

Chapter 44

Lymph Nodes Transfer Microvascular Reconstructive Surgery

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Introduction

Manual lymphatic drainage – based complex decongestive therapy has become the mainstay of chronic lymphedema management for many decades, as reviewed extensively in Chaps. 9 and 10.

Complex decongestive therapy (CDT) is now the treatment of choice regardless of the severity/clinical stage. Unfortunately, however, CDT-based management is only able to delay the progress during the treatment period; to maintain long-term control, continuous patient commitment with a lifetime pledge is mandatory.

Therefore, surgical treatment, either for curative/reconstructive or palliative/excisional purposes, has been pursued as an alternative method of controlling chronic lymphedema for decades. Indeed, reconstructive surgery in particular is theoretically optimal for restoring normal function.

Reconstructive surgery, regardless of its method, is aimed at relieving lymphatic hypertension to improve lymphatic function at best, although there is a theoretical chance of a cure when performed under ideal conditions, as reviewed in Chap. 11.

Free lymph node transplantation surgery (FLTS)¹⁻⁵ is an “indirect approach” to lymphatic reconstruction, which is relatively new compared with the “direct approach” with various lymphovenous anastomotic surgeries that were reviewed in sections of Chap. 11.

The concept of lymph node transplantation seems to be a logic approach for the reconstruction of a damaged lymph transport system after radical mastectomy/axillary lymph node dissection in particular.¹⁻⁵

Based on extensive experimental studies,⁶⁻⁸ including anatomical studies,⁹ 1,000 patients with different types of lymphedema, both primary and secondary,^{10,11} were treated and had excellent outcomes.¹⁻⁵

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Secondary Lymphedema

In developed countries, the etiology of chronic lymphedema is mostly secondary to the lymphadenectomy as a part of cancer management. Such surgical excision of the lymph nodes often is combined with postoperative radiation therapy to the lymphadenectomy site, which will result in further damage to the remaining lymph nodes and lymph-transporting system and will further jeopardize normal function. Hence, this approach to restore the lost function by replacement with normal lymph nodes is naturally a more logical approach.

The free fatty flap containing lymph nodes for lymph node transplantation provides various benefits:

- Abundant interconnections in the nodes with the venous circulation
- The germinal cells in the nodes as a critical part of the immune system
- Abundant cytokines within the fatty tissue around the nodes, promoting lymph angiogenesis

Furthermore, the dissection of postsurgical/postradiation fibrosis in the axillary or inguinal region and subsequent free fatty flap interposition improve the venous flow as well.

Lymphedema of the Arm: Upper Extremity

Indication for Node Grafting

Manual lymphatic drainage-based CDT is the mainstay of treatment to control edema. However, when the lymphedema becomes resistant to this conventional therapy, such a condition may become an indication for lymph node grafting as an additional procedure.

Preoperative evaluation warrants thorough clinical description and physical examination, and radionuclide lymphoscintigraphy, which would provide a road map for the subsequent surgery; it is mandatory to know whether there are any drainage pathways. If drainage is absent, the indication for free node transfer is established.^{12,13}

Operative Technique

The same incision as for the previous adenectomy is generally sufficient to prepare the lymph node graft recipient site, but occasionally the old incision needs to be extended for appropriate preparation when severe fibrosis is involved.

The axillary region is then carefully dissected to identify the thoracic-dorsal branch, which is located distal to the branch the dorsalis muscle, is selected and

prepared for the micro-anastomosis. The local thoracic nerves are neurolyzed in case neuromas develop following previous surgery and cause pain.

To harvest the nodes for grafting from the inguinal region, an incision is made above the inguinal ligament from the iliac crest to the pubic region.

The fat under the fascia cribriformis is elevated from the muscular layer in the direction of the point of emergence of the circumflex iliac vessels. This flap generally contains four to five nodes and includes neither the deep nodes nor the nodes under the inguinal ligament. The size of the flap is comparable to the size of a palm of a hand.

The flap is then imported to the graft recipient site/axillary region, where the micro-anastomosis is performed under a microscope (with 10–0 nylon). The flap is then placed along the axillary vein before closure of the wound.

The manual lymphatic drainage should be started immediately after the operation; during the postoperative 3-month period, it has to be given daily in advanced cases or every other day in mild cases to prevent lymph stasis along the graft site.

Results

The long-term results after 5 years among “less advanced” lymphedema patients, have shown complete relief of the lymphedema in 40% of the cases with a normal lymphoscintigraphy (Fig. 44.1a). In 20%, the clinical results are better than on the images of the radioisotopes. However, the overall results show 98% with improvement, and 2% with no change (Fig. 44.1b).

In the 2% with no clinical improvement following surgery, the operation did not worsen the pre-existing lymphedema.

The incidence of erysipelas also decreased drastically to 2% without any prophylactic antibiotics from 68% of all the patients presenting chronic infections.

The postoperative lymphoscintigraphy at 1 year has shown the uptake of technetium in the transplanted nodes, or the new pathways, or both (Fig. 44.2).

Longstanding lymphedema of more than 20 years shows substantial improvement, although the results are proportional to the quality of the dermis (thickness, fibrosis destruction, etc.). Even after 30 years, we can observe significant improvement, in terms of volume, quality of the skin, and infections (Fig. 44.1b).¹⁴

Plexopathy

An additional benefit of the free fatty flap is it can improve radiotherapy-induced pain and progressive palsy by new vascularization of the nerves. Some young patients can recover in 2 years while older patients can experience stabilization of the palsy. Occasionally, when the lymphedema disappears, tendon transfers can reinforce some movements if some of the muscles are strong enough.



Fig. 44.1 (a) Moderate lymphedema involving the upper limb: preoperatively (*left*) and postoperatively 2 years (*right*). (b) Preoperative finding of advanced lymphedema along the right upper limb (*left*) and postoperative (4 years) finding (*right*) following lymph node transplantation, showing complete relief

The pain in the thoracic and breast region, induced by the surgery, disappears immediately after the neurolysis of those branches.^{15,16}

Breast Reconstruction Combined with Lymphedema Treatment

The deep inferior epigastric perforator (DIEP) flap or even transverse rectus abdominis muscle (TRAM) flap can be elevated with some external inguinal nodes.¹⁷

The nodes are inserted into the previous adenectomy site, and the abdominal skin is folded to rebuild the breast. The anastomosis of the vessels of the flap (deep epigastric or superficial epigastric vessels) is performed in the axillary region, to the thoracodorsal vessels, or on the internal mammary vessels. The fibrosis in the axillary region must be dissected before implanting nodes, and if needed, epineurolysis of the brachial plexus can be added, before insertion of the nodes (Fig. 44.3).

The results are exactly identical to those obtained with only the inguinal flap.

