The Nodovenous Shunt and Reduction Surgery for Post-Filarial Lymphedema—Surgical Technique and Clinical Outcomes

Jonathan Victor¹ Tovia Stephen² Devajyoti Guin³ Joseph Victor⁴

¹Department of Plastic Surgery, Pondicherry Institute of Medical Sciences, Kalapet, Pondicherry, India

²Department of Community Medicine, Pondicherry Institute of Medical Sciences, Kalapet, Pondicherry, India

³Department of Microsurgery, Tata Medical Center, Kolkata, West Bengal, India

⁴Department of Plastic Surgery, Vinodhagan Memorial Hospital, Thanjavur, India

Address for correspondence Devajyoti Guin, MBBS, MS, MCh, DNB, Department of Microsurgery, Tata Medical Center, Kolkata 700160, West Bengal, India (e-mail: devajyotiguin@gmail.com).

Indian J Plast Surg:2021;54:75–81.

Abstract

Background Most of the patients in our Indian setting present with grade 4 lymphedema in which no other surgical option is available and in these debilitating cases the nodovenous shunt followed by reduction surgery provides acceptable outcomes. We would like to describe the surgical technique used for the nodovenous shunt procedure and debulking surgery done in post-filarial lymphedema and share our experience with clinical outcomes.

Materials and Methods This was a descriptive study. The study period was from 2010 to 2019. Patient records were reviewed retrospectively, and the data was analyzed. All patients with post-filarial lymphedema, operated by two surgeons, were studied. The surgical technique was described.

Results In the study period, 16 patients with lymphedema were treated surgically. The number of procedures done was 32. In 14 of them nodovenous shunt followed by debulking surgery was done. Two of the patients with post-filarial lymphedema had multiple nodules following secondary skin changes and in them sculpting surgery was done following the nodovenous shunt. Most of the patients presented with grade 4 lymphedema. In all the patients there was significant (>5 cm) reduction in limb circumference postoperatively.

Conclusion Nodovenous shunt followed by reduction surgery for lymphedema is a reliable surgical option to reduce disease morbidity in patients with post-filarial lymphedema.

Keywords

- filarial lymphedema
- lymphatic filariasis
- nodovenous shunt

Introduction

Post-filarial lymphedema impairs quality of life due to recurrent episodes of lymphangitis, secondary skin changes, fungal infections, difficulty to carry out activities of daily living, and in some instances requires amputation of the limb. Surgical procedures are available to decrease the disease burden and improve quality of life. Most of the patients in our Indian setting present

with grade 4 lymphedema in which no other surgical option is available and in these debilitating cases the nodovenous shunt followed by reduction surgery provides acceptable outcomes.

We would like to describe the surgical technique used for the nodovenous shunt procedure and debulking surgery done in post-filarial lymphedema and share our experience with clinical outcomes.

published online
March 2, 2021

DOI <https://doi.org/10.1055/s-0041-1723908>
ISSN 0970-0358.

© 2021. Association of Plastic Surgeons of India.

This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>).

Thieme Medical and Scientific Publishers Pvt. Ltd. A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

Materials and Methods

This was a descriptive study. The study period was from 2010 to 2019. Patient records were reviewed retrospectively, and the data was analyzed. All patients with post-filarial lymphedema operated by two surgeons^{1,2} were studied. Contraindications for surgery included recent lymphangitis within last 3 months and infected skin ulcer.

Surgical Technique

Preoperative skin preparation is a very important step. This is not easy but is essential to have favorable surgical outcomes. We started cleaning the cracks and crevices with lukewarm water and soap from the time of admission. If there was intertrigo in between the toes or skin folds, topical antifungals and a course of systemic antifungals were used.

Nodovenous Shunt

The nodovenous shunt surgery was done under loupe magnification (3.5–4X). The procedure was done under local anesthesia. Spinal anesthesia was used only in obese patients in whom the great saphenous vein might be in a deeper plane. After palpating the femoral artery pulse, an oblique longitudinal incision was made medial to the femoral artery pulsation. The great saphenous vein was then identified and dissected. An inguinal node was identified in the vertical group. Care was taken to not dissect the inguinal node all around as this would jeopardize the vascularity of the node and injure the afferent or efferent lymphatics. On identifying a lymph node, it is dissected just enough to make a window on its surface for the anastomosis.

A window was made on the surface of the lymph node and we looked for good flow of lymph. If the lymph flow was poor, we looked for another lymph node. Then we decided on the type of anastomosis—side-to-side or end-to-side. This depended on the proximity of the node to the vein. For an end-to-side anastomosis, the vein was spatulated. For a side-to-side anastomosis a venotomy was made. Anastomosis was done with 6-0 Prolene or Ethilon using continuous sutures (► Figs. 1–8). In cases of scrotal or vulvar lymphedema, an inguinal lymph node from the horizontal group was chosen for nodovenous shunt.

