

Lymphovenous Bypass Using Indocyanine Green Mapping for Successful Treatment of Penile and Scrotal Lymphedema

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Summary: Male genital lymphedema is a debilitating condition with significant physiologic and psychologic ramifications. Classical surgical treatments for male genital lymphedema include primarily ablative procedures through removal of excess soft tissue, which often have poor aesthetic and functional outcomes. Super microsurgical techniques (including lymphovenous bypass and lymph node transfers) are promising contemporary interventions. In this case report, we aim to share our experience of lymphovenous bypass with indocyanine green (ICG) lymphangiography in the management of penile and scrotal lymphedema. We performed ICG lymphography of the male genitalia and right thigh by injecting ICG at multiple sites followed by concomitant evaluation with a handheld fluorescent portable imager. Skin incisions were designed over the linear lymphatics upstream from the site of obstruction and dermal backflow. Four end-to-end and one end-to-side lymphovenous bypasses were performed. After completion, lymphovenous bypasses patency was confirmed by injecting ICG proximal to the incision and observing flow. At 10-month clinic follow-up, the patient showed marked improvement with improved skin tenting, softer tissues, improved sensation, visible dorsal penile vein, ability to retract foreskin for cleaning, and confidence to engage in sexual activities. This case report describes successful use of lymphovenous bypass in the treatment of penile and scrotal lymphedema using ICG lymphography intraoperatively to map functioning of superficial lymphatics. The full potential of this microsurgical approach is yet to be discovered, and future studies are needed to enhance the long-term outcomes for the treatment of penoscrotal lymphedema. (*Plast Reconstr Surg Glob Open* 2020;8:e2938; doi: [10.1097/GOX.0000000000002938](https://doi.org/10.1097/GOX.0000000000002938); Published online 24 July 2020.)

INTRODUCTION

Male genital lymphedema is a debilitating condition with significant physiologic and psychologic ramifications. Classical surgical treatments for male genital lymphedema include primarily “ablative” procedures through removal of excess soft tissue, which often have poor aesthetic and functional outcomes.^{1,2} Lymphovenous bypass and vascularized lymph node transplants are microsurgical techniques typically used to manage lymphedema of the extremities. Lymphovenous bypass includes the

anastomoses of lymphatic vessels to adjacent subdermal venules to permit or “bypass” lymphatic drainage into the venous circulation. Originally described in 1985, few reports have been published on lymphovenous bypass for the treatment of primary or secondary male genital lymphedema.³ Aulia⁴ performed a recent review of surgical management for male genital lymphedema and found that while both ablative and physiologic surgeries provided some symptom relief, lymphovenous bypass cases had no recurrence of symptoms at 1-year follow up, compared with rates up to 25% in the ablative group. To our knowledge, few reports have described the utilization of indocyanine green (ICG) lymphangiography for intraoperative planning in male genital lymphedema surgery.² ICG fluorescence lymphangiography can be used to provide real-time, high-resolution intraoperative visualization of the functioning lymphatic system while avoiding exposure to ionizing radiation.³ Further, ICG lymphangiography can provide a snapshot of nonfunctional lymphatics

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This work was conducted in accordance with ethical standards.

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and facilitate the localization of potential target areas for lymphovenous bypass. In this case report, we aim to share our experience of lymphovenous bypass with ICG lymphangiography in the management of penile and scrotal lymphedema.

CASE PRESENTATION

A 27-year-old man presented with a 2-year history of penile and scrotal lymphedema. He reported significant pain and discomfort performing manual work, locoregional numbness, poor foreskin hygiene, difficulty wearing clothes, and sexual dysfunction. The patient had previously been evaluated by 2 urologists and infectious disease specialists. Evaluations including computed tomography, hemogram, complete blood count, urinalysis, urine culture, and electrocardiogram were normal. Interventions included a 2-week course of furosemide without improvement of symptoms. The patient was further evaluated and treated by a lymphedema therapist without significant improvement. The lymphedema continued to worsen with eventual progression and involvement of the proximal right thigh.

