



Monique Gueudet-Bornstein. *Brass Band*. New Orleans 1998.

Compared with open procedures, the LRPLND technique has provided improvements in operative time, complications, and morbidity for patients with testis cancer.

Laparoscopic Retroperitoneal Lymph Node Dissection in the Management of Testis Cancer

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Background: *The surgical approach to management of testis cancer has been traditionally through an open incision, but in the last decade, several centers have reported their experience with laparoscopic retroperitoneal lymph node dissection (LRPLND).*

Methods: *We reviewed the English literature, summarized the outcomes, and included our initial experience with the LRPLND procedure.*

Results: *Improvements in operative time, complications, and morbidity have occurred as surgical experience has increased. The procedure is more challenging in postchemotherapy patients. Outcomes at our institute are comparable to reported series from other institutions, and LRPLND is our current procedure of choice for RPLND.*

Conclusions: *LRPLND has been shown to be a safe, effective, minimally invasive procedure in the management of testicular cancer patients who require surgery to address the retroperitoneal lymph nodes.*

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Abbreviations used in this paper: RPLND = retroperitoneal lymph node dissection, NSGCT = nonseminomatous germ cell tumor, LRPLND = laparoscopic retroperitoneal lymph node dissection.

Introduction

Testis cancer accounts for 1% to 2% of all cancers in North America, but it is the most common solid malignancy in men 20 to 30 years of age. In 2007 in the United States, an estimated 7,920 new cases of testis cancer will be diagnosed and 380 people will die of this malignancy.¹

The surgical management of testis cancer has two goals: eradication of the primary tumor in all cases and removal of the retroperitoneal lymph nodes in selected cases. An inguinal radical orchiectomy is performed to achieve the former and a retroperitoneal lymph node dissection (RPLND) is used to achieve the latter. An RPLND is indicated for patients with testicular stage I

nonseminomatous germ cell tumors (NSGCTs) with a high probability of metastasis to the retroperitoneal lymph nodes. An RPLND is also indicated for patients with residual retroperitoneal lymphadenopathy after chemotherapy. The surgical approach was traditionally through an open incision; however, in the last decade, several centers have reported their experience with laparoscopic retroperitoneal lymph node dissection (LRPLND).²

This article reviews the English literature, summarizes the outcomes, and presents our initial experience with the procedure.

History

Rukstalis and Chodak³ first reported on a patient with stage I testis cancer who underwent an LRPLND. This initial experience was followed by case reports in both the United States and Latin America.^{4,5} In 1994, two reports were published, each involving a larger series of patients. In the first report, Gerber et al⁶ included 20 patients. The procedure was completed in 18 patients, the median operative time was 6 hours, the median estimated blood loss was 250 cc, and a median of 14.5 lymph nodes were removed. Among the 18 patients, 3 (17%) had positive lymph nodes. Most patients were hospitalized for 3 days or less and returned to normal activities within 2 to 3 weeks. Antegrade ejaculation was preserved in all. Significant complications occurred in 6 (30%) of 20 patients, with bleeding being the most common adverse event. An abdominal incision and completion of the procedure by open RPLND were required in 2 patients due to significant bleeding following injury to the gonadal vessels. With a median follow-up of 10 months (range 2 to 25 months), 2 patients developed pulmonary metastasis and none had abdominal recurrence. In the second report, Janetschek et al⁷ included 15 patients, 9 with right-sided tumors and 6 with left-sided tumors. Conversion to open surgery occurred due to uncontrollable bleeding in 1 patient and a large metastasis in 1 patient. Microscopic metastasis was detected in 2 additional patients. No blood transfusions were required.

Indications for LRPLND

Following radical inguinal orchiectomy, the histologic type and clinical stage determine the need for further therapy. Most patients with NSGCT present with clinical stage I disease, but between 30% and 50% have clinically occult metastases in the retroperitoneum after lymph node dissection.^{8,9}

RPLND is the only reliable method to identify micrometastases as it provides pathologic staging of the

retroperitoneum and gives prognostic information.¹⁰ For patients with stage II disease, the initial management is chemotherapy, with LRPLND reserved for cases with postchemotherapy residual lymphadenopathy.¹¹⁻¹³

Clinical Stage I NSGCT

Stage I NSGCT can be managed in low-risk patients by surveillance and in high-risk patients by surgery or chemotherapy. LRPLND provides more accurate information on staging and on the probability of further treatment.

