ideal option for patients who wish to avoid the extensive follow-up of surveillance or chemotherapy.

Open RPLND is the surgical gold standard, but has a number of limitations. One of the limiting factors associated with open RPLND is the morbidity of the surgery and the cosmesis and pain of the open abdominal incision. The most common incision used in an open RPLND is a midline incision from the xiphoid process to the suprapubic area.

With the development of laparoscopic surgery in recent years, laparoscopic surgery in urology has been widely applied. The first primary laparoscopic RPLND was described by Rukstalis and Chodak[8] in 1992. Compared with the gold standard open RPLND, laparoscopic RPLND has shown great promise in reducing the morbidity of the procedure and similar accuracy and tumor control. Despite its advantages, the main problem of laparoscopic RPLND is its long and steep learning curve, requiring advanced laparoscopic skills that are not easily transferable from open surgery.

The da Vinci Surgical System (Intuitive Surgical, Sunnyvale, CA) helps bridge the 3D benefits of open surgery with the minimally invasive benefits of laparoscopy. In addition, robotics adds the advantages of 3D visualization, reduction of tremor, and increased freedom of movement compared with standard

laparoscopic surgery. In recent years, this technology has largely replaced conventional laparoscopy for many urological procedures, including radical prostatectomy, partial nephrectomy, pyeloplasty, adrenalectomy, and nephrectomy. These characteristics make it attractive for the application to advanced laparoscopic techniques such as laparoscopic RPLND.

The first R-RPLND was described by Davol et al[1] in 2006. The procedure was performed in an 18-year-old man with a mixed germ cell tumor. The operative time was 235 minutes, estimated blood loss was 125 mL, and there were no perioperative complications.

The largest available series to date was published by Pearce et al[9] and included 47 patients. The median operative time was 235 minutes, estimated blood loss was 50 mL, median LN yield was 26, and the median length of stay was 1 day. There were 2 intraoperative complications (4%), 4 early postoperative complications (9%). Of the 8 patients (17%) with positive nodes (7 pN1and 1 pN2), 5 (62%) received adjuvant chemotherapy. The median follow-up was 16 months and the 2-years recurrence-free survival rate was 97%. At the last follow-up, 100% of the patients had antegrade ejaculation. Although limited by its retrospective nature, this report demonstrated R-RPLND as a potential option at experienced centers in select patients with low-stage NSGCT.

The first comparative analysis laparoscopic and robotic RPLND examined the perioperative outcomes of 16 and 21 patients who underwent R-RPLND and laparoscopic RPLND respectively.[3] Intra and perioperative outcomes including operative time, estimated blood loss, lymph node yield, complicate rate, and ejaculatory status were similar between groups (all $P > .1$). The results show that R-RPLND is at best equivalent to the laparoscopic approach in terms of safety and perioperative outcomes.

The extraperitoneal approach is relatively unique in urological laparoscopic surgery. Two approaches to laparoscopic RPLND have been previously described. Most laparoscopic RPLNDs are performed via a transperitoneal approach. However, it typically involves significant bowel mobilization and manipulation. Several extraperitoneal laparoscopic RPLND cases have been reported. Many scholars believed that the extraperitoneal approach can avoid the impact on the abdominal organs, resulting in superior bowel function recovery than the transperitoneal route.[10–14]

Typically, R-RPLND has been performed via a transperitoneal approach.[1,9,15–17] We describe a novel R-RPLND technique using an extraperitoneal approach. Our perioperative outcomes are similar to those of larger series previously reported using the transperitoneal approaches. Compared with the transperitoneal approach, some scholars have suggested significant advantages such as fewer complications of injury to surrounding visceral organs, bowel paralysis, and adhesion. To our knowledge, we describe the first published case of R-RPLND technique using an extraperitoneal approach.

4. Conclusions

Extraperitoneal R-RPLND by experienced robotic surgeons for early-stage NSGCT appears to be safe with acceptable perioperative outcomes. Larger cohorts of patients with longer term follow-up are needed for further studies to determine the role of different approaches to R-RPLND.

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