Preoperatively, the patient underwent lymphoscintigraphy with injection of Tc-99m tilmanocept, which revealed obstruction with compensatory collateral flow of bilateral inguinal regions. The patient was scheduled for intraoperative lymphangiography and lymphovenous bypass. Intraoperatively, ICG lymphography was performed on multiple injection sites, including the right hemiscrotum, ventral penis, dorsal penis, right foot first web space, right medial ankle, and right medial thigh. The 6 injection sites were administered with 0.1 mL of ICG at each respective location, and fluorescence lymphography was performed using a handheld portable imager (SPY Portable Handheld Imager, Styker, Kalamazoo, Mich.). **Figure 1** demonstrates the mapped lymphatic flow in red and planned incision markings in blue. Linear flow from the genital injection sites was followed to the right groin, where abnormal retrograde flow into the dermis and right thigh was noted. Significant dermal backflow into the dermis of the penis and scrotum was also noted. Lymphography of the right leg was performed by injection of the foot first web space, which revealed linear lymphatics until marked dermal backflow was again noted in the proximal right thigh. Skin incisions were designed over the linear lymphatics upstream from the site of obstruction and dermal backflow. After injection of 1% lidocaine with 1:100,000 epinephrine, isosulfan blue was injected upstream to each incision to identify the lymphatics. Four end-to-end and one end-to-side lymphovenous bypasses were performed. The end-to-side anastomosis was performed at the base of the right hemiscrotum. After completion, patency without leak was confirmed by injecting ICG proximal to the incision and observing flow using the ICG camera on the microscope. The patient was discharged home the same day, with instructions to continue aspirin 325 mg for 30 days, maintain penoscrotal elevation, and follow-up in clinic. At 10-month clinic follow-up, the patient showed marked improvement with improved skin tenting, softer

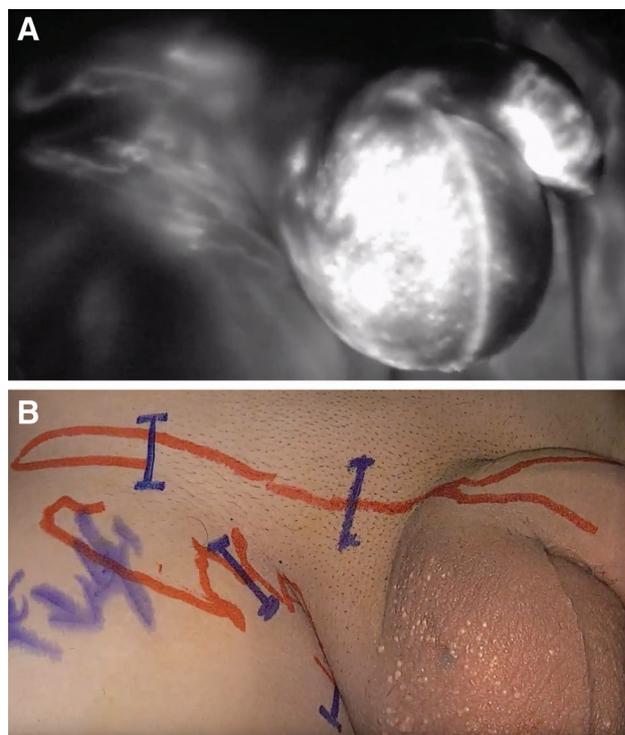


Fig. 1. Intraoperative ICG lymphatic mapping and incision planning. A, ICG lymphography demonstrates linear lymphatics and areas of dermal backflow. B, Red marking indicates linear lymphatics, and blue marking indicates final planned incisions.

tissues, improved sensation, visible dorsal penile vein, ability to retract foreskin for cleaning, and confidence to engage in sexual activity. **Figure 2** demonstrates a side-by-side comparison of patient photographs taken on the day of surgery and taken after 10-month follow-up. The patient was able to return to all normal activities and was pleased with the results of surgery.

