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ORIGINAL ARTICLE – MELANOMAS

Initial Experience with Videoscopic Inguinal Lymphadenectomy

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ABSTRACT

Background. Inguinofemoral lymphadenectomy is associated with frequent and marked incision-related morbidity. Our initial feasibility study of videoscopic inguinal lymphadenectomy (VIL) for melanoma showed appropriate nodal yield and anatomic dissection. Although a limited suprafascial dissection has been reported in the urologic literature, we report our growing experience with VIL applying a comprehensive approach to dissection.

Methods. Patients with inguinal metastases from varied malignancies were offered VIL. With institutional review board approval, procedures were performed via three ports: one at the apex of the femoral triangle, a second medial to the adductor, and a third lateral to sartorius. Femoral vessels were skeletonized, and all lymphatic tissue within the femoral triangle to 5 cm up onto the external oblique aponeurosis was resected. Specimens were removed through the apical port via a specimen bag. Clinicopathologic and perioperative outcome data were recorded.

Results. Forty-five VILs were performed in 32 patients: 19 had unilateral VILs, and 13 had bilateral VILs for neuroendocrine, extramammary Paget disease, or varied genitourinary malignancies. Nine procedures (20%) were performed in women. Median age was 61 (range 16–87) years. Median body mass index was 30 (range 19–53). Median operative time was 165 (range 75–245) minutes, median length of stay was 1 (range 1–14) day, and median drain duration was 15 days. Median number of collected nodes was 11 (range 4–24), and the largest node removed was 5.6 cm in size. Wound complications were observed in 8 cases (18%). Six patients (13%) developed cellulitis without any wound dehiscences, 1 patient developed a seroma, and 1 patient with diabetes had mild skin flap necrosis, which resolved with minimal local care.

Conclusions. VIL is an alternative approach to traditional open inguinal lymphadenectomy. In our growing experience, node retrieval is appropriate and wound complications are substantially fewer than reported via an open approach. Further comparative analysis of VIL and traditional inguinofemoral lymphadenectomy is being pursued in a randomized, prospective trial.

Inguinal lymphadenectomy for metastatic cutaneous, genitourinary, and occasional other rare tumors is the standard of care and offers excellent control of regional disease. Unfortunately, the procedure has been noted to have a high risk of complications.[1–7] A videoscopic approach to inguinal lymphadenectomy has recently been shown to be a feasible option for potentially reducing the complications of groin surgery.[8] Although this approach has been published in the urology literature, a recent article describes the feasibility of the use of the more extensive anatomic dissection typically used to treat patients with metastatic melanoma.[9,10] Inguinal lymphadenectomy (inguinofemoral dissection, superficial groin dissection, groin dissection) for melanoma includes removal of all fibrofatty tissue within the femoral triangle, as defined by the inguinal ligament, the sartorius muscle, and the adductor longus. Dissection typically continues superiorly 5 cm above the inguinal ligament to include of all of the node-bearing tissue superior to the inguinal ligament but superficial to the external oblique aponeurosis. For most genitourinary tumors, dissection is typically limited to the tissues superficial to the deep fascia of the thigh and those surrounding the saphenofemoral junction; however, for melanoma, this and all tissue deep to the fossa ovalis and medial to the femoral vein, extending superiorly to the femoral canal, are routinely resected.

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In 2009, we first reported a modification of the approach described by Tobias-Machado et al. to allow for the dissection that would be anatomically appropriate for melanoma.[11] In the current report, we present our experience with the initial 45 procedures performed using the modified, more comprehensive lymphadenectomy typically used to treat patients with melanoma.

PATIENTS AND METHODS

Patients

Patients with inguinal metastases from any malignancy were offered the option of videoscopic inguinal lymphadenectomy (VIL). Risks and benefits of groin dissection, including but not limited to, lymphocele, prolonged lymphorrhea, thromboembolic events, lymphedema, neuromuscular damage, and hemorrhage, were discussed with each patient before operation. Furthermore, the potential for incomplete lymphadenectomy was discussed. The fact that this was a novel way to perform this procedure was discussed with patients in detail, as was the fact that specifically as a result of its novelty, some of the risks may not be clearly anticipated. The results of the initial five feasibility patients reported previously were discussed with all patients interested in this approach. The report of the data was reviewed under the guidelines of the Emory University institutional review board.

