Laparoscopic retroperitoneal lymph node dissection.

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Summary.- OBJECTIVES: Primary objective of the present article is to evaluate the surgical efficiency of the laparoscopic retroperitoneal lymph node dissection in clinical stage I and II testis tumor. Secondary objective is the description of the technique used by the author.

METHODS: A description of the author’s experience and review of the litterature in terms of feasibility, oncological results and quality of life.

RESULTS: Once the learning curve has been overcome, the operative time is in the range of that open surgery with lower morbidity and complications. Ejaculation can be preserved in virtually all patients by means of a template dissection. With a mean follow-up of almost four years oncologic long-term outcome is not compromised by the laparoscopic approach.

CONCLUSIONS: In clinical stage I testis tumor laparoscopic retroperitoneal lymph node dissection can be used as a diagnostic measure with the same long term results as the open procedure. In stage II disease removal of residual tumor can also be achieved by laparoscopy.

Keywords: Testicular carcinoma. Retroperitoneal lymph node dissection. Laparoscopy. Chemotherapy.

Resumen.- OBJETIVOS: El objetivo primario del presente artículo es la evaluación de la eficacia quirúrgica de la linfadenectomía retroperitoneal laparoscópica en los tumores de testículo estadios I y II. El objetivo secundario es la descripción de la técnica utilizada por el autor.

MÉTODOS: Una descripción de la experiencia personal del autor y una revisión de la literatura desde el punto de vista de la viabilidad, los resultados oncológicos y la calidad de vida.

RESULTADOS: Una vez superada la curva de aprendizaje, el tiempo de operación se sitúa en el rango del de la cirugía abierta con menor morbilidad y complicaciones. La eyaculación puede conservarse prácticamente todos los pacientes utilizando un molde para la diseción. Con un seguimiento medio de casi cuatro años los resultados oncológicos a largo plazo no se han visto comprometidos por el abordaje laparoscópico.

CONCLUSIONES: En los tumores de testículo estadio I la linfadenectomía laparoscópica puede ser utilizada como una medida diagnóstica con iguales resultados a largo plazo a los de la operación abierta. En el estadio II también se puede conseguir la eliminación del tumor residual por laparoscopia.

Palabras clave: Carcinoma testicular. Linfadenectomía retroperitoneal. Laparoscopia. Quimioterapia.
INTRODUCTION

The retroperitoneum is the primary landing site of lymph node metastases from testicular tumor. Early diagnosis and treatment of such metastases allows for cure.

In **clinical stage I disease**, retroperitoneal lymph node dissection (RPLND) traditionally has two purposes: diagnosis of occult lymph node metastases, and also their definitive treatment.

25-30 per cent of patients with clinical stage I nonseminomatous testicular cancers have occult lymph node metastases which cannot be diagnosed even with the most sensitive imaging techniques available today (1, 2). Also, the non-specificity of clinical staging is a concern, and up to 20 per cent of patients with suspicious findings on CT will actually have pathologic stage I disease (3). RPLND is the only method that permits instant and reliable identification of small positive lymph nodes as well as the exclusion of false positive results. However, the morbidity of open RPLND is too high for a procedure which is diagnostic only in about 70 per cent of patients.

Short-term morbidity is that of major intraabdominal surgery, but long-term morbidity is even more striking and includes loss of antegrade ejaculation and a long scar which impairs the mostly young patients until the end of their life. Due to the high morbidity of open surgical RPLND one might be tempted to use it as a single therapeutic measure in clinical stage I patients diagnosed with metastases at surgery. However, relapse rates after therapeutic open RPLND are as high as 8-29 per cent (4, 5) for stage IIA tumors and between 34-55 per cent (5-7) for stage IIB tumors. Relying on surgery alone in pathologic stage II disease without performing adjuvant chemotherapy would entail the same or even more problems as surveillance in clinical stage I disease. By comparison, relapse rates for stage IIB tumors are as low as 0-1 per cent if two cycles of adjuvant chemotherapy are given (5, 7, 8). However, the morbidity of this combined therapy is very high.

