RETROPERITONEAL LAPAROSCOPIC LYMPH NODE DISSECTION FOR STAGING NON-SEMINOMATOUS GERM CELL TUMORS BEFORE AND AFTER CHEMOTHERAPY

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ABSTRACT

We describe our experience with laparoscopic retroperitoneal lymph node dissection in 19 patients with non-seminomatous germ cell tumors. Twelve patients had stage I disease with no clinical evidence (CT-scan, ultrasound, tumor markers) of metastases; 7 patients (stage IIb=2, stage IIc=5) had residual tumor after chemotherapy but with negative tumor markers. A laparoscopic dissection was used to assess more fully the pathologic status of the relevant retroperitoneal lymph nodes of both groups. The patient was positioned and trocars introduced at sites similar to that used for transperitoneal laparoscopic nephrectomy (flank position, five ports - 3x10mm; 2x5mm). After reflecting the colon anteromedially, the landmarks of the lymph node dissection were isolated—namely the ureter, aorta, inferior vena cava, and both renal veins. The lymph node dissection included the paracaval, interaorto-caval, upper preaortic, and right common iliac zonal nodes for right-sided tumors, and paraaortic, upper preaortic zones for left-sided tumors. Retrieval of the lymph nodal chains was accomplished using a small organ bag.

The mean duration of the procedure was 298 (range 150-405) minutes. In only one patient was a lymph node positive for tumor (stage I). Otherwise nodes showed extensive necrosis (after chemotherapy). No intraoperative complications were encountered but three patients developed a delayed complication (ureteral stenosis, pulmonary embolism, and retrograde ejaculation, respectively). Whereas we completed the dissection in each patient with stage I tumors, the laparoscopic procedure was more difficult in patients with stage II tumors after chemotherapy. In two patients with stage IIb disease laparoscopic lymphadenectomy was successful. In four other patients parts of the dissection had to be done after conversion to an open (conventional) operation using a small incision (suprainguinal or pararectal); in one patient the laparoscopic approach was abandoned and converted to an open operation. In the postchemotherapy group the outcome depended primarily on the tumor bulk prior to drug treatment. In two patients in whom all residual necrotic tissue was removed laparoscopically they had "minor" disease (stage IIb); the others had stage IIc tumors.

Our preliminary experience suggests that a modified laparoscopic lymph node dissection is feasible for stage I tumors and in selected patients with marker negative residual tumor after chemotherapy (stage IIb).

Disagreement exists over the optimal management for clinical stage I non-seminomatous germ cell tumors. Whereas some advocate continued surveillance based on the efficacy of chemotherapy in terms of

Fig. 1. Positioning of the patient and site of the trocars for modified laparoscopic retroperitoneal lymphadenectomy (left-sided testicular tumor).
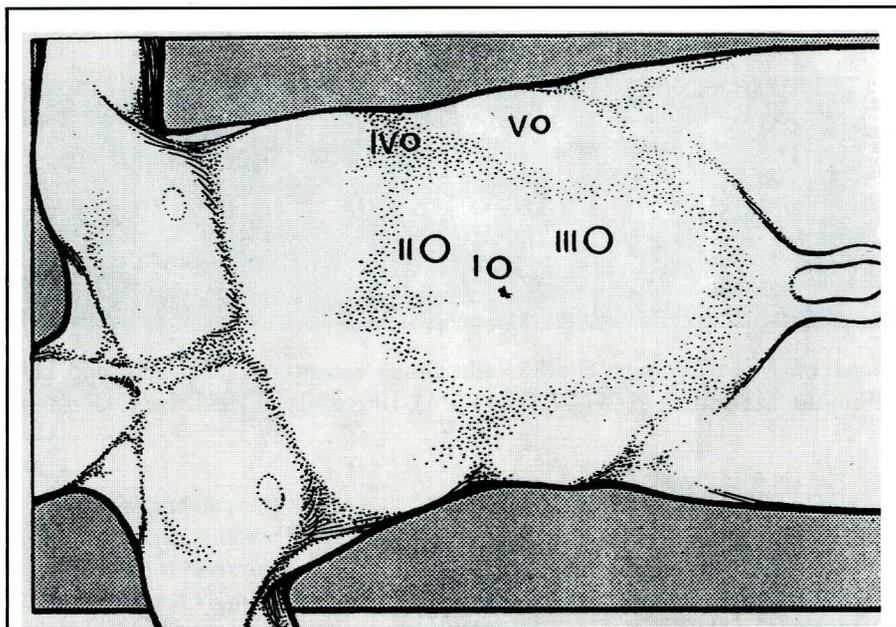
tumor progression (1-6), others prefer a modified or nerve sparing lymphadenectomy (7-14) emphasizing early detection and subsequent chemotherapeutic treatment of retroperitoneal (micro)metastases, which may coexist in approximately 30% of these patients (2,4,6,15). The ongoing surveillance strategy also requires complete patient compliance (1,4,5). On balance, *laparoscopic* retroperitoneal lymph node dissection seems to offer a minimally invasive alternative for precise lymph node staging of metastatic disease (16,17).