Risk factors that predict metastatic progression of NSGCT include presence of lymphovascular invasion in the primary tumor (stage pT2), predominance of embryonal carcinoma in the primary tumor (>40% to 50%), and invasion of the spermatic cord (stage pT3).^{14,15} These patients have an increased risk of harboring occult retroperitoneal metastases. For patients with pathologically confirmed stage I disease after RPLND, the incidence of retroperitoneal relapse is less than 1%.¹⁴ With modified unilateral surgical templates,¹⁶ postoperative ejaculatory emission has been maintained in 90% to 99% of patients.¹⁷⁻¹⁹

Clinical Stage II Low-Volume NSGCT

Patients with clinical stage IIA or IIB NSGCT can be managed by either primary chemotherapy followed by RPLND if residual retroperitoneal masses are present or by RPLND with or without adjuvant chemotherapy. One report noted that 70% of patients can be cured by RPLND alone without additional chemotherapy.²⁰ In most LRPLND series, stage II patients receive adjuvant chemotherapy consisting of two cycles of bleomycin, etoposide, and cisplatin.^{21,22} The risk of systemic relapse in patients with stage II disease after LRPLND depends on the volume and extent of nodal disease. Patients with pN2 or pN3 disease have a systemic relapse rate of about 50%.^{23,24} The risk of systemic relapse in patients with low-volume nodal disease (pN1) is about 20%.²⁵

Postchemotherapy RPLND

Candidates for LRPLND are patients treated with chemotherapy and consequent normalization of serum markers but with residual disease in the retroperitoneum by imaging. The pathologic findings of the resected masses reported by Indiana University in these cases demonstrate residual cancer in 20%, growing benign teratoma in 40%, and necrosis or scar tissue in 40%.^{26,27} The procedure is technically challenging due to fibrosis and desmoplastic reaction caused by the chemotherapy. A higher rate of complications is reported for this proce-

dures than for primary RPLND, with 42.8% of major complications in a report by Palese et al.¹¹ Recent series report fewer major complications as a result of increasing surgical experience. In a series by Permpongkosol et al,²⁸ seven complications were reported as minor during the postoperative period of 16 patients, including two open conversions. All vascular complications occurred during the first half of cases in that series.

LRPLND Compared With Open Technique

Recent series have demonstrated that compared with an open technique, LRPLND offers reduced postoperative morbidity and provides equal diagnostic accuracy.²⁹ Studies that have compared laparoscopic and open RPLND demonstrate advantages with the laparoscopic approach in terms of less blood loss, shorter convalescence, and improved cosmetic results. In a series comparing open and laparoscopic RPLND, Janetschek et al³⁰ reported that the laparoscopic approach was superior in all the measured parameters except operative time.

Few studies have compared the costs associated with LRPLND and open surgery. The surgical expense is higher with laparoscopy, but the costs associated with hospital stay are higher for open surgery. When recovery time is taken into consideration, laparoscopy offers a clear cost advantage over open surgery.^{8,31}

RPLND Templates

Historically, bilateral infrahilum RPLND templates were associated with significant retrograde ejaculation due to damage to the sympathetic trunks, hypogastric plexus, and postganglionic efferent nerves. With increased

understanding of metastatic spread, the bilateral RPLND has evolved to a unilateral template type dissection with nerve-sparing to preserve antegrade ejaculation in 90% to 98% of cases and with similar oncologic efficacy.^{16,18,32}

