Rapid excision of massive localized lymphedema of the male genitalia with vessel sealing device

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Introduction: *To present a series of patients who underwent surgical treatment for massive localized lymphedema (MLL) of the male genitalia and explore the utility of the LigaSure hemostatic vessel sealing device (VSD) for resection of advanced cases.*

Materials and methods: *Although conservative and microsurgical treatments have been reported, MLL of the male genitalia requires open surgical resection with primary reconstruction. We reviewed our prospectively maintained database of all lymphedema excisions performed between January 2007 and December 2014 comparing resection with Bovie electrocautery to resection with the LigaSure VSD. Our analysis focused on any significant differences in rate of resection, estimated blood loss (EBL), and recurrence.*

Results: *Nineteen patients with MLL of the male genitalia underwent excision with either LigaSure (8 patients) or conventional Bovie electrocautery (11 patients). Rate of resection was significantly faster with LigaSure compared to Bovie (33.74 g/min versus 5.32 g/min, p = .035). Additionally, estimated EBL per gram of tissue resected was decreased in the LigaSure group (0.41 mL/g versus 0.17 mL/g, p = .057). Two of the 11 Bovie patients (18%) had recurrence of lymphedema requiring repeat resection, while none of the LigaSure patients developed recurrence.*

Conclusions: *Resection of genital lymphedema using the LigaSure device offers promising results in managing advanced MLL of the male genitalia with the potential for faster resections, less EBL per tissue resected, and a lower rate of recurrence.*

Key Words: scrotal lymphedema, massive localized lymphedema, vessel sealing device, obesity

Introduction

Lymphedema of the male genitalia is a physically and psychologically debilitating disease, often causing infection as well as urinary and sexual dysfunction.[1] The disease is classically categorized as either congenital (primary) or acquired (secondary).[2] Globally, acquired genital lymphedema affects 25 million men, largely secondary to filarial disease in endemic nations, however this infection is rare in the developed world. Lymphedema secondary to radiation, surgery, and malignancy have all been described.

Massive localized lymphedema (MLL),[3] is a unique entity of lymphedema in the obese population,

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Figure 1. Patient with massive localized lymphedema with abdominopenoscrotal involvement (left). Patient in dorsal lithotomy position with access to posterior scrotum using a specialized retractor (center). Ligasure device used to excise 40 lb lymphedema specimen (right).

Figure 1. The pathophysiology of MLL involves obstruction of lymphatic channels due to external compression from fat folds. On histology, MLL simulates well-differentiated liposarcoma (WDL) with the characteristic feature of fat lobules separated by connective tissue septa. However, MLL's lack of nuclear atypia and clustering of reactive vessels between fat and connective tissue layers differentiates it from WDL and other acquired lymphedemas.[3] Radiologic MLL findings may vary but often show a diffuse reticular soft tissue pattern, hypertrophic skin, and edema.[4] Clinically, MLL features local changes such as early pitting edema transitioning to chronic non-pitting edema and inflammation, as well as skin changes such as thickening, peau d'orange appearance, warty verrucosis, lymphorrhea, frequent cellulitis, and abscesses.[3] If left untreated, MLL may progress to Stewart-Treves syndrome with development of angiosarcoma in the affected tissues.[5]

MLL is slightly more common in women and tends to affect the lower extremities, with involvement of the male genitalia in 11.8% of cases.[4] Due to the unique anatomic challenges and physiologic complications associated with MLL of the male genitalia, as well as surgical risks and challenges presented by the morbidly obese patient, these cases require careful assessment and complex strategic intervention. Similar to other causes of genital lymphedema, MLL rarely responds to conservative measures, necessitating surgical resection in almost all cases. We present a novel approach and our results for these technically challenging cases.

Materials and methods

Study population

We performed a review of our prospectively maintained, institutional review board-approved database of all lymphedema operations performed between January 2007 and December 2014. Two consecutive groups were studied, patients who underwent resection with Bovie electrocautery alone (2007-2011) and patients undergoing resection with the LigaSure vessel sealing device (VSD) (2012-2014). Those with follow up < 3 months were excluded. The two groups were compared based on demographic information, preoperative characteristics, intraoperative measurements, lymphedema location, and recurrence defined as the need for an additional procedure.

Surgical technique

Positioning

Dorsal lithotomy position to allow access to the posterior scrotum for complete resection. Strict attention to pressure points with adequate padding to prevent positional injuries in these high risk patients. It may be necessary to suspend the enlarged scrotum via a specialized table-mounted retractor, Figure 1.