Another potential usefulness of laparoscopic retroperitoneal lymphadenectomy is evaluation of the response after chemotherapy in stage IIb or IIc disease (18). Nowadays in an era of second line chemotherapy, retroperitoneal lymph node dissection allows detection of foci of residual tumor with complete removal of the retroperitoneal lymphatic tissue ("salvage lymphadenectomy"). A major question, however, for this latter indication is whether it is possible to perform this dissection laparoscopically. With the feasibility of transperitoneal laparoscopic nephrectomy (19) and pelvic lymphadenectomy (20), we decided to extend the applicability of laparoscopy to the dissection of retroperitoneal lymph nodes in patients with non-seminomatous germ cell cancer of the testis. We initially evaluated the technical feasibility of using this minimally invasive approach to further clinically stage I tumors and later stage IIb and IIc disease after chemotherapy with residual retroperitoneal lymphadenopathy.

Technique of Laparoscopic Retroperitoneal Lymphadenectomy

Preparation

Each patient underwent similar preoperative preparation to open surgery which included a mild bowel cathartic. Retrograde stenting of the ipsilateral ureter was abandoned after the first two patients. An indwelling bladder catheter was routinely placed. Under general anesthesia a nasogastric tube was inserted and the patient placed in an oblique flank position of the relevant side (left or right testicular tumor) with a 30° head down position (*Fig. 1*).
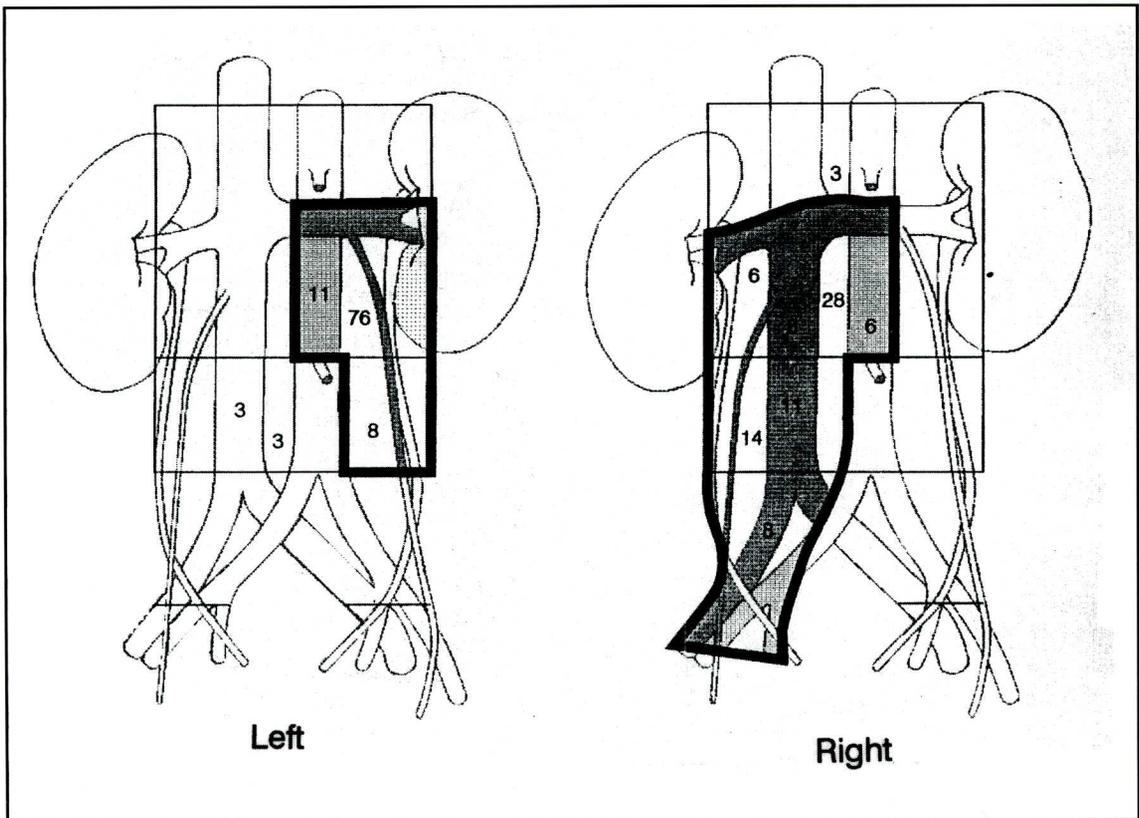
Fig. 2. Part I-IV. Modified field of dissection with the distribution of positive lymph nodes for left and right testicular tumor (according to Weissbach and Boedefeld (13)).

Trocar placement