In a recent study by Eggener et al³³ that addressed the incidence of disease outside the modified RPLND templates in clinical stage I or IIA NSGCT, a significant amount of disease outside the templates was found using 5 different templates: 3 for open surgery and 2 for laparoscopic surgery. The incidence of disease outside the 2 modified laparoscopic templates was 19% to 23%. They found that for right-sided templates, inclusion of para-aortic, preaortic, and right common iliac regions decreased the incidence of extra-template disease to 2%. For left-sided templates, inclusion of interaortocaval, precaval, paracaval and left common iliac regions decreased the incidence of extra-template disease to 3%. The accompanying editorial comment in this article discussed the major template areas of disagreement for the initial modified RPLND, which are the para-aortic region for right-sided tumors and the precaval and paracaval areas for left-sided tumors. Although these areas are difficult to dissect laparoscopically, the frequency of metastasis to these zones is less than 5%. As noted in the discussion section, the LRPLND is a legitimate alternative to open RPLND in experienced hands.³³

When positive nodes are found on frozen sections at the time of surgery, a complete bilateral RPLND to the inferior mesenteric artery should be performed.

Surgical Technique

All procedures are performed with the patient in the flank position. At our institute, the transperitoneal approach is preferred because it allows a larger work-

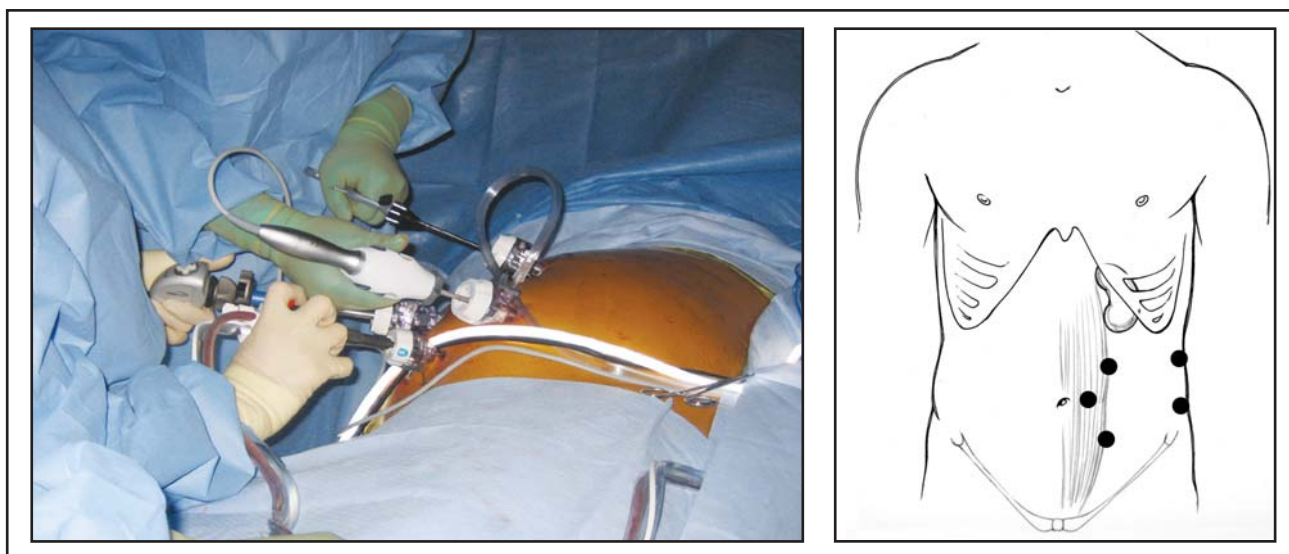


Fig 1. — Photograph and illustration of trocar distribution for a left-sided LRPLND. Illustration modified from Hsu TH, Su LM, Ong A. Anterior extraperitoneal approach to laparoscopic retroperitoneal lymph node dissection: a novel technique. *J Urol.* 2003;169:258-260. Reprinted with permission by Elsevier.

ing space and more flexibility in extending the procedure to the contralateral side when required in cases of positive lymph nodes on frozen sections.