Procedure

The details of the procedure have been described elsewhere.[8,11] In brief, patients are placed on a split-leg table. If a bilateral procedure is planned, both groins are prepared and draped and both hips are externally rotated and flexed so that the patient is almost in a frog-leg position. If a unilateral procedure is planned, one leg is left straight, and the operative hip is externally rotated and flexed. Knees and ankles are supported and padded on all operative limbs. The groin is anatomically marked, and three ports are placed as described previously. If the patient was diagnosed by either excisional biopsy or sentinel lymph node biopsy, the scar is left intact. Once the dissection is completed, the specimen is removed by placing it in a specimen bag and removing it through the apical port. A drain is placed through the medial trocar site.

Postoperative Care

Patients ambulate the day after surgery and are routinely discharged this day as well. In cases where additional procedures are performed (concurrent pelvic lymphadenectomy, resection of extensive primary disease) or complications are evident, patients may remain in the hospital longer. Patients are permitted to shower, and wounds are not dressed after postoperative day 1. Drains are managed by the patient and are left in place until they drain <30 ml daily.

Outcome Measures

Clinical and pathologic variables were recorded, including demographic information, body mass index (BMI), tumor histology, node counts, number of metastatic nodes, size of the largest metastatic node, and, if appropriate, non–sentinel node involvement. Incidence and nature of wound infection, duration of drain usage, length of stay, operative time, and readmission rates were also recorded. In this analysis, lymphedema was only recorded via subjective reporting, not via objective measurements.

RESULTS

Patient Demographics and Clinicopathologic Data

Forty-five procedures were performed in 32 patients. Thirteen patients had bilateral groin dissections and 19 had unilateral procedures. Twenty-three procedures (11 bilateral and 1 unilateral) were for either penile or scrotal carcinoma, 2 for a metastatic neuroendocrine carcinoma of the anus, and 2 for extramammary Paget disease. Eighteen procedures were for melanoma.

Median age was 61 (range 16–87) years, and 9 patients (20%) were female. Median BMI was 30 (range 19–53). Twenty-three patients (51%) had microscopic disease; the remainder was detected by imaging, clinical examination, or excisional biopsy (Table 1). Analyzing the melanoma patients independently because they represent a unique data set demonstrated a median age of 55 years, 9 women (50%), 13 diagnosed via sentinel lymph node biopsy, and 16 (89%) with primary disease in an extremity. In the melanoma group, median Breslow depth was 2.8 (range 0.6–9.9) mm, ulceration was present in 8 patients (44%), and all (100%) were Clark's IV or higher (Table 2).

Operative Outcomes

Median operative time was 165 min (2.75 hours) with a range of 75–245 minutes. Median length of stay was 1 day with a mean of 3.1 days. Three patients were hospitalized for longer periods because they underwent additional procedures (pelvic lymphadenectomy or synchronous penectomy) for which it is our standard to keep them in the hospital longer than for an isolated inguinofemoral lymphadenectomy. Two patients were hospitalized longer as a

TABLE 1 Clinicopathologic data for 45 procedures performed in all patients undergoing videoscopic groin dissection

Characteristic	Value
Median age, years (range)	61 (16–87)
Female sex, *n* (%)	9 (20%)
Median body mass index (range)	30 (19–53)
Microscopic disease, *n* (%)	23 (51%)
Histologic type, *n* (%)	
Penile	19 (42%)
Melanoma	18 (40%)
Scrotal/urethral	4 (9%)
Nonmelanoma, nongenitourinary	4 (9%)

TABLE 2 Clinicopathologic data for 18 patients undergoing videoscopic groin dissections specifically for melanoma

Characteristic	Value
Median age (years)	55
Female sex, *n* (%)	9 (50%)
Sentinel node positive, *n* (%)	13 (72%)
Primary location, *n* (%)	
Extremity	16 (89%)
Trunk	2 (12%)
Median Breslow depth (mm) (mean)	2.8 (3.77)
Breslow depth range (mm)	0.6–9.9
Clark's level IV or V, *n* (%)	18 (100%)
Ulceration, *n* (%)	8 (44%)

result of complex social situations; one patient was hospitalized as a result of a resistant cellulitis and the need for intravenous antibiotics.