A pneumoperitoneum was attained after insertion of a Veress needle, placed lateral to the rectus abdominis muscle on line with the umbilicus with the patient in the flank position. Trocars were then inserted through the anterior abdominal wall as depicted in *Fig. 1.* The laparoscope was passed through Port I and was used to intraabdominally inspect the trocar insertions for Ports II and III. The ports were fixed with sterile adhesive tape and sutured to the skin. After inspection of the intraabdominal contents either the ascending (right lymphadenectomy) or descending (left lymphadenectomy) colon was mobilized through a laterocolic incision of the peritoneum (along the white line of Toldt). After the respective colon was mobilized medially one or two further ports were inserted through the newly exposed retroperitoneum (*Fig. 1*). These extra ports were primarily used to retract the liver or colon during dissection, for exposure of the inferior vena cava and aorta, and for suction and irrigation.

Extent of Lymph Node Dissection

Similar to open (conventional) dissection we followed the procedure as described by Weissbach and Boedefeld (13) as the basis for retroperitoneal lymphadenectomy (*Fig. 2*). The extent of lymph node dissection depended on the side of the testicular tumor. For non-seminomas on the *right*, retroperitoneal dissection included the para-, pre-, retro- and interaortocaval zone from the right renal

artery to the bifurcation of the inferior vena cava and the area of the right common iliac vessels as well as the preaortic zone from the renal vessels to the inferior mesenteric artery. For *left-sided* non-seminomatous testicular tumor the paraaortic zone from the renal vessels to the bifurcation of the aorta and the preaortic lymphatic tissue to the inferior mesenteric artery were dissected.