Three 12-mm trocars are placed off the midline into the peritoneum to either the right or the left, depending on the required template. The first trocar (camera) is lateral to the umbilicus, and the two others (operating) are lateral to the rectus muscle and approximately 10-cm caudad and cephalad to the first one. Two additional 12-mm trocars are placed in the anterior axillary line for retracting and assisting (Fig 1). The retroperitoneum is fully exposed after wide mobilization of the right or left colon, and a right, left, or full template dissection is performed depending on the clinical circumstances (Fig 2). For right-sided dissection, the boundaries include the ipsilateral ureter laterally, the take-off of the renal vessels superiorly, and the bifurcation of the right iliac artery inferiorly. Medially, the dissection is carried to the midpoint of the anterior aorta, above the take-off of the inferior mesenteric artery. For left-sided dissection, the boundaries include the ipsilateral ureter laterally, the renal vessels superiorly, and the bifurcation of the left common iliac inferiorly. Lymph node dissection should not extend below the take-off of the inferior mesentery artery but should extend medially to remove the interaortocaval lymph nodes above this anatomic landmark.

In both sides, the gonadal vein is taken from its origin and dissected down to the internal ring where it can be taken out with the remainder of the stump of the specimen cord left at the time of radical orchiectomy.

A posterior dissection below the great vessels is not performed, based on a study by Holtl et al³⁴ indicating that this is not required. Lumbar vessels are preserved as much as possible to optimize nerve preservation. Frozen sections are performed in all cases, and the extent of the dissection is tailored to the results. If positive, a bilateral dissection is performed. A nasogastric tube is placed at the beginning of the procedure and removed at the end of surgery. A Foley catheter is left indwelling overnight. Patients are started on clear liquids the evening of the surgery and advanced to a full diet by the first postoperative day.

Results From Reported Series

Janetschek et al³⁵ reported the largest series, including 103 patients with clinical stage I disease and 59 with clinical stage II disease. The stage I group had 3 conversions due to vascular injuries. After the first 30 patients, operative time was reduced to a median of 217 minutes. Positive lymph nodes were present in 26 patients. Retrograde ejaculation was not reported. For