Intraoperatively, three patients developed markedly increased end-tidal CO_2 levels. One patient was treated successfully by anesthesia and was able to maintain levels in the low 60s, and one patient had elevations into the high 70s, but by intermittently decompressing the operative field, the procedure was successfully completed; however, one patient (a 52-year-old woman with no comorbidities) developed levels in the high 70s midway through the procedure, and despite efforts to control this, the decision was made to convert to an open procedure. She is reported as one of the conversions below.

Conversion to Open Procedures

Two (4%) of 45 procedures were converted to an open approach, one the result of high end-tidal CO_2 levels and the other the result of unclear anatomy. This second patient had a restricted range of motion at the hip and knee because of her advanced age, compounded by a complex wound from the resection of her primary melanoma, which had been performed elsewhere. As a result of this restricted range of motion, operative positioning was compromised, and this made external anatomic landmarking confusing. This patient had clinically detected disease, and as a result of concerns that the dissection may have been anatomically suboptimal, we converted to an open procedure through a limited incision to ensure an adequate lymphadenectomy.

Pathology and Follow-up

The median node count was 11 with a mean of 11 and a range of 4 to 24. Thirty-three (73%) of 45 procedures had a node yield of 8 or greater, and with experience, we have recognized aspects of the procedure that may have contributed to a lower yield earlier in the program. Eight procedures yielded node counts of $\geq$15. The largest lymph node removed was 5.6 cm, requiring an extension of the apical port by a few millimeters to successfully remove it from the field. Median drain duration was 15 days with a range of 7–25 days. One patient required placement of a Seroma-Cath after drain removal, and one patient had persistent drainage from a punctate defect in the skin at an area of focal necrosis. Eight (18%) of 45 procedures had complications in total: the patients previously mentioned, who had a seroma and focal skin necrosis, and 6 additional patients who developed cellulitis. Two patients had to be admitted for intravenous antibiotics to manage their cellulitis. No patient had a wound breakdown or dehiscence despite cellulitis or focal superficial skin necrosis.

At longer follow-up, 2 (11%) of 18 patients had lymphedema necessitating the use of a compression stocking. Remarkably, no other melanoma patients had subjectively clinically important lymphedema.

DISCUSSION

Inguinal lymphadenectomy (groin dissection, inguinofemoral lymphadenectomy) remains the standard of care for patients with nodal metastases to the groin from most malignancies. Unfortunately, recent data demonstrate that only 50% of patients with metastatic melanoma actually undergo this recommended procedure, a statistic that may largely reflect the high incidence of complications that patients experience from the surgery.[12] Several studies from large centers have demonstrated that inguinal lymphadenectomy is associated with a complication rate as high as 50%, even in centers where the procedure is routinely performed (Table 3).[2–7,13–15] A high proportion of these complications are related to the wound, with wound dehiscence (Fig. 1) being common enough to prompt most melanoma surgeons to routinely use a sartorius muscle flap to protect potentially exposed femoral vessels.

TABLE 3 Review of wound complications from several reported series in the literature

Study	Year	No. of patients	Overall wound complications (%)	Wound dehiscence (%)
Shaw and Rumball [3]	1990	58	43	17
Beitsch and Balch [13]	1992	168	51	26
Strobbe et al. [7]	1999	71	32	15
De Vries et al. [14]	2006	14	35	7
van Akkooi et al. [15]	2007	129	29	NS
Sabel et al. [2]	2007	212	19	NS
Mortenson et al. [6]	2008	30	NS	44
Poos et al. [4]	2009	129	21	18

NS not specified

FIG. 1 Open inguinal incision after wound dehiscence

It is noteworthy that although the current report describes a per-procedure complication rate, if we are to consider the results per patient, a remarkable reduction in complication risk is still observed, with only 8 (25%) of 32 patients in the current series of VILs experiencing complications. At our institution, where inguinal lymphadenectomy is routinely performed for several malignancies, the open approach has yielded results similar to those reported in the literature. A retrospective analysis of all patients undergoing inguinal lymphadenectomy for melanoma using an open approach for the 2 years before our current series of VIL identified 17 (43%) of 40 patients as having complications directly related to the open-approach incision. This analysis excluded lymphedema as a complication and only identified issues related to the surgical site. Interestingly, in this group of patients, 5 (12.5%) required readmission to the hospital, and 2 (5%) had complete wound dehiscences requiring a wound vacuum assisted closure (VAC). When this group is used as a comparison of our institutional experience with groin dissection, the outcomes of the reported cohort perhaps becomes even more important.