DISCUSSION

As initially described by Sappey and Mascagni, the superficial and deep lymphatic pathways provide 2 options for lymphovenous shunting in the male genital region.¹ In a series of 3 patients, Otsuki et al supported utilization of the higher caliber, deep lymphatic system as opposed to the potentially degenerated superficial lymphatic system as described by Mukenge and Huang in separate years prior.^{1,3,5} However, deep inguinal lymphatics are close in proximity to the femoral vessels, potentially increasing the risk of iatrogenic injury during exploration. With utilization of ICG lymphography, we identified and used the functioning superficial lymphatic vessels in a single male patient with secondary penoscrotal lymphedema similar to lymphography evaluation previously described by Yamamoto et al.⁶ Due to the visible superficial linear lymphatics, we elected to proceed with multiple lymphovenous bypasses for the treatment of penoscrotal lymphedema as previously described in the literature.⁷

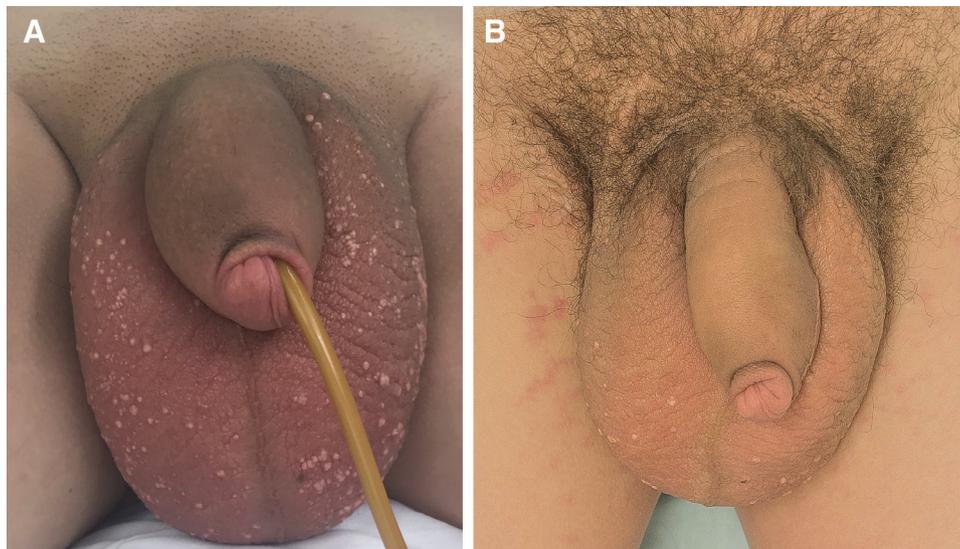


Fig. 2. Preoperative and postoperative comparison of the patient's genitalia. A, Anterior view of penis and scrotum on the day of surgery. B, Anterior view of penis and scrotum on postoperative 10-month clinical follow-up.

Guiotto et al⁸ performed a systematic review of outcomes after genital lymphedema surgery, which examined 20 published reports, including a total of 151 patients. Three main surgical treatment groups were identified, including resection and primary closure or skin graft, resection followed by flap reconstruction, and lymphovenous bypass. Lymphovenous bypass was found to have the lowest complication rate (9%), but it was only performed in 14.5% of the total cases. The study highlighted the lack of consensus recommendations for preoperative assessment and surgical management of patients with genital lymphedema.⁸ Based on our limited experience in genital lymphedema surgery, we advocate that ICG lymphography is a reliable method to characterize both normal and abnormal lymphatic flow, as well as provide microsurgeon's assistance in selecting sites for lymphovenous bypass within the superficial lymphatic system.

CONCLUSIONS

This case report describes successful use of lymphovenous bypass in the treatment of penile and scrotal lymphedema using ICG lymphography intraoperatively to map functioning superficial lymphatics. The full potential of this microsurgical approach is yet to be discovered, and future studies are needed to enhance the long-term outcomes for the treatment of penoscrotal lymphedema.

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