SURGICAL TECHNIQUE

Video endoscopic inguinal lymphadenectomy: Surgical and oncological results

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Abstract
Introduction: We evaluated the reproducibility of video endoscopic inguinal lymphadenectomy (VEIL) and we report our initial experience in the treatment of penile cancer with palpable inguinal lymph nodes.

Materials and methods: From July 2006 to November 2010 we conducted 33 VEIL in 20 patients as complementary treatment for penile cancer in two referral hospitals in Latin America. We analyzed the epidemiological and clinical characteristics of patients and surgical and oncologic outcomes.

Results: Fifty-five percent of the patients included were clinical stage N0 and 45% were N+. Thirteen patients underwent bilateral VEIL and the remaining seven underwent VEIL unilaterial and conventional open surgery in the contralateral limb. The average operative time for VEIL was 119 min and mean resected lymph nodes was 8 per lymphadenectomy. The overall complication rate was 33.2%. No patient had skin necrosis. The lymphatic complication rate was 27.2%. Of the 6 cases in which the saphenous vein was preserved (18.2%) there were no lymphatic complications (p = .2). The overall survival rate was 80% and cancer-specific survival was 90%. Mean follow-up was 20 months.

Conclusions: VEIL in the adjunctive treatment of penile cancer is safe, reproducible and may be an alternative to conventional lymphadenectomy. Patients with palpable lymphadenopathy also may benefit from this technique. Oncological results seem to be adequate however require longer follow-up to be confirmed.

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**Resumen**

**Introducción:** Evaluamos la reproducibilidad de la linfadenectomía inguinal video endoscópica (VEIL) y relatamos nuestra experiencia inicial en el tratamiento del cáncer de pene con ganglios palpables.

**Material y métodos:** De julio de 2006 a noviembre de 2010 fueron realizadas 33 linfadenectomías inguinales video endoscópicas en 20 pacientes, como tratamiento complementario del cáncer de pene, en 2 hospitales de referencia en Latinoamérica. Fueron analizadas las características epidemiológicas y clínicas de los pacientes, así como los resultados quirúrgicos y oncológicos.

**Resultados:** De los pacientes incluidos el 55% fueron de estadio clínico NO y el 45% fueron N+. La VEIL se llevó a cabo de forma bilateral en 13 pacientes y en 7 casos se realizó VEIL unilateral, asociada con la cirugía convencional contralateral. El tiempo operatorio medio de la VEIL fue de 119 min, y la media de adenopatías resecadas fue de 8 por cada linfadenectomía. La tasa global de complicaciones fue del 33,2%. Ningún paciente presentó necrosis cutánea. La tasa de complicaciones linfáticas fue del 27,2%. En los 6 casos en que se preservó la vena safena interna (18,2%) no hubo complicaciones linfáticas (p = 0,2). La tasa de sobrevida global fue del 80% y la sobrevida cáncer específica fue del 90%. El seguimiento medio fue de 20 meses.

**Conclusión:** La VEIL en el tratamiento complementario del cáncer de pene es un procedimiento seguro y reproducible, siendo una alternativa a la linfadenectomía convencional. Los pacientes con adenopatías palpables también se pueden beneficiar con esta técnica. Los resultados oncológicos son adecuados, aunque se necesita más tiempo de seguimiento.

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**Introduction**

Despite its low incidence in developed countries, in underdeveloped ones, penile carcinoma is a disease that can reach 10% of male neoplastic diseases.\(^1,2\) Its etiology is not entirely clear, but there is a strong association with poor local hygiene, other predisposing conditions are phimosis, preputial exuberance, and infection with human papilloma virus.\(^1,3\)

The main site of metastasis is inguinal adenopathies.\(^2,3\) From 20 to 40% of the patients with penile cancer have inguinal commitment at the time of diagnosis, this being a determining factor of cancer-related mortality.

Conventional inguinal lymphadenectomy is considered the gold standard in the treatment of inguinal metastases of penile cancer, despite the high rate of complications, which may occur in up to 50% of the cases, even in the most recent series which used the most refined surgical techniques.\(^1,4,5\)

Various modifications in the technique of lymphadenectomy were described, with the aim of reducing surgical morbidity, such as the sentinel node and simplified lymphadenectomy. In these cases, lymph node resection is performed more narrowly, however, increasing the possibilities of false negatives.