Since the publication of the randomized trial comparing oncologic outcomes of laparoscopic versus open colectomy for colon cancer, the use of a minimally invasive approach to malignancy has been accepted.[16] When a three-port approach is used, as has been described previously, the groin incision can essentially be eliminated.[8,11] Recognizing the important role that the incision plays in contributing to complications, VIL may offer improved outcomes with respect to complications. The current study does not reflect a randomized trial but provides some insight using a prospectively collected data set to offer a comparison to historical data. The present analysis demonstrates a wound dehiscence rate of 0% compared to historical highs of 26% reported by some authors.[13] Furthermore, in this initial experience, we noted cellulitis in only 13% of our patients. Importantly, in our initial experience, patients with erythema were empirically treated for cellulitis, despite the absence of fever and/or an elevated white blood cell count. In our growing experience, we have since come to recognize that an initial erythematous response is not uncommon after the dissection and that this does not, in fact, routinely represent cellulitis. Despite this, because we could not fairly go back and retrospectively prove that patients treated with antibiotics would have improved with observation alone, we have included the 2 patients treated empirically in that fashion as if they had true wound infections. We now use additional symptoms to indicate an actual infection: increasing pain, the presence of erythema outside of the dissection field, fever, elevated white blood cell count, or the development of erythema after the immediate perioperative normalization of skin color.

Comparison of the open incision to the VIL approach demonstrates the remarkable contrast between the two approaches (Fig. 2). Although not a measured endpoint in this analysis, patients seem to have a better quality of life and a quicker return to normal activity after VIL when compared to the open technique. We have also noticed a

FIG. 2 Side-by-side comparison between (**a**) open inguinal incision and (**b**) three-port videoscopic scars. In the patient who underwent the videoscopioc approach, the healed sentinel lymph node biopsy scar is visible at the level of the groin crease

remarkable decrease in the reported incidence of lymphedema in patients undergoing VIL instead of open surgery. Interestingly, in the 5 patients undergoing therapeutic lymphadenectomy for clinically detected recurrences of melanoma, none developed lymphedema. We speculate that the reduction in wound complications, particularly infection and the maintenance of intact dermal lymphatics, may contribute to this observation. The objective measurement of lymphedema and quality of life will be analyzed as endpoints in a prospective, randomized trial that is currently under way at our institution.

Some of the challenges with groin surgery are exacerbated by obesity. Because of body habitus, it is even more difficult to maintain a clean and dry wound in patients with higher BMIs (characterized as >25 in one study), which leads to an increased risk of wound complications.[2,4] The median BMI for this patient group was 30, demonstrating that by some authors' accounts, the study population was at an increased risk for wound complications on the basis of body size alone. Over 50% of the procedures in this series were performed in patients with a BMI of 30 or higher. Importantly, the maximum BMI was 53, and this patient underwent a bilateral groin dissection for a metastatic neuroendocrine tumor without subsequent complication.

A final challenge for VIL is tumor size. The minimally invasive approach offers little benefit if the tumor being removed mandates an incision that is similar in size to the incision necessary to perform the procedure through an open approach. Despite this, the ability to resect markedly enlarged nodes is a critical component of the procedure, and we have demonstrated that like most cutaneous wounds, the tissue remains pliable, and as long as a specimen bag is used, fairly large masses can be removed through relatively small incisions. In this series, 3.5- and 4-cm nodes were removed with the use of a specimen bag without having to increase the size of the 12-mm apical port. Similarly, 5-, 5.5-, and 5.6-cm nodes were removed by increasing the size of the apical port by only a few millimeters. Because this wound is remote from the groin crease itself, even in large patients, a port site just over 12 mm is well tolerated and usually only needs to be lengthened to 15 mm to evacuate a mass up to 5.5 cm.

VIL demonstrates promise as an alternative to traditional open surgery. Displacing the wounds away from the groin, eliminating the longer, more extensive incision, and avoiding the need for routine sartorius muscle transposition all seem to contribute to improved outcomes when VIL is used. Incidentally, quality of life and risk of lymphedema both seem to be better with this approach. We are currently comparing VIL and open inguinal lymphadenectomy in a prospective, randomized trial to assess the true differences between the methods.

CONFLICT OF INTEREST The authors declare no conflict of interest.

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