To overcome the above mentioned problems, alternative therapeutic regimens have been developed, namely surveillance (1, 2) and risk-adapted chemotherapy (4, 5). We have developed another alternative concept. Since knowledge of the definitive lymph node status is a prerequisite for adequate stage-adapted treatment, RPLND is retained, but as a diagnostic measure only, and its morbidity is substantially reduced by the introduction of laparoscopy (9, 10). All patients with metastases detected at surgery receive two cycles of adjuvant chemotherapy. This combined treatment has proved to be very efficient, but exposes the patients to a high morbidity (5, 7, 8). Again, the problem of morbidity can be mitigated by the introduction of laparoscopy.

Management of **clinical stage II disease** is different. When used as a single measure, neither retroperitoneal lymphadenectomy (4, 5, 7, 11) nor chemotherapy (12-15) can be expected to be curative in all patients. There is no doubt that the most effective treatment for retroperitoneal metastases from nonseminomatous testicular cancer is the combination of surgery and chemotherapy. If RPLND is used as first step, it is performed in a therapeutic intent. However, the template of a therapeutic RPLND differs from that of a purely diagnostic procedure and is bilateral since it has not only to include the primary landing site, but all sites of possible tumor spread (16, 17). By means of laparoscopy, a bilateral RPLND is only feasible as a staged procedure, which decreases efficiency and increases morbidity. Therefore we adhere to the concept of primary chemotherapy and subsequent RPLND for the removal of residual tumor (12-15). In this setting, RPLND is performed for diagnostic reasons, i.e. to exclude that the residual tumor contains active tumor cells. If, however, mature teratoma is found and removed, RPLND is therapeutic as well.

CLINICAL STAGE I

**Template:**

Weissbach (16) has described templates which include practically all primary landing sites of lymph node metastases. If all lymphatic tissue is resected within these templates, there is only a minimal risk for a metastasis to be overlooked. The templates for the left and the right side differ substantially; only the template for right-sided tumors includes the interaortocaval tissue. However, there is still some controversy whether or not to remove the tissue behind the lumbar vessels, the vena cava and the aorta. There is as yet no study available investigating whether this area is among the primary landing sites of lymph node
metastases. In our initial 29 patients all tissue in this area was completely removed. We have developed a laparoscopic split-and-roll technique that enables us to transect all lumbar vessels and to perform the same radical dissection as with open surgery (9). Meanwhile, we have investigated the primary landing sites with regard to their ventro-dorsal location. All solitary metastases, and at least one of multiple metastases were detected ventral to the lumbar vessels (18). Therefore, it can be concluded that the primary landing sites are invariably located ventrally, while dorsal metastases result from further tumor spread. Consequently, we no longer routinely transect all lumbar vessels to remove the tissue behind them; it is not required in diagnostic RPLND for clinical stage I tumors. This makes the laparoscopic procedure considerably easier, safer and faster.

Preservation of antegrade ejaculation:

Loss of antegrade ejaculation is the most common long-term complication of RPLND. This problem can be overcome by performing either a template dissection (17) or nerve-sparing RPLND (19).

Using a template dissection (16) ejaculation was preserved in 28 of 30 patients who underwent open RPLND for clinical stage I disease (20). In two patients the templates were too large; even though this was realized intraoperatively, ejaculatory function could not be preserved.

With the introduction of nerve-sparing RPLND, Donohue was able to improve the ejaculation rate from 70 to almost 100 per cent (19). However, Donohue did not only introduce nerve-sparing dissection but at the same time limited the dissection to a unilateral template, and it is the latter by which the contralateral sympathetic nerve is spared (21). It has been known since 1964 that destruction of the sympathetic nerve on one side does not result in aspermia as long as the contralateral side remains intact (22). Hence, antegrade ejaculation will not be disturbed if RPLND is restricted to a unilateral template; additional preservation of the ipsilateral nerve by a nerve-sparing technique is not required.

By performing a template dissection only, we were able to preserve antegrade ejaculation in all but one of our patients. Similar results have been reported by other groups (23, 24).

Surgical Efficiency:

In an early publication on laparoscopic RPLND we reported operative times up to 630 minutes (9). In the meantime, we have overcome the learning curve by performing 76 laparoscopic RPLND’s in clinical stage I patients, and therefore, in our most recent patients mean operative time decreased to 219 minutes (10).