Technique of Dissection

Important landmarks of laparoscopic retroperitoneal lymphadenectomy are adequate exposure of the vena cava and/or aorta, the renal vein(s) and the ureter (*Fig. 3*). In some instances we used a transcutaneous suture with a straight needle through Gerota's fascia to retract the kidney laterally thereby obviating the need for an additional trocar. Initially we stented the ureter prior to the procedure and placed the ureter in a vessel loop after complete isolation. After, however, the first patient developed a late ureteral stricture requiring open ureterolysis we abandoned both these maneuvers. None-theless identification of the lumbar ureter is still essential to avoid its injury. The lymph node dissection usually starts superiorly and medially (i.e., within the preaortic and inter-aortocaval zone for a right testicular tumor). This region represents the deepest and most difficult point of the procedure (*Fig. 3b*) and may be obscured by fluid or blood if this portion of the dissection is not performed early in the operation. In contrast the paracaval lymph node dissection can be performed more readily.

In contradistinction to Janetschek et al (17), we do not routinely divide all lumbar veins and arteries for removal of retrocaval and retroaortic lymphatic tissue, because the latter can be sufficiently resected in most patients by simply retracting the vena cava with a small sponge stick (*Fig. 3b*). In general the same dissecting technique is used with laparoscopy as with an open modified retroperitoneal lymphadenectomy (13,14). In brief, a combination of blunt and sharp dissection is used to perform an en-bloc dissection of the interaortocaval and preaortic chains with clipping and electrocauterization of small vascular (blood and lymphatic) vessels. On the left side, in one case, we employed a "nerve-sparing" dissection (2). Despite its feasibility, however, the technique is demanding and tedious compared to a traditional en-bloc technique. Capture of the resected nodal tissue is facilitated by use of a small sized organ bag (LapSac^R, LapBag^R) or in the case of small nodes utilizing a reducer sheath. We routinely drain the operative field for 2 days (*Fig. 3c*).

RESULTS

We have now performed 19 laparoscopic retroperitoneal lymphadenectomies (*Table 1*). Twelve patients had clinical stage I disease and were operated upon to evaluate the status of regional lymph nodes whereas 7 patients had residual lymphadenopathy after chemotherapy for clinical stage IIb (n=2); (*Fig. 4*) or stage IIc (n=5). Fourteen retroperitoneal lymphadenectomies were done on the right side and 5 on the left side. The mean duration of the procedure was 298 (150-405) minutes (*Table 2*).

Conversion to an open (conventional) operation was necessary only in patients with stage IIc disease (*Table 2*). In 4 patients open dissection was required because of dense desmoplastic reaction around the aorta and vena cava. However, laparoscopy enabled dissection to be performed via a relatively small pararectal incision or even to utilize the suprainguinal incision required for orchiectomy. We would term this approach "laparoscopically assisted" retroperitoneal lymphadenectomy. In another patient laparo-scopic dissection was abandoned altogether. The postoperative stay ranged from 3 to 10 days with an average of 5.5 days.