Early identification of penis/testes

Silk traction suture to the glans penis. If phallus is retracted, a dorsal incision of the retracted phallus

tunnel is extended until the glans penis is visualized. Foley catheter is placed once meatus is visualized. Dissection of bilateral spermatic cords to the level of the external inguinal ring and then carried distally to isolate the testes. The testes are freed from their gubernacular attachments and placed outside of the resection field.

Excision of lymphedema via LigaSure

With the penis and both testes/spermatic cords excluded from the field, the lymphedema specimen can be rapidly excised with the LigaSure device, Figure 1. The posterior scrotum is typically uninvolved and is preserved for testes coverage during reconstruction. The resulting defect is brought together with multiple layers of 2-0 monocryl sutures with adjacent tissue transfer as needed, Figure 2.

Buried penis reconstruction

The penopubic angle is re-established with permanent suture anchoring the dorsal tunica at the base of the penis to the rectus fascia at its tendonous attachment to the pubis. Likewise the penoscrotal angle is reestablished via sutures placed to anchor the ventral tunica at the base of the penis to the reconstructed scrotal fascia to provide good phallic projection, Figure 2.

Penile shaft coverage

If penile shaft skin is deficient, a split-thickness skin graft (STSG) is used. Donor site skin from the upper later thigh is harvested with a dermatome set to thickness of 0.015 inches. The donor skin is tapered and secured to the penile shaft with interrupted 4-0 chromic sutures, Figure 2.

Drains and dressings

Non-adhesive dressing is applied to skin graft and negative-pressure wound vac is left in place for 5 days. Subcutaneous drains are left in place for 3 days and intravenous antibiotics are continued until drains are removed.

Results

During the study period, 19 patients with MLL presented for surgical excision, Table 1. Resection using the Bovie was performed on 11 patients and 8 patients underwent excision with the LigaSure. Majority of patients were obese, body mass index (BMI) > 30 with a mean BMI of 31 kg/m^2 (range 21-42) in the Bovie group and 50 kg/m^2 in the LigaSure group (range 38-71). The lymphedema involved penoscrotal alone in 37% (7/19 patients), abdominopenoscrotal in 32% (6/19 patients), scrotal alone 26% (5/19 patients), and penile in 5% (1/19 patients). Depending on the area of tissue involved, both STSG and adjacent tissue transfer (ATT) was performed most commonly in 42% (8/19 patients) followed by ATT in 37% (7/19 patients) and STSG alone in 21% (4/19 patients).

LigaSure patients on average had significantly more tissue excised (6909 g versus 765 g; p value = 0.02), at a more rapid rate of resection (33.7 g/min versus 5.3 g/min; p value = 0.035) when compared to the Bovie patients. Additionally, the estimated blood loss (EBL) per gram of tissue resected was less in those treated with LigaSure compared to Bovie (0.16 cc/g versus 0.41 cc/g; p value = 0.057). Two Bovie patients (18%) had recurrence of lymphedema requiring repeat resection. No LigaSure patient developed a recurrence of lymphedema, however one patient developed an abscess that resolved after surgical drainage in the operating room.

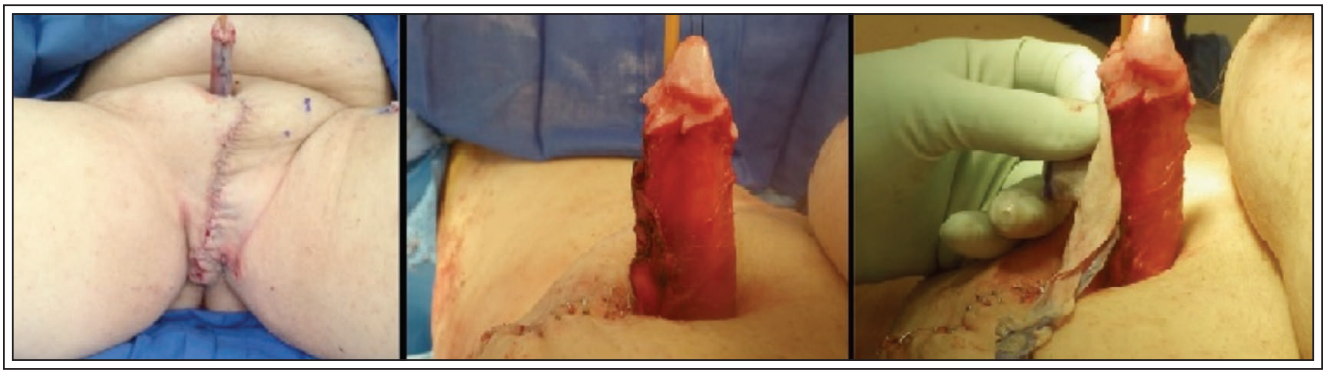

Figure 2. Coverage of excised area with uninvolved posterior scrotal tissue (left). Buried penis reconstruction by re-establishing the penopubic and penoscrotal angles (center). Securing split-thickness skin graft onto penis (right).