Manual lymphatic drainage (MLD) or pneumatic pump therapy was started 6 to 8 hours after the nodovenous shunt surgery. The high lymphatic pressure generated will tend to increase flow across the anastomosis and increase patency rates. Tablet aspirin 75-mg OD was given. We did not use injection heparin as the local complications like hematoma formation outweigh the benefits. The limb was kept elevated and patient was instructed strict bedrest, as flexion at the hip could disrupt the anastomosis. Reduction surgery was planned 5 to 7 days after nodovenous shunt. Once the fluid component of the lymphedema significantly reduced and the skin became lax, the debulking surgery was planned.

Reduction Surgery of the Foot

Incision was made along medial aspect of foot extending over the dorsum along the base of toes (► Figs. 8A,B). Elliptical excision was done along the medial aspect. Skin flap was

Fig. 1 Marking the incision medial to the femoral artery pulsation.

Fig. 2 Dissection of the great saphenous vein.

elevated in the plane above the extensor tendons. The fibrotic tissue was debulked. Wedge excision was done in the web spaces between the toes. The incisions were closed over suction drains.

In patients with multiple nodules, “sculpting” surgery was done in which the nodules were shaved off up to the underlying dermis using serial passes with a skin graft harvest handle. After achieving an acceptable contour, the wounds were

Fig. 3 Dissection of the lymph node and making a window in the node.

Fig. 4 End-to-side anastomosis.

Fig. 5 Side-to-side anastomosis (first anastomotic suture tied).

Fig. 6 Illustration of the surgical steps of nodovenous anastomosis.

Fig. 7 Illustration of side-to-side and end-to-side anastomosis of the saphenous vein to the inguinal lymph node.

Fig. 8 (A,B) Incision for reduction surgery of foot (a) medially, (b) on the dorsum.

dressed with a Vaseline dressing. Over the next 2 weeks the wounds re-epithelized.

Reduction Surgery of the Leg

Skin incision-elliptical incision with a planned excision of redundant skin only as much up to which primary closure can be achieved. Flap elevation is done in a plane above the deep fascia of the leg. The flaps were raised till the medial border of tibia anteriorly and up to the tendoachilles posteriorly. Flap

thinning was done leaving the flaps of about an inch thickness near the margins and progressively thicker toward the center. If there was skin redundancy after thinning of flaps—a sliver of skin can be further excised. Closure was done with 2–0 Ethilon after taking few deeper sutures with 2–0 Vicryl. Closure was done over suction drains (►Fig. 9–11).

Following reduction surgery of leg two suction drains are placed, one under the anterior flap and one under the posterior flap. Following reduction surgery of foot, a suction drain is placed under the dorsal flap. The drains are usually kept for 7 to 10 days and removed once the output becomes less than 10 mL over 24 hours.

A Course of Injection Amoxycillin and Clavulanate Was Given for 5 Days Postoperatively

After the wounds were healed in about 3 weeks, Class-3 compression stocking was prescribed. Patients were advised penicillin prophylaxis—Inj. benzathine penicillin 1.2 million units intramuscular once every 3 weeks or tablet penicillin G 400-mg OD and daily foot care.

Results

In the study period, 16 patients with lymphedema were treated surgically (►Table 1). The number of procedures performed were 32. In 14 of them nodovenous shunt followed by debulking surgery was done. Two of the patients with post-filarial lymphedema had multiple nodules following secondary skin changes and in them sculpting surgery was done following the nodovenous shunt.

Nodovenous shunt + debulking surgery = 14.

Nodovenous shunt + sculpting surgery = 2.

The mean age of the patients was 52.6 years with a range of 21 to 66 years. Twelve were males and two were females. Most of the patients presented with grade 4 lymphedema.

Preoperative limb girth measurements were done for all patients. The measurements were repeated after the nodovenous shunt surgery and 3 weeks after the reduction surgery and every 6 months during follow-up.

Following the nodovenous shunt surgery there was a reduction of 2.6 cm (range 2–3 cm) in the limb circumference. Reduction of limb circumference alone is not the aim of this procedure, as there is a definite improvement in the quality of the skin and better wound healing following the debulking procedure. In all the patients there was significant reduction (>5 cm) in limb circumference postoperatively following the debulking surgery (►Figs. 12–17).

Complications included skin flap necrosis in three patients, seroma at the site of the nodovenous shunt in one patient, and cellulitis in two patients. When there was necrosis of the skin flaps, the patients were initially managed conservatively; after the demarcation of necrosis, if it was full-thickness necrosis, it was debrided and skin grafted.

These 16 cases were carried out over a period of 9 years. The patients who were operated in the initial years of the study period ($n = 10$) have been followed up for 6 to 7 years with good outcomes (only one patient had one episode of cellulitis after 5 years). The rest of the patients have been followed up for 1 to 3 years with good outcomes.