There were no untoward intraoperative complications. One patient developed a retroperitoneal hematoma and subsequently a
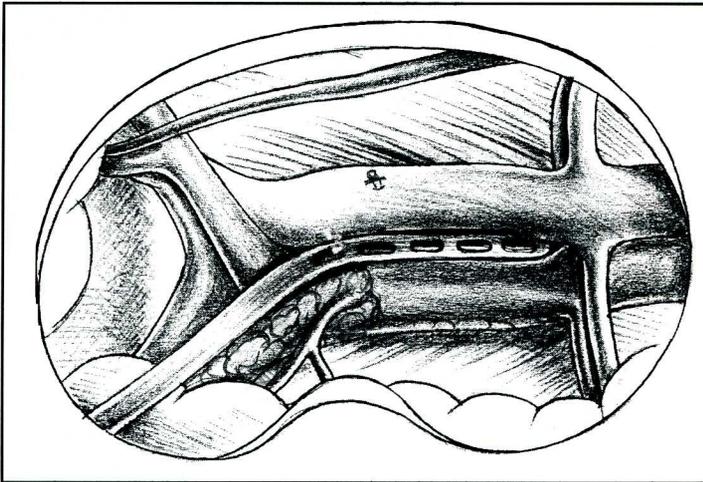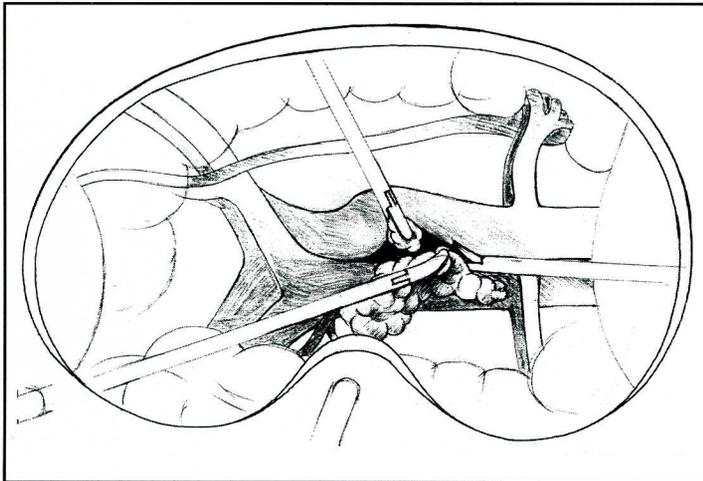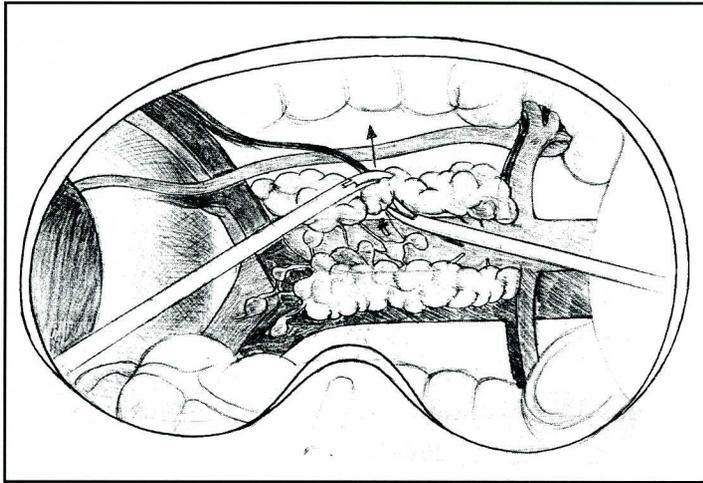
Fig. 3. Outline of laparoscopic modified retroperitoneal lymph node dissection for a right stage I testicular tumor. Upper – Isolation of vena cava and transection of right spermatic vein (Endoclip); Middle – Isolation of aorta during interaortacaval lymph node dissection. Thereafter, the renal artery and vein are isolated representing the cranial borderline of paracaval lymph node dissection; Lower – After the nodal dissection is complete, a drain is placed between the vena cava and the aorta.

Fig. 4. Laparoscopic "salvage" lymphadenectomy after chemotherapy for a right stage IIb testicular cancer. Upper – Computer tomography before chemo-therapy showing retroperitoneal lympha-denopathy (arrows) of an embryonal cell carcinoma (stage IIb); Middle – Residual lympha-denopathy (arrows) after PIV-chemotherapy (3 cycles of cisplatin, iphosphamide, vinblastine) with normalization of tumor markers; Lower – Follow-up computer tomography showing complete removal of the residual lymphadeno-pathy and endoclips (arrows). Histology revealed complete necrosis.

ureteral stenosis requiring open ureterolysis 8 weeks later. Another patient developed a pulmonary embolism on the second postoperative day which was treated successfully by anticoagulation therapy (heparinization). The patient in whom laparoscopy was abandoned with conversion to an open retroperitoneal lymphadenectomy later developed a lymphocele managed by percutaneous drainage. This complication, however, was unrelated to the attempt at laparoscopy. One other patient developed retrograde ejaculation after laparoscopic nodal dissection.