Right from the beginning, the complication rate of laparoscopic RPLND was lower than that of open surgery (9). The main problem was intraoperative hemorrhage, which could be overcome by conservative measures in most patients. Only 2 out of the 76 patients required conversion to open surgery. In the first patient, conversion was due to the learning curve (arterial bleeding) (9). In the second, the anatomic situation was complicated by a horseshoe kidney. However, RPLND could be completed in both by means of laparoscopy, and only a relatively small incision was required to repair the vascular lesion.

Postoperatively, there were no major and only few minor complications.

Mean postoperative hospitalization was 3.3 (2-5) days. Normal antegrade ejaculation was preserved in 73 of the 74 patients followed (98.7%). In one patient ejaculation has not yet been restored at three months after surgery, but function may return in the further course. The two most recent patients have not been assessed yet. Histologic findings were positive in 19 of the 76 patients (25 %) (10).

Long-term Outcome:

The major concern in laparoscopic RPLND is that the dissection may not be as complete as with open surgery. However, if metastatic lymph nodes were left behind leading to false-negative histologic staging, they would grow rapidly and become clinically manifest within a very short period of time. Therefore, the number of retroperitoneal relapses is a good indicator of the sensitivity of laparoscopic RPLND. Data on long-term outcome have been published previously (10, 25). Two pathologic stage I patients were lost to followup, and only patients with a followup of at least 6 months have been included. Mean followup in the 47 pathologic stage I patients was 45.3 (10-87) months. One retroperitoneal recurrence occurred on the
conteralateral side outside the surgical field. Further investigation revealed that the tumor in the primary landing site had been removed at surgery but was missed on histologic examination. The patient was cured with two cycles of chemotherapy and additional contralateral laparoscopic RPLND. No other relapse has been observed, which clearly demonstrates the oncologic efficacy of the procedure. In the literature, relapse rates up to 10 per cent have been reported for pathologic stage I lesions, most of the recurrences occurring outside the retroperitoneum, primarily in the lungs (5, 26, 27). By comparison, the recurrence rate in our series is extraordinarily low, a fact which we are unable to explain. Admittedly, our experience is based on a relatively small series. Nevertheless, it is tempting to speculate that at least some of the recurrences reported in the literature may be due to false-negative findings on histologic examination. Interestingly enough, this possibility has never been discussed, although it probably does play a role in this context.

The rate of retroperitoneal relapses after open surgical RPLND was reported to be 6.8% in 88 clinical stage I patients. 37 of the 88 patients had pathologic stage I lesions, and the relapse rate in this group was 2.7% (28). Our data compare favorably with this report.

Mean followup in 17 clinical stage I / pathologic stage II patients who received two cycles of adjuvant chemotherapy was 45.7 (9-89) months. Over this period no relapse has been seen (10). The most recent update confirms these results (29).

**STAGE II AFTER CHEMOTHERAPY**

The most effective treatment for retroperitoneal metastases from testicular carcinoma is the combination of surgery and chemotherapy. Because of the morbidity associated with either treatment modality, it is tempting to try to achieve a cure with a single treatment, but recurrence rates are high. In the case of a recurrence, however, the treatment morbidity is considerably higher than that of combined treatment if performed initially. The concept of primary chemotherapy for low-volume retroperitoneal metastases includes RPLND for residual tumor, which will be necessary in about one third of patients (12-15). To reduce the morbidity of this regimen, we have replaced open surgery with the laparoscopic approach in stage IIb tumors (2 to 5 cm in diameter) (30).

In an attempt to further reduce the morbidity of combined treatment, the dose of chemotherapy was decreased to two cycles for stage IIb disease, which obviously is the minimum dose required for complete tumor control (10). However, this approach is experimental at present, which makes evaluation of the effect of chemotherapy by means of laparoscopic RPLND mandatory in each patient. Thus, patients are spared a third and a fourth cycle. In this context, it must be noted that the toxicity of chemotherapy is dose-dependent and therefore increases significantly with each additional cycle. By comparison, the morbidity associated with laparoscopic RPLND, which due to the presence of residual tumor must be performed in every third patient anyhow, is clearly lower.

The oncologic efficacy of two cycles of cisplatin-based chemotherapy for stage IIb tumors has been reviewed only recently in 46 patients. In all of these patients RPLND had been performed following chemotherapy by means of either open or laparoscopic surgery. Median follow-up was 65.9 months. Only one patient had active tumor cells in the specimen, but 34.5% of patients were found to have mature teratoma so that surgery was curative for them. No relapse occurred and no patient died (31).