Fig. 9 Marking the incision for reduction surgery of leg.

Fig. 10 Elevation of skin flaps and excision of fibrotic tissue.

Fig. 11 Closure over suction drains.

Discussion

Lymphedema is initially managed with nonsurgical methods. Milder grades can continue to be managed with these methods. Surgical procedures should be used only after nonsurgical methods like MLD, pneumatic pressure pumps, and compression stocking.^{1,3,4}

Table 1 Details of the patients studied

Sr. no.	Age/Sex	Diagnosis	Surgical procedure	Complications
1	57/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	Skin necrosis (Skin grafting)
2	55/F	Filarial lymphedema of thigh and leg (grade 4)	Nodovenous shunt + debulking surgery	Cellulitis after 1 y
3	45/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	–
4	62/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	–
5	58/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	–
6	65/F	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + sculpting surgery of leg and foot	–
7	60/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	–
8	58/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	–
9	66/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	Cellulitis after 5 y
10	56/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	–
11	46/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	Skin necrosis (Skin graft)
12	42/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	–
13	55/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	Skin flap necrosis (needed skin grafting)
14	37/F	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	–
15	21/M	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + sculpting surgery	–
16	60/F	Filarial lymphedema of leg and foot (grade 4)	Nodovenous shunt + debulking surgery	–

Fig. 12 Grade 4 post-filarial lymphedema.

Surgery is not curative in lymphedema. Several surgical procedures for lymphedema have been described in recent years. The physiological procedures include nodovenous shunt, lymphovenous anastomosis (LVA), vascularized lymph node transfer (VLNT), lympholymphatic bypass, and

Fig. 13 Fifth day postoperative following nodovenous shunt.

lymph-interpositional-flap transfer.^{2,5,6} However, most of these procedures have been conducted in a setting of secondary lymphedema following lymph node excision for

Fig. 14 (A,B) Post-reduction surgery.

Fig. 16 Following nodovenous shunt and reduction surgery of foot.

Fig. 15 Grade 4 post-filarial lymphedema.

Fig. 17 One-year follow-up.

malignancy surgeries or radiotherapy. There is not much experience of using these procedures in post-infective clinical setting as seen in post-filarial lymphedema where the lymphatics are usually sclerosed from recurrent inflammation. These procedures require super-microsurgical expertise and equipment and have a steep learning curve.

The nodovenous shunt was initially described by Nielubowicz and Olszewski who performed experimental studies to prove the effectiveness of this procedure.^{7,8} Olszewski went on to perform the nodovenous shunt in more than 1,300 patients over 45 years with reliable results and documented the improved lymphatic flow with lymphoscintigrams.⁹

Jamal has a vast experience of using this procedure in post-filarial lymphedema.¹⁰ It is a straightforward procedure which does not require advanced microsurgical expertise or equipment. The anatomy in this region is also familiar to most surgeons. The key step in this procedure is identifying a lymph

node with good lymph flow. The great saphenous vein should be dissected adequately to achieve a tension-free anastomoses. End-to-side anastomoses are preferred over side-to-side anastomoses as there might be higher rates of thrombosis in the side-to-side anastomoses. If another lymph node with good lymph flow is found, it can be anastomosed to one of the tributaries of the great saphenous vein.

The reduction surgery which we perform involves excision of redundant skin, debulking the skin flaps, and achieving primary closure. The extent of debulking surgery should be limited to the midline posteriorly (midline of tendoachilles) and the medial border of the tibia anteriorly. If required, a second-stage debulking surgery for the lateral component can be done after at least a 3-month interval. Skin necrosis at the margins of the skin flaps is a common complication, but is usually limited to superficial necrosis which can be managed conservatively. If full

thickness skin necrosis is seen it requires debridement followed by skin grafting. Radical resection with perforator preservation as described by Salgado et al might improve the reliability of the skin flaps.¹¹

The procedures of nodovenous shunt and debulking surgery have been used effectively in patients with post-filarial lymphedema with good results. In a resource-constrained environment, nodovenous shunt and debulking surgery are procedures which can effectively decrease the disease burden, decrease episodes of lymphangitis, and improve the quality of life. They can be performed effectively with a reasonable amount of surgical expertise and have a short learning curve.^{12,13} In low income group countries where lymphatic filariasis is prevalent, nodovenous shunt and debulking surgery offer a cost-effective solution with reliable results.

Liposuction for debulking in the setting of lymphedema has been described by Brorson and Svensson.¹⁴ This is effective when the fat component is more than the fluid component. Preoperative magnetic resonance imaging is effective in determining the fat/fluid predominance in the limb.