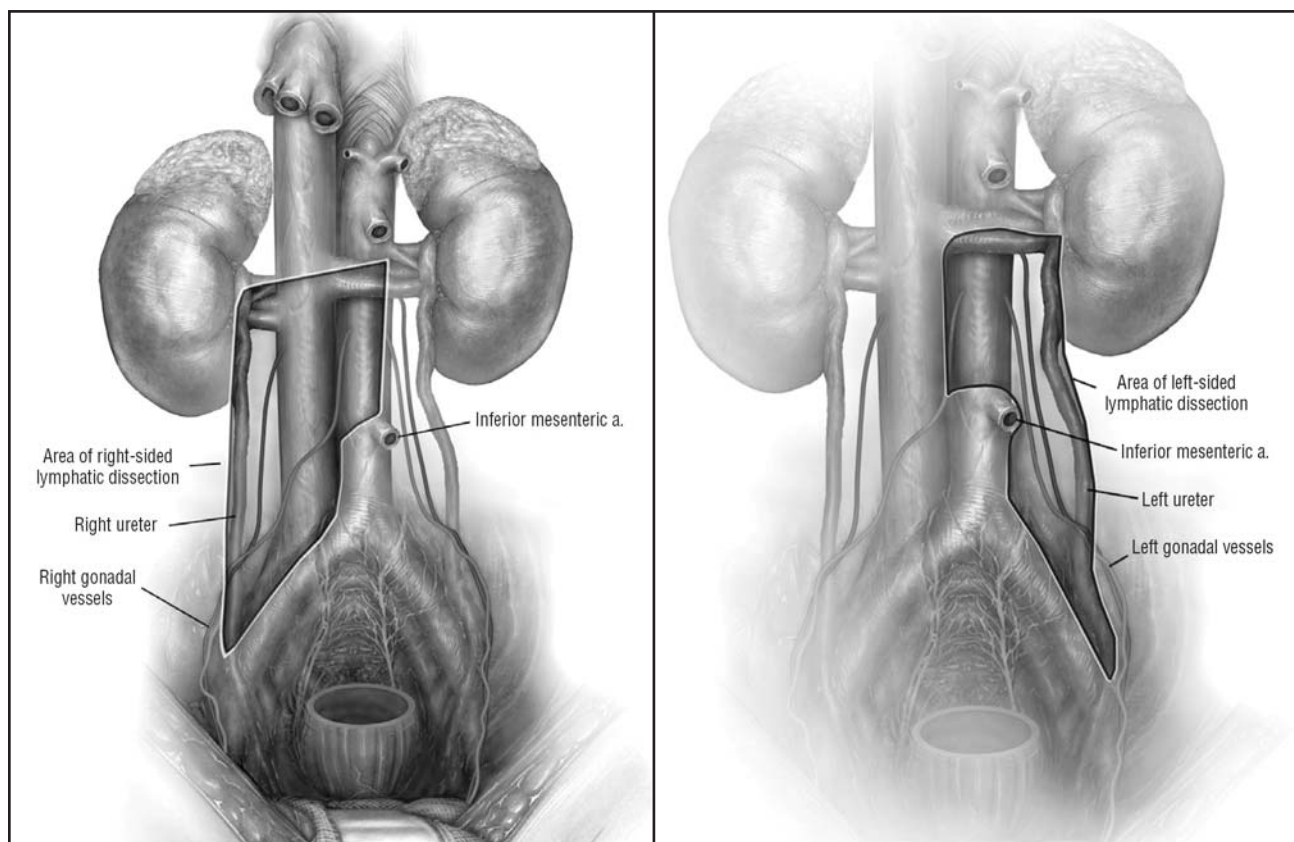


Fig 2. — Right- and left-sided templates. From Wood CG. Retroperitoneal lymph node dissection in the management of testicular cancer. *Op Tech Gen Surg.* 2006;8:112-116. Reprinted with permission by Elsevier (Mosby/Saunders).

clinical stage II patients, conversion was not reported. The mean operative time was 234 minutes, and the mean blood loss was 165 mL (range 20 to 350 mL). In both groups, the mean postoperative hospitalization was 3.8 days (range 2 to 8 days). Outcomes from reported series are comparable in terms of intraoperative and postoperative findings. Series with long-term follow-up are summarized in Tables 1 and 2.

Moffitt Cancer Center Series

Our institutional experience with laparoscopic surgery began in July 2000 with laparoscopic hand-assisted nephrectomy, which then progressed to laparoscopic radical prostatectomy in January of 2004 and laparoscopic radical cystectomy in February 2004.

We reviewed our LRPLND cases from our IRB-approved database for testis cancer. Twenty patients underwent a LRPLND by a single surgeon (J.M.P.S.) from September 2004 to February 2007. The patients were given informed consent regarding the option of undergoing the open or laparoscopic procedure; alternatives, risks, and complications were discussed and documented in the medical records. All patients were at increased risk for disease in the retroperitoneum or had a residual postchemotherapy mass. Factors that defined increased risk for retroperitoneal compromise were presence of lymphovascular invasion in the primary tumor (stage pT2), predominance of embryonal carcinoma in the primary tumor (>40%), and invasion of the spermatic cord (stage pT3). All patients had negative tumor markers previous to LRPLND. Twelve patients underwent LRPLND for primary disease. One patient required conversion to