Initially, postchemotherapeutic RPLND was performed not only in stage IIb patients but also in patients presenting with small (5-8 cm) stage IIc tumors. Laparoscopic RPLND proved technically feasible in the latter. However, at this stage the risk of contralateral tumor spread is high, because it is related to tumor size. As laparoscopy allows for unilateral dissection only, we have now restricted it to stage IIb tumors (10, 30).

Unilateral laparoscopic RPLND is performed within the template described for the primary landing site, while bilateral RPLND is not attempted. The templates for right and left-sided tumors are the same as for clinical stage I disease (16). In all of our patients, the residual tumor was located within these templates. The operative technique is essentially the same as for stage I tumors. However, the dissection is usually more difficult, since the different tissue layers often cannot be identified any longer. Small venous branches draining the tumor have to be dissected with great care.
and are then clipped and transected.

49 patients underwent laparoscopic RPLND after chemotherapy (stage IIb: 35 pts.; stage IIc: 14 pts.). Mean age of the patients was 29.4 (15-56) years. 27 tumors were located on the right and 22 on the left side.

There was not a single conversion to open surgery. Mean operative time was 226 (range 165-300) min for the 35 stage IIb and 298 (range 195-360) for the 14 stage IIc patients. Intraoperative hemorrhage occurred in nine patients, which could be managed laparoscopically in all instances. None of the patients required blood transfusions. Postoperative chylous ascites was observed in six patients, which, however, resolved with conservative measures (low-fat diet and, in certain cases, a special diet with medium-chain triglycerides). Asymptomatic lymphoceles were observed in four patients.

Mean postoperative hospital stay was 3.5 (range 3-7) days. Histology revealed active tumor in one patient (2%) only. This was a borderline case which initially should have been staged as IIc instead of IIb. This patient received two more cycles of chemotherapy and has been free of relapse for 69 months. In the 18 patients (36.7%) in whom mature teratomas were removed, RPLND was therapeutic as well. In 30 patients (61.3%) the resection specimens revealed necrosis and fibrosis only. 47 patients have been followed for at least 6 months. Mean followup is 35 (range 6-65) months. Over this period not a single relapse has been observed (10). These data have been confirmed recently (29).

Extraperitoneal Approach:

We have always favored the transperitoneal approach for RPLND because we feel that it provides the best access to the interaortocaval space. Extraperitoneal lymph node dissection was initially reported for pelvic lymphadenectomy. Extraperitoneal para-aortic lymph node dissection has been done in gynecologic patients for staging cervical cancer (32). Now two groups have shown that endoscopic RPLND for testicular cancer can be performed by means of an extraperitoneal approach as well (33, 34).

What is the advantage of an extraperitoneal approach? Is it technically easier, and/or is it less morbid for the patient? We should remember in this context that the extraperitoneal approach for pelvic lymph node dissection in prostate cancer has now more less been given up in favor of the transperitoneal technique.

The one author points out as single argument that operating time is shorter for retroperitoneoscopy (33). However an analysis of these data reveals that the difference between the two techniques is obviously only due to the learning curve which is very steep for this procedure. No other advantage of retroperitoneoscopy is mentioned in this publication.

The other author discusses several potential advantages of retroperitoneoscopy (34). In this technique there is no need of a steep Trendelenburg or lateral position, which is a possible source of pressure sores or nerves stretching. Moreover, this flat supine position enables the surgeon to perform laparotomy rapidly in the event of an uncontrollable hemorrhage. We observed pressure sores in our very first patients only, and the lateral position is not only standard for RPLND, but also for radical nephrectomy, which is a much more frequent indication. Also the lateral position was no problem in the two patients which had to be converted to open surgery.

Next the author speculates that absent peritoneal penetration during the whole procedure minimizes the risk of vascular or bowel injury or burn (34). This argument is difficult to understand because the vessels are located in the retroperitoneum, not within the peritoneal cavity. The bowel is out of view, indeed, but the surgeon is still very close to it so that injuries may occur as well. In addition we did never observe a laceration to an intraabdominal organ in our series.