Histopathologically in one patient (clinical stage I) embryonal carcinoma was detected in the nodes excised but all other patients had either unremarkable lymphatic tissue (stage I) or showed complete necrosis after chemotherapy (stage II). Thus far, no local relapse has been documented, but one patient (clinical stage I) developed pulmonary metastases 6 months after laparoscopic lymphadenectomy (Table 2).

DISCUSSION

Management of an early stage non-seminomatous germ cell tumor is controversial. The options include either chemotherapy and surveillance or retroperitoneal lymph node dissection for complete staging before chemotherapy and continued surveillance. The major impetus to the first option for clinical stage I
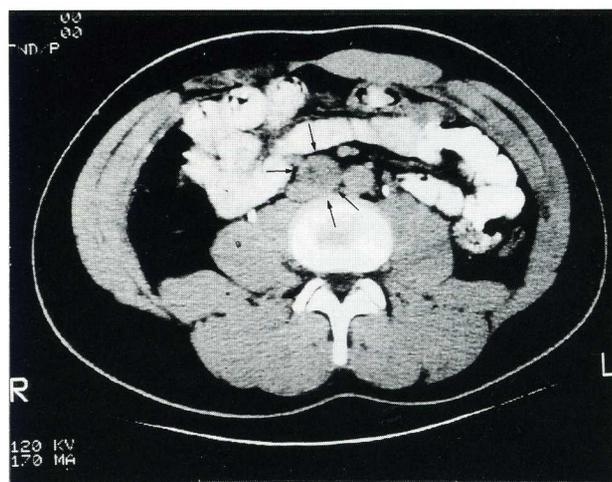
TABLE 1
Laparoscopic Retroperitoneal Lymphadenectomy for Non-seminomatous Testicular Cancer

Clinical stage	Patients (n)	Indication
1	12	Evaluation of lymph node status
IIb	2	Evaluation of response after chemotherapy (residual
IIc	5	lymphadenopathy)

TABLE 2
Results of Laparoscopic Retroperitoneal Lymphadenectomy for Non-seminomatous Testicular Cancer

Duration of procedure	298 (150-205) minutes
Conversion to open surgery	
- stage I	none
- stage II	4 "laparoscopically assisted"; 1 laparoscopyabandoned
Histology	
- stage I	positive nodes in 1 patient (stage IIa)
- stage II	complete necrosis in each of seven patients
Complications	
- intraoperative	none
- postoperative	ureteral stenosis [1], retroperitoneal hematoma [1], pulmonary embolism [1], retrograde ejaculation [1]
Postoperative stay	5.5 (3-10) days
Relapse	
- regional	none
- systemic	pulmonary metastases [2]

[] - signifies # patients

testicular cancer is to avoid the morbidity of retroperitoneal lymphadenectomy, namely the trauma of operation and the risk of retrograde ejaculation which may occur in nearly 50% of patients (19).

On the other hand, retroperitoneal lymphadenectomy is the only current reliable method to identify as early as possible patients with germ cell tumors who already have pathological stage II disease. Because of the insufficiency of clinical staging alone, surveillance without prior lymph node dissection has a relapse rate of 19-40% (1-6, 15) versus 11% for pathologic stage I

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testicular cancer after retroperitoneal lymphadenectomy (8-10, 14). Moreover, the most serious drawback of surveillance is not only a high relapse rate but the associated death rate of approximately 10% among those patients who do relapse. A major reason for this failure may be poor patient compliance with lack of close follow-up (15). This shortcoming of surveillance or expectant therapy emphasizes the major advantage of primary retrograde lymphadenectomy in early stage non-seminomatous testicular cancer. During the last several years, the risk of retrograde ejaculation after retroperitoneal lymphadenectomy has been significantly reduced. Several studies have demonstrated that downscaling the field of operative dissection maintains acceptable sensitivity (7-10,13,14); (*Fig. 2*) and more importantly, it does not result in an increase of relapse. Moreover, with the innovation of a "nerve-sparing" modified retroperitoneal lympha-denectomy a 99% rate of prograde ejaculation has been achieved (8,11,12). Anatomical studies, however, suggest that a similar rate of prograde ejaculation can be attained by simply preserving the postganglionic sympathetic nerves below the origin of the inferior mesenteric artery (7).