With the aim of reducing surgical morbidity in 2006, the video laparoscopic approach in clinical practice was described by Tobias-Machado et al.\(^6,9\) This technique attempts to reduce the morbidity, maintaining the radicality and the same oncological principles as the conventional technique. Since then, 4 series were reported, with a total of 45 video endoscopic inguinal lymphadenectomies (VEIL).\(^9,10\)

The aim of this study was to evaluate the reproducibility of the VEIL technique and report our initial experience. We discuss some technical aspects: surgery in patients with palpable adenopathies, energy source used, and preservation of the internal saphenous vein.

**Materials and methods**

This is a multi-institutional work, developed in 2 referral hospitals in Latin America. 4 urologists took part, 2 of each center, all the patients operating together. The study was conducted from July 2006 to November 2010. The indication criteria for lymphadenectomy were mobile palpable adenopathies after 4 weeks of antibiotic therapy, locally advanced tumors (T2 or greater), moderately differentiated or undifferentiated tumors (GII or GIII), and lymphatic vascular invasion. 33 lymphadenectomies were performed in 20 patients as complementary treatment to penectomy. Two patients who developed cutaneous ulceration in the inguinal region did not undergo video endoscopic lymphadenectomy, undergoing conventional lymphadenectomy.

The data were retrospectively evaluated after the completion of the research protocol. We analyzed:

1. Epidemiological characteristics of the patients, lymph node clinical stage and comorbidities.
2. Perioperative data: surgical time, type of energy used for the dissection, preservation of the internal saphenous vein, surgical complications, drainage time, time of admission, and late surgical complications.
3. Oncological results: pathological stage, number of adenopathies resected, and local relapses.

All the patients were informed of the innovative technique and gave formal authorization for its performance.
The statistical analysis was performed using the Epilinfo 2000® software. Chi-square and Fisher’s exact exact tests were carried out with significance set at $p < 0.05$.

Surgical technique

The patient is positioned in dorsal decubitus with abduction and external rotation of the lower limb to be operated. The surgeon stands between the patient’s legs and the first assistant lateral to the member approached. The monitor is positioned on the left or right side of the patient, as the surgeon prefers. The femoral triangle and its boundaries are demarcated with methylene blue.

A 15-mm incision is made 2 cm distal to the femoral triangle vertex. We start building the workspace through digital dissection below Scarpas fascia. Other 2 incisions, a 10-mm and a 5-mm one, are performed 6 cm laterally and medially to the vertex of the triangle respectively, where trocars will be located for forceps and scissors (Fig. 1). Through the opening of the vertex, we place a Hasson trocar, through which the 30 lens is inserted. The space created is blown with CO2 and the pressure is maintained at around 10 mm Hg (Fig. 2).

Previous transillumination, palpation, and demarcation facilitate identification of the boundaries of the dissection. In order to perform hemostasis, monopolar, bipolar, or ultrasonic energy can be used.

The long adductor muscle and the sartorius one, which correspond respectively to the medial and lateral limits of the femoral triangle, are dissected. At this stage, the internal saphenous vein is identified on the long adductor muscle, and dissected up to its junction in case of preservation.

We proceed to the section of the fascia of the adductor, sartorius, and femoral sheath at the level of the femoral triangle vertex, to access the deep nodes that must be dissected separate from the superficial ones, in case of preserving the internal saphenous vein. Skeletonization of the femoral vessels is performed to the junction of the saphenous vein, being careful not to injure femoral nerve branches located laterally to the femoral artery.

In cases of preservation of the saphenous vein, its tributaries will be linked with metal clips (Fig. 3). You must be extremely meticulous in the clamping of the lymphatic vessels, this being a very important technical detail.

The surgical specimen is removed through the portal of the lens. Two suction drainages are positioned through the holes in the lateral and medial trocars to the vertex of the triangle.

Results

The mean age of the patients was 51 years (38–80 years), all underwent penectomy between one and three months beforeinguinal lymphadenectomy, with 18 patients (90%) undergoing partial penectomy and the rest total penectomy. 13 patients underwent bilateral endoscopic lymphadenectomy, in the remaining 7 it was made open on a side and endoscopic on the other (Table 1).

The monopolar energy source was used in 72.7% of the lymphadenectomies, in the other cases, harmonic scalpel was used. In the patients in whom we used monopolar energy, we had greater care in the dissection close...
Table 1  Demographic and surgical characteristics.

<table>
<thead>
<tr>
<th>Patients</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilateral VEIL</td>
<td>13</td>
</tr>
<tr>
<td>Operated members</td>
<td>33</td>
</tr>
<tr>
<td>Age</td>
<td>51 years (38–80)</td>
</tr>
<tr>
<td>Surgical time</td>
<td>119 min (55–210)</td>
</tr>
<tr>
<td>Days of hospitalization</td>
<td>5 (2–10)</td>
</tr>
<tr>
<td>Resected lymph nodes</td>
<td>8 (3–16)</td>
</tr>
</tbody>
</table>

to the skin, given the increased risk of skin necrosis due to greater heat dissipation. Comparing the surgical complications related to the type of energy used, there were no differences in overall, lymphatic, and skin complications (Table 2).