Retroperitoneoscopy allows for genuine nerve sparing dissection as was shown in 12 patients (34). As we have stated before and as our results and those of other authors demonstrate, nerve sparing dissection is not necessary as long as the contralateral sympathetic nerve remains intact (32).

Finally the author points out that retrovascular dissection is made easier by the extraperitoneal route. This argument is true, but retrovascular dissection is not required in clinical stage I testicular cancer since the primary landing site of lymph node metastases is exclusively ventral to the lumbar vessels.

It is interesting that none of the two authors argues that retroperitoneoscopy is less morbid for the patient. We feel that retroperitoneoscopy has several distinct disadvantages. Laparoscopic RPLND in our first 29 patients was performed in two steps, and the second step consisted in a lateral approach as in
retroperitoneoscopy (9, 35). This lateral approach allowed for easy transection of the lumbar vessels—a maneuver which we gave up in the meantime—but did not provide a good access to the interaortocaval space. The situation is similar in retroperitoneoscopy. Good access to the interaortocaval space is very important for RPLND after chemotherapy, and no group has shown so far that this procedure is feasible by means of retroperitoneoscopy.

Lymphocele formation is another potential risk of the extraperitoneal approach. Not a single lymphocele was observed after extraperitoneal RPLND in 17 and 25 patients, respectively (33, 34). One randomized experimental study has been performed in pigs comparing transperitoneal versus extraperitoneal para-aortic lymph node dissection (36). No case of lymphocele formation was observed in the transperitoneal versus 43% in the extraperitoneal group. Therefore some percentage of lymphocele formation has to be expected once extraperitoneal RPLND will be performed in a larger group of patients.

QUALITY OF LIFE AFTER RPLND

Since excellent results are achieved by RPLND, surveillance as well as risk-adapted chemotherapy, treatment-dependent quality of life has become a major issue. To exclude the bias of the surgeon, a quality of life study has been performed in cooperation with the psychiatrists (30). A questionnaire including 39 questions was distributed to 119 patients and completed in personal interviews by 118. Thus, compliance was 99.2%. The questionnaire included questions about patient satisfaction with the information about the disease and how they experienced treatment and its side effects. They were asked about the time it took until they were able to do gentle physical exercise, go back to normal activities, and until they were free of symptoms. There were questions about interest in sexual activity, whether they felt lovable, experienced any problems in their partnership, psyche, or social life, and whether they were anxious about losing their jobs or had emotional problems associated with the loss of a testicle or the RPLND procedure.

The open RPLND group included 53 (47.3 %) patients (stage I: 17 pts.; stage II after chemotherapy: 36 pts.), while the laparoscopic RPLND group comprised 59 (52.7 %) patients (stage I: 25 pts.; stage II after chemotherapy: 34 pts.).

Surprisingly, not only laparoscopic but also open RPLND was better tolerated than chemotherapy. Open RPLND impairs the quality of life much more than laparoscopic RPLND. There was not a single item where open RPLND was superior to laparoscopy. The patients who participated in the study preferred laparoscopic RPLND to all other treatment modalities.

CONCLUSIONS

In clinical stage I disease, the concept of diagnostic laparoscopic RPLND, which is supplemented by two cycles of cisplatin-based adjuvant chemotherapy if tumor has been found in the retroperitoneum, has demonstrated both its surgical efficiency and its oncologic efficacy. In this setting, RPLND is only therapeutic if mature teratoma, which is resistant to chemotherapy, or yolk sack tumor, which is responsible for late recurrences, have been removed as well. Patient satisfaction is high, and the disadvantages of surveillance and primary chemotherapy can be overcome.

In clinical stage IIb disease, the combination of both chemotherapy and surgery has proved to be very effective. Efficacy of this combined regimen was not compromised by reduction of the initial chemotherapy from 3-4 cycles to 2 cycles only. However, RPLND then becomes mandatory, the morbidity of which was markedly decreased by the introduction of laparoscopy.

The main disadvantage of laparoscopic RPLND is its long and steep learning curve. Good results can only be achieved if this operation is performed on a regular basis, which is practicable in specialized centers only. However, centers specialized in the treatment of testicular cancer should be able to offer this new alternative to their patients.

REFERENCES AND RECOMMENDED READING (*of special interest, **of outstanding interest)

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