Table 1. — Reported Series for LRPLND for Stage I NSGCT

Series	Approach	No. of Patients	Mean Operative Time (min)	Mean Estimated Blood Loss (mL)	No. of Conversions	Intraoperative Complications		Postoperative Complications		Hospital Stay (days)	No. of Lymph Nodes	Mean Follow-Up (yrs)
						Major	Minor	Major	Minor			
Bhayani et al ⁵⁶	Transperitoneal	29	258	241	3	NR	NR	NR	2	2.6	20 ± 2 (7–53)	6 (4–11)
Rassweiler et al ^{37,38}	Transperitoneal (first 17)	34	248	N/A	1	NR	4	1	NR	5.3 (3–9)	N/A	3.3
	Retroperitoneoscopic (last 17)											
LeBlanc et al ²¹	Extraperitoneal	20	230	≤50	0	NR	1	NR	NR	1.2	9.8 ± 4.4 (3–19) Right 17.7 ± 7.4 (5–29) Left	1.25 (0.25–2.91)
Janetschek ³⁵	Transperitoneal	103	217	144	3	NR	7	NR	5	3.6	N/A	N/A
Present Series H. Lee Moffitt Cancer Center & Research Institute	Transperitoneal	11	323.18 (255–480)	202.27 (50–400)	1	0	0	0	2 RE 1 pleural effusion	2.9 (2–5)	14.9 (8–23)	0.53 (0.08–1.25)

RE = retrograde ejaculation, NR = not reported.

Table 2. — Reported Series for Postchemotherapy LRPLND

Series	Approach	No. of Patients	Mean Operative Time (min)	Mean Estimated Blood Loss (mL)	No. of Conversions	Intraoperative Complications		Postoperative Complications		Hospital Stay (days)	Patient Outcome	
						Major	Minor	Major	Minor		(+) Nodes	(-) Nodes
Steiner et al ²⁹	Transperitoneal	72	243	78	0	NR	2	NR	25	3.7	27	45
Rassweiler et al ^{37,38}	Transperitoneal	8	348	—	0	NR	NR	NR	1	3.5	No viable tumor	
LeBlanc et al ²¹	Extraperitoneal	5	230	<50	0	NR	NR	NR	NR	1.2	4	1
Janetschek ³⁵	Transperitoneal	59	216	165	3	NR	9	NR	11	3.8	21	38
Present Series H. Lee Moffitt Cancer Center & Research Institute	Transperitoneal	9	358 (240–540)	400 (150–1500)	0	1 vena cava lesion	0	0	0	2.8 (1–5)	2.5	23.5

NR = not reported.

open surgery due to failure to progress during surgery and was excluded from the analysis. Nine patients underwent LRPLND after chemotherapy for residual retroperitoneal lymphadenopathy and negative tumor markers.

Overall mean operative time was 339.25 minutes (range 240 to 540 minutes), mean blood loss was 291.25 cc (range 50 to 1500 cc), mean hospital stay was 2.9 days (range 1 to 5 days), and mean lymph node count was 16.2 (range 3 to 36). Operative time was longer in postchemotherapy LRPLND, with a mean of 358.8 minutes (range 240 to 540 minutes) vs a mean of 323.18 minutes (range 255 to 480 minutes) for primary LRPLND. The mean blood loss in postchemotherapy LRPLND was 400 cc (range 50 to 1500 cc) vs a mean of 202.27 (range 50 to 400 cc) for primary LRPLND. The mean hospital stay was 2.9 days (range 2 to 5 days) for the primary LRPLND and 2.8 days (range 1 to 5 days) for postchemotherapy LRPLND.

One intraoperative complication occurred: minimal vena cava laceration that was laparoscopically repaired uneventfully. One postoperative complication occurred in a patient with primary LRPLND consisting of a pleural effusion that was managed medically.

Among 11 patients who underwent a primary LRPLND, 5 had positive lymph nodes and received adjuvant chemotherapy, and 6 had a negative dissection. Among 9 patients who underwent a postchemotherapy LRPLND, 5 patients had residual teratoma and 4 had no viable tumor.

Long-term oncologic follow-up is not yet available in this series since most cases were performed within the last 12 months. Retrograde ejaculation occurred in 2 patients (10%) in the primary LRPLND group. Ejaculatory function could not be assessed in the postchemotherapy LRPLND group due to short follow-up time.

Conclusions

LRPLND is a safe, effective, minimally invasive procedure in the management of testicular cancer patients who require surgery to address the retroperitoneal lymph nodes. The procedure is more challenging in postchemotherapy patients. Operative time, complications, and morbidity have been reduced as surgical experience has increased. Outcomes at our institute are comparable to reported series from other institutions. LRPLND is our procedure of choice for RPLND.

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