TABLE 1. **Patient demographics and results**

	Total	Bovie	LigaSure	p value
No. Case	19	11	8	--
Mean age, years (range)	48	47	49	0.825
Mean BMI (kg/m^2)	39	31	50	0.001
Location, no. (%)				
Penile	1/19 (5%)	1/11 (9%)	0/8 (0%)	
Scrotal	5/19 (26%)	3/11 (27%)	2/8 (25%)	
Penoscrotal	7/19 (37%)	4/11 (36%)	3/8 (37.5%)	
Abdominopenoscrotal	6/19 (32%)	3/11 (27%)	3/8 (37.5%)	
Procedure, no. (%)				
Adjacent tissue transfer	7/19 (37%)	6/11 (55%)	1/8 (17%)	
Split thickness skin graft	4/19 (21%)	3/11 (27%)	1/8 (17%)	
Both	8/19 (42%)	2/11 (18%)	6/8 (75%)	
Mean specimen weight, g	3016	765	6909	0.023*
Mean EBL, cc	379	218	546	0.128
Rate of resection, g/min	19.9	5.3	33.74	0.035*
EBL per weight resected, cc/g	0.31	0.41	0.17	0.057
Mean follow up, months (range)	44 (3-96)	60 (24-96)	18 (3-29)	0.001*
Recurrence, no. (%)	2/19 (11%)	2/11 (18%)	0/8 (0%)	0.256

Discussion

It is important to acknowledge that conservative measures are often taken to treat MLL in its early stages. These measures may include non-surgical interventions, such as complete decongestive therapy (CDT)[6] and the use of male genitalia lymphedema-specific compression garments,[7] or physiological operations aimed at increasing the transport capacity of lymphatic fluid and improving lymph stasis.[8] Unfortunately, most MLL cases present at an advanced stage in which conservative management and physiological surgery is no longer feasible.[4] For example, chronic edema may lead to a degree of fibrosis that renders lymphatic channels unsuitable for anastomosis.[9] Ultimately, in over 80% of reported MLL cases, excisional surgery involving resection and reconstruction is required.[4]

Invasive surgical management of MLL requires a multidisciplinary approach, and a step-wise reconstructive process. Extensive resection of lymphedematous tissue is the first step in surgical management with typically uninvolved posterior scrotal tissue preserved for thermoregulation.[10] Often MLL patients will present with penile skin loss due to buried penis, which the literature suggests can be most effectively covered with STSG.[11] Additionally, negative pressure wound therapy (NPWT) applied over the STSG decreases lateral tension, prevents fluid accumulation, promotes angiogenesis and the formation of granulation tissue through microdeformational strain, and may promote lymphangiogenesis.[12,13] Recreating penoscrotal and penopubic junctions is also critical in achieving successful reconstruction.[14]

Rapid excision with LigaSure

Surgical resection for lymphedema is successful where conservative measures fail. However invasive surgery in the obese population carries increased risk due to the many associated comorbidities.[15] MLL patients' morbid obesity greatly increases the risks of perioperative complications associated with anesthetization as well as the probability of positional injury.[16] Decreasing procedural time, and thus time under anesthesia, may mitigate some of the increased risk. Minimizing resection time—the focus of our study—reduces the amount of time patients spend on the operating table without altering or compromising reconstructive methods.

Additional benefits of VSD

VSDs incorporates an advanced technology that senses the tissue's resistance and cauterizes tissue with a

specific voltage. Furthermore, it utilizes both bipolar technology and mechanical pressure to efficiently form a coagulum. Studies in animal models have shown that LigaSure is the most effective VSD in terms of mean time to seal and burst pressure.[17] Other reports have also documented decreased operative times with LigaSure during various procedures that were performed open, closed, or with another electrocautery device.[18]

Our results support prior findings that LigaSure greatly increases excisional speed and burst pressure value, reduces collateral thermal effect and tissue injury, and seals vessels up to 6 mm in diameter.[17,18] In addition to reducing operating time, resection with LigaSure leaves behind less devitalized tissue and seals more reliably than Bovie electrocautery, thereby promoting a more favorable resection bed for healing. LigaSure thus provides promising results in the management of MLL and should be considered the standard resection device in such cases.