In all the patients, the lymphadenectomy was performed in a superficial and deep way. The saphenous vein was preserved in 18.2% of the lymphadenectomies, where lymphatic complications were not observed ($p = 0.2$). The internal saphenous vein was preserved in 4 members with non-palpable adenopathies and in 2 with palpable lymph nodes.

The operative time ranged from 55 to 210 min (mean 119 min). Blood loss was minimal, transfusion not being necessary in any of the cases. There were no signs of hypercapnia or significant subcutaneous emphysema, except for one case, as we have already mentioned.

The drainages were removed during admission or in an outpatient way between day 3 and 21 after surgery, after the spending was less than 50 ml in 24 h. The mean hospital stay ranged from 2 to 10 days, recording that the low socio-cultural level of some patients delayed hospital discharge.

The mean resected lymph nodes was 8 (3 to 16 per operated side). Of the 33 operated members, 55% were clinical stage N0 and 45% had palpable nodules even after antibiotic therapy. All the lymph nodes were mobile, being single in 60% and multiple in 40% of the cases. In 10 lymphadenectomies (9 patients) there were positive adenopathies for metastasis (30.3%). The incidence of pathologically involved lymph nodes in patients with clinical stage N0 was 36.3%, and in patients with palpable lymph nodes it was 55.5% (Table 3).

The mean follow-up was 20 months (2–36). No patient had permanent lower limb edema. The overall complication rate was 33.2%, there was 6% skin complications attributed to cellulitis, which resolved with antibiotic therapy. There was no skin necrosis. Lymphatic complications, all attributed to lymphocele, occurred in 27.2%. In only one, open drainage was required, where local recurrence was found, the rest were resolved by puncture.

One patient died of unknown causes and another one of complications of his diabetes. A third patient died in the eighth postoperative month due to pelvic commitment of the tumor, and the fourth one died of local recurrence (patient with high-grade disease and positive lymph nodes) (Table 3).

The overall survival rate was 80% and cancer-specific survival was 90%.

Discussion

The conventional inguinal lymphadenectomy is the gold standard in the oncological control of the main site of penile cancer metastasis.\textsuperscript{1,4,5,11} However, it has a high surgical morbidity.\textsuperscript{2,5,11,12}

The various alternatives to conventional inguinal lymphadenectomy, performed so far, have as a principle reducing morbidity at the cost of reducing the number of adenopathies resected, so they failed to reproduce the oncological results of the conventional technique.\textsuperscript{6,7}

In 2006, the video laparoscopic technique was described with the aim of reducing surgical morbidity, maintaining oncological radicality.\textsuperscript{8} The location of the ports distal to the potentially devitalized skin area by the lymphadenectomy, would theoretically reduce skin complications. With the image magnification, the lymphatic and small vessels are well identified and ligated, promoting adequate lymphostasis and hemostasis, and theoretically reducing the complications.

The initial series described the VEIL in patients without palpable nodules,\textsuperscript{6,10} doubts still persisting about what the limits of endoscopic lymphadenectomy are, in the number and size of palpable nodes, as well as the degree of adhesions to neighboring structures.

Our series includes 45% of the members operated with palpable lymph nodes, 6 being with multiple adenopathies. The incidence of pathologically involved lymph nodes was similar to the literature, both in the group of patients with

Table 2  Complications according to the type of energy used in VEIL.

<table>
<thead>
<tr>
<th>Energy</th>
<th>N\textsuperscript{0} procedures</th>
<th>Overall complications</th>
<th>$p$</th>
<th>Lymphatic complications</th>
<th>$p$</th>
<th>Skin complications</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monopolar</td>
<td>24</td>
<td>6</td>
<td>0.1</td>
<td>6</td>
<td>0.6</td>
<td>0</td>
<td>0.06</td>
</tr>
<tr>
<td>Harmonic</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3  Patients and cancer-specific survival according to nodal involvement.

<table>
<thead>
<tr>
<th>N\textsuperscript{0} patients</th>
<th>pN\textsuperscript{+}</th>
<th>Death of cancer of the penis</th>
<th>Cancer-specific survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cn0</td>
<td>11</td>
<td>4 (36.3%)</td>
<td>91%</td>
</tr>
<tr>
<td>cN\textsuperscript{+}</td>
<td>9</td>
<td>5 (55.5%)</td>
<td>89.9%</td>
</tr>
</tbody>
</table>

\textsuperscript{a}  Positive lymphadenectomy with early inguinal recurrence and multiple implants.