Unrealistic expectation from the surgery for lymphedema is something we need to warn patients against. The need for adjuvant therapy in the form of MLD, compression stocking, chemoprophylaxis must be reinforced, and patient compliance should be assessed before performing surgical procedures in these patients.

Post-filarial lymphedema is very different from the lymphoedema seen in the West where it is obstructive or iatrogenic because of radiotherapy or radical nodal dissection in axilla and groin following ablative cancer surgery. The recurrent inflammation causes sclerotic changes in the lymphatics. The fact that filarial lymphedemas are chronic, with recurrent lymphangitis resulting in a lot of fibrous component, significant skin changes, and skin infections make them peculiar. Hence the surgical procedures like LVA which are used to treat secondary lymphedema following ablative procedures might not be applicable in post-filarial lymphedema.

Future Directions

The results of these procedures can be better studied with Indocyanine green (ICG) dye studies to visualize the improvement in lymphatic drainage. Comparative studies can be done in a prospective manner to compare the efficacy of these procedures with newer procedures like LVA and VLNT.

Limitations

The limitations include inadequate preoperative and postoperative imaging. We work in a resource-constrained environment. The cost of a lymphoscintigram exceeds the cost of the operative procedure. We use lymphoscintigram selectively only in congenital lymphedema to rule out aplasia of lymphatics or in early stages of lymphedema to perform diagnosis. The cost of equipment for ICG studies is exorbitant. Neither our hospitals nor patients can afford it. A discussion on health economics is beyond the scope of this paper.

Conclusion

Nodovenous shunt followed by reduction surgery for lymphedema in our limited experience is a reliable surgical option to reduce disease morbidity in patients with post-filarial lymphedema.

References

- McNeely ML, Magee DJ, Lees AW, Bagnall KM, Haykowsky M, Hanson J. The addition of manual lymph drainage to compression therapy for breast cancer related lymphedema: a randomized controlled trial. *Breast Cancer Res Treat* 2004; 86(2):95–106
- Lin CH, Ali R, Chen SC, et al. Vascularized groin lymph node transfer using the wrist as a recipient site for management of postmastectomy upper extremity lymphedema. *Plast Reconstr Surg* 2009;123(4):1265–1275
- Rodrick JR, Poage E, Wanchai A, Stewart BR, Cormier JN, Armer JM. Complementary, alternative, and other noncomplete decongestive therapy treatment methods in the management of lymphedema: a systematic search and review. *PM R* 2014;6(3):250–274, quiz 274
- Feldman JL, Stout NL, Wanchai A, Stewart BR, Cormier JN, Armer JM. Intermittent pneumatic compression therapy: a systematic review. *Lymphology* 2012;45(1):13–25
- Damstra RJ, Voesten HG, van Schelven WD, van der Lei B. Lymphatic venous anastomosis (LVA) for treatment of secondary arm lymphedema. A prospective study of 11 LVA procedures in 10 patients with breast cancer related lymphedema and a critical review of the literature. *Breast Cancer Res Treat* 2009;113(2):199–206
- Manokaran G, Agarwal R, Agarwal D, Filaria. In: Neligan PC, Masia J, Piller N, eds. *Lymphedema: Complete Medical and Surgical Management*. 1st ed. Boca Raton, Florida: CRC Press; 2015:215–233
- Nielubowicz J, Olszewski W. Experimental lymphovenous anastomosis. *Br J Surg* 1968;55(6):449–451
- Nielubowicz J, Olszewski W. Surgical lymphaticovenous shunts in patients with secondary lymphoedema. *Br J Surg* 1968; 55(6):440–442
- Olszewski WL. Lymphovenous microsurgical shunts in treatment of lymphedema of lower limbs: a 45-year experience of one surgeon/one center. *Eur J Vasc Endovasc Surg* 2013; 45(3):282–290
- Jamal S. Lymphovenous anastomosis in filarial lymphedema. *Lymphology* 1981;14(2):64–68
- Salgado CJ, Sassu P, Gharb BB, Spanio di Spilimbergo S, Mardini S, Chen HC. Radical reduction of upper extremity lymphedema with preservation of perforators. *Ann Plast Surg* 2009; 63(3):302–306
- Rao YG, Ananthakrishnan N, Pani SP, Kate V, Yuvaraj J, Krishnamoorthy K. Factors influencing response to lymphonodovenous shunt in filarial lymphoedema. *Natl Med J India* 1999; 12(2):55–58
- O'Brien BM, Mellow CG, Khazanchi RK, Dvir E, Kumar V, Pederson WC. Long-term results after microlymphaticovenous anastomoses for the treatment of obstructive lymphedema. *Plast Reconstr Surg* 1990;85(4):562–572
- Brorson H, Svensson H. Liposuction combined with controlled compression therapy reduces arm lymphedema more effectively than controlled compression therapy alone. *Plast Reconstr Surg* 1998;102(4):1058–1067, discussion 1068