With the introduction of laparoscopic dissection the morbidity of retroperitoneal lymphadenectomy can be further reduced. Our preliminary experience and those of others (16,17) suggest that a modified retroperitoneal lymphadenectomy based on the field of dissection as described by Weissbach and Boedefeld (13) is technically feasible, safe and accurate with a clinically negative (stage I) retroperitoneum (*Table 2*). Comparable to our experience with transperi-toneal laparoscopic nephrectomy (19) the amount of analgesics, duration of postopera-tive analgesia and hospital stay can be reduced significantly after laparoscopic modified retroperitoneal lymphadenectomy. Theoretically, even a nerve-sparing dissection technique can be performed laparoscopically. However, similar to open surgery we prefer a

modified en bloc dissection technique which assures prograde ejaculation in the vast majority (90%) of patients. Moreover, we do not routinely divide all lumbar veins and arteries as proposed by Janetschek et al (17) for excision of the retrocaval lymphatic tissue. We find this maneuver not only unnecessary but also leads to a more prolonged operation. Whereas Janetschek et al reports an operating time of 420 to 540 minutes, our operating time averaged less than 300 minutes.

Despite our preliminary success we emphasize that this approach is still in a developmental phase and caution should be exercised that it be limited only to centers providing advanced laparoscopic expertise. Laparoscopic dissection is difficult and hazardous in the vicinity of the aorta, vena cava and renal veins. Major bleeding may ensue and needs to be managed by prompt laparotomy.

In contrast to our favorable experience with laparoscopic retroperitoneal lympha-denectomy for stage I disease, its use for evaluation of the chemotherapeutic response in stage II non-seminomatous cancer of the testicle is more restrictive. Only in stage IIb disease were we able to perform the entire nodal dissection laparoscopically. The main limitation was the intense desmoplasia in the vicinity of the great vessels after chemo-therapy. In stage IIb disease fibrous reaction was limited to a more circumscribed area whereas in stage IIc disease almost the entire retroperitoneum was affected. Despite this drawback we were able to dissect at least portions of the nodal tissue with removal of the residual mass via a relatively small pararectal or suprainguinal incision. Future studies have to evaluate whether such a "laparoscopic assisted" approach is worthwhile.

In conclusion, modified laparoscopic retroperitoneal lymphadenectomy represents a promising technique for staging early non-seminomatous germ cancer by further reducing operative trauma and postoperative

morbidity. The procedure, however, is techni-cally demanding and must await a larger clinical experience of centers with advanced laparoscopic expertise. Additionally, the advantages, staging-accuracy and safety of laparoscopic retroperitoneal lymphadenec-tomy should be evidenced in a prospective randomized clinical trial comparing it to the conventional open procedure. Laparoscopy may also be useful to reassess pathologically the retroperitoneal nodes in stage IIb germ cell tumors after chemotherapy although extensive desmoplasia in response to tumor necrosis may preclude or severely limit laparoscopic dissection.