\textsuperscript{b}  Local recurrence with negative lymphadenectomy in one patient (pT3).
clinically negative lymph nodes and those with palpable lymph nodes preoperatively.\textsuperscript{13} The results confirm the possibility of performing lymphadenectomy even with multiple palpable mobile adenopathies, while there is no invasion of vascular structures or the skin.

The energy sources used for the hemostasis in the laparoscopic access are frequent cause of controversy. The use of the harmonic scalpel, as it was described in the original technique, can reduce the surgical time.\textsuperscript{5} On the other hand, the costs are high, it is not available in most services, and it does not seal the lymph vessels. Thus, its superiority over monopolar energy is not confirmed in our series with respect to the effect on postoperative complications. Among the patients who used the harmonic scalpel, there were 2 cases of cellulitis; however, there were no differences between the 2 groups (p = 0.06). This can be justified by a more deliberate use of the harmonic scalpel next to the skin or as a coincidence, since the 2 procedures that developed cellulitis occurred in a patient undergoing bilateral VEIL. The use of metal clips in the ligation of lymph nodes emerges as the most suitable for reducing the incidence of lymphatic complications.

The fact that the incisions are made out of the dissection area, contrary to what happens with conventional surgery, may explain the reduction of skin complications.

The preservation of the internal saphenous vein during inguinal lymphadenectomy was first described in the treatment of neoplasms of the vulva, and it resulted in a reduction in morbidity.\textsuperscript{14} Since then, several papers have been published on open inguinal lymphadenectomy, with saphenous vein preservation for carcinoma of the penis, suggesting a reduction in morbidity, without oncological risks.\textsuperscript{15,16} In this series, the lymphadenectomies in which the saphenous vein was preserved did not have lymphatic complications. Due to the small number of cases with preservation of the vein that we present, it was not possible to conclude whether this maneuver had influence on the lymphatic complications, compared with the cases in which ligation was performed. However, there was no intention of the authors to compare the role of preservation, and there was for its feasibility. Video endoscopic dissection of the internal saphenous vein to the junction with the femoral vein, with ligation or clamping of its tributaries, can be performed without difficulty; however, the presence of a lymph node near its junction can hinder dissection.

Superficial and deep inguinal lymphadenectomy was performed en bloc in all patients. In patients with palpable adenopathies, it was technically more difficult, but it did not prevent video endoscopic dissection, because the nodes were not fixed to adjacent structures. Tumor invasion of the skin or great vessels are formal contraindications for performing this technique.

We consider removal of superficial lymph nodes possible in the first place, with anatomopathological assessment by means of freezing, and depending on the results, performance or not of deep lymphadenectomy.

The mean operative time of 119 min for conducting bilateral lymphadenectomy was higher than the conventional open technique, and similar to the video endoscopic series.\textsuperscript{9,10} Greater experience of the surgical team will reduce the operative time, especially in the absence of large nodal masses.

Although 45% of the operated members had palpable adenopathies and monopolar energy was used, the overall complication rates (33.2%) were similar to the previously published video endoscopic series.\textsuperscript{9,10} There was no skin necrosis, which reinforces the great advantage of this technique for reducing the morbidity of lymphadenectomies. Lymphatic complications (27.2%) such as lymphorrhoea and lymphocele were similar to previous video endoscopic series and to open surgery.\textsuperscript{2,5,9-12} The role of the preservation of the saphenous vein in reducing lymphatic complications needs to be better defined.

This series confirms, the same as previous works, that the VEIL makes it possible to reproduce the oncological radicality of open surgery. The number of nodes removed was equivalent to previous VEIL and open surgery series.\textsuperscript{2,5,9-12} The presence of a single inguinal relapse in 33 lymphadenectomies performed, and 80 and 90% overall and specific mortality, respectively, is comparable to what happened with open surgery, and refers to the oncological safety of this procedure.

Conclusions

The VEIL in the complementary treatment of cancer of the penis is a safe and reproducible procedure, being an alternative to conventional lymphadenectomy. The patients with palpable adenopathies may benefit from this technique. Preserving the internal saphenous vein, as well as using monopolar energy, seem to be viable when performing VEIL. The oncological results are suitable, although it takes longer follow-up time. The publication of larger series will allow for better evaluation of the results and the reproducibility of the technique.

Conflict of interest

The authors declare that they have no conflict of interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.acuroe.2012.11.005.

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