Limitations

Although MLL of the male genitalia has become more prevalent due to the rising incidence of morbid obesity, it is still a rare condition and therefore it is difficult to analyze a large sample size. Advanced cases cause significant detriment to quality of life and require surgical excision of the lymphedematous tissue, which is often a uniquely challenging surgical exercise. While it is possible that the latter group of patients (LigaSure) had more favorable outcomes than the former due to additional surgical experience, our impression is that the surgical resection device itself was the predominant enhancement. To our knowledge, this is the largest single series of scrotal lymphedema patients. Patient reported outcomes for sexual and urinary function were not performed and this represents an area for future analysis in these patients.

Conclusion

LigaSure VSD shows increased rate of resection and decreased EBL when compared to Bovie without compromise in outcome or recurrence. □

References

1. Torio-Padron N, Stark GB, Foldi E, Simunovic F. Treatment of male genital lymphedema: an integrated concept. *J Plast Reconstr Aesthet Surg* 2015;68(2):262-268.
2. McDougal WS. Lymphedema of the external genitalia. *J Urol* 2003;170(3):711-716.
3. Farshid G, Weiss SW. Massive localized lymphedema in the morbidly obese: a histologically distinct reactive lesion simulating liposarcoma. *Am J Surg Pathol* 1998;22(10):1277-1283.
4. Chopra K, Tadisina KK, Brewer M, Holton LH, Banda AK, Singh DP. Massive localized lymphedema revisited: a quickly rising complication of the obesity epidemic. *Ann Plast Surg* 2015; 74(1):126-132.
5. Lee R, Saardi KM, Schwartz RA. Lymphedema-related angiogenic tumors and other malignancies. *Clin Dermatol* 2014; 32(5):616-620.
6. Lerner R. Complete decongestive physiotherapy and the Lerner Lymphedema Services Academy of Lymphatic Studies (the Lerner School). *Cancer* 1998;83(12 Suppl American):2861-2863.
7. de Godoy JM, Facio FN Jr, de Carvalho EC Godoy MDE F. New compression mechanism in penile-scrotal lymphedema and sexual rehabilitation. *Urol Ann* 2014;6(1):88-90.
8. Baumeister RG, Siuda S, Bohmert H, Moser E. A microsurgical method for reconstruction of interrupted lymphatic pathways: autologous lymph-vessel transplantation for treatment of lymphedemas. *Scand J Plast Reconstr Surg* 1986;20(1):141-146.
9. Brotherhood HL, Metcalfe M, Goldenberg L, Pommerville P, Bowman C, Naysmith D. A surgical challenge: Idiopathic scrotal elephantiasis. *Can Urol Assoc J* 2014;8(7-8):E500-E507.
10. Steinberg J, Kim ED, McVary KT. A surgical approach to penoscrotal lymphedema. *J Urol* 1996;156(5):1770.
11. Black PC, Fridrich JB, Engrav LH, Wessells H. Meshed unexpanded split-thickness skin grafting for reconstruction of penile skin loss. *J Urol* 2004;172(3):976-979.
12. Stokes TH, Follmar KE, Silverstein AD et al. Use of negative-pressure dressings and split-thickness skin grafts following penile shaft reduction and reduction scrotoplasty in the management of penoscrotal elephantiasis. *Ann Plast Surg* 2006; 56(6):649-653.
13. Wilkes R, Zhao Y, Kieswetter K, Haridas B. Effects of dressing type on 3D tissue microdeformations during negative pressure wound therapy: a computational study. *J Biomech Eng* 2009;131(3):031012.
14. Alter GJ. Surgical techniques: surgery to correct hidden penis. *J Sex Med* 2006;3(5):939-942.
15. Bamgbade OA, Rutter TW, Nafu OO, Dorje P. Postoperative complications in obese and nonobese patients. *World J Surg* 2007; 31(3):556-560; discussion 561.
16. Joshi GP, Ahmad S, Riad W, Eckert S, Chung F. Selection of obese patients undergoing ambulatory surgery: a systematic review of the literature. *Anesth Analg* 2013;117(5):1082-1091.
17. Lamberton GR, Hsi RS, Jin DH, Lindler TU, Jellison FC, Baldwin DD. Prospective comparison of four laparoscopic vessel ligation devices. *J Endourol* 2008;22(10):2307-2312.
18. Tan EK, Cornish J, Darzi AW, Papagrigoriadis S, Tekkis PP. Meta-analysis of short-term outcomes of randomized controlled trials of LigaSure vs. conventional hemorrhoidectomy. *Arch Surg* 2007;142(12):1209-1218; discussion 1218.
19. Landman J, Kerbi K, Rehman J et al. Evaluation of a vessel sealing system, bipolar electrosurgery, harmonic scalpel, titanium clips, endoscopic gastrointestinal anastomosis vascular staples and sutures for arterial and venous ligation in a porcine model. *J Urol* 2003;169(2):697-700.