REFERENCES

1. Jewett, MAS, JG Herman, JFG Sturgeron, et al: Expectant therapy for clinical stage A nonseminomatous germ cell testicular tumor. World J. Urol. 2 (1984), 57-58.
2. Liedke, SE, EP Allhoff, U Jonas: Wait and see in NSGCT clinical stage I: A critical assessment after eight years. J. Urol. 143 (1990), 397A.
3. Peckham, MJ, A Barrett, A Horwich, et al: Orchiectomy alone for stage I testicular non-seminoma. Brit. J. Urol. 55 (1983), 754-759.
4. Pizzocaro G, F Zanoni, R Salvioni, et al: Difficulties of a surveillance study omitting retroperitoneal lymphadenectomy in clinical stage I nonseminomatous germ cell tumor of the testis. J. Urol. 138 (1987), 1393-1396.
5. Raghavan, D, B Colls, J Leir: Surveillance for stage I nonseminomatous germ cell tumors of the testis: The optimal protocol has not yet been developed. Br. J. Urol. 61 (1988), 522-526.
6. Sogani, PC, WR Fair: Surveillance alone in the treatment of clinical stage I nonsemi-nomatous germ cell tumor of the testis. Sem. Urol. 6 (1988), 53-56.
7. Colleselli, K, S Poisel, W Schachtner, et al: Nerve-preserving bilateral retroperitoneal lym-phadenectomy: Anatomical study and opera-tive approach. J. Urol. 144 (1990), 293-298.
8. Donohue, JP, RS Foster, RG Rowland, et al: Nerve-sparing retroperitoneal lymphadenec-tomy with preservation of ejaculation. J. Urol. 144 (1990), 287-292.
9. Fossa, SD, S Ous, AE Stenwig, et al: Distribu-tion of retroperitoneal lymph node metastases in patients with nonseminomatous testicular cancer in clinical stage I. Eur. Urol. 17 (1990), 107-112.
10. Jaeger, N, W Vahlensieck: Unilateral lymphadenectomy in stage I nonseminoma-tous testicular tumor. In: *Germ Cell Tumors*, Jones, WG, MA Ward, CK Anderson (Eds.), Pergamon Press, Oxford (1985), pp. 453-455.
11. Jewett, MAS: Nerve-sparing technique for retroperitoneal lymphadenectomy in testis cancer. Urol. Clin. North Am. 17 (1990), 449-456.
12. v. Stauffenberg, A, R Hartung, W Kropp, et al: Nerve-sparing retroperitoneal lympha-denectomy with intraoperative neurostimu-lation. Akt. Urol. 24 (Suppl)(1993), 11-15.
13. Weissach, L, EA Boedefeld: Localization of solitary and multiple metastases in stage II nonseminomatous testis tumors as basis for a modified lymph node dissection in stage I. J. Urol. 138 (1987), 77-82.
14. Weißach, L, EA Boedefeld, B Horstmann-Dubral: Surgical treatment of stage I nonseminomatous germ cell testis tumor. Eur. Urol. 17 (1990), 97-106.
15. Thompson, PI, J Nixon, VJ Harvey: Disease relapse in patients with stage I nonseminoma-tous germ cell tumors of the testis on active surveillance. J. Clin. Oncol. 6 (1988), 1597-1603.
16. Hulbert, JC, EE Fraley: Laparoscopic retroperitoneal lymphadenectomy: New approach to pathologic staging of clinical stage I germ cell tumors of the testis. J. Endourol. 6 (1992), 123-126.
17. Janetschek, G, A Reissigl, R Peschel, et al: Laparoscopic retroperitoneal lymphadenec-tomy for testicular tumor: Animal studies and first clinical experience. Min. Inv. Ther. 1 (Suppl)(1992), 69 (Abstract No. B-31).
18. Jaeger, N, L Weißbach, W Vahlensieck: Second-look lymphadenectomy in the treatment of germ cell testis tumors.
19. Rassweiler, J, TO Henkel, DM Potempa, et al: Transperitoneal laparoscopic nephrectomy: Training, technique, and results. J. Endourol. 7 (1993), 505-516.
20. Winfield, HN, JF Donovan, WA See, et al: Laparoscopic pelvic lymph node dissection for genitourinary malignancies: Indication, techniques, and results. J. Endourol. 6 (1992), 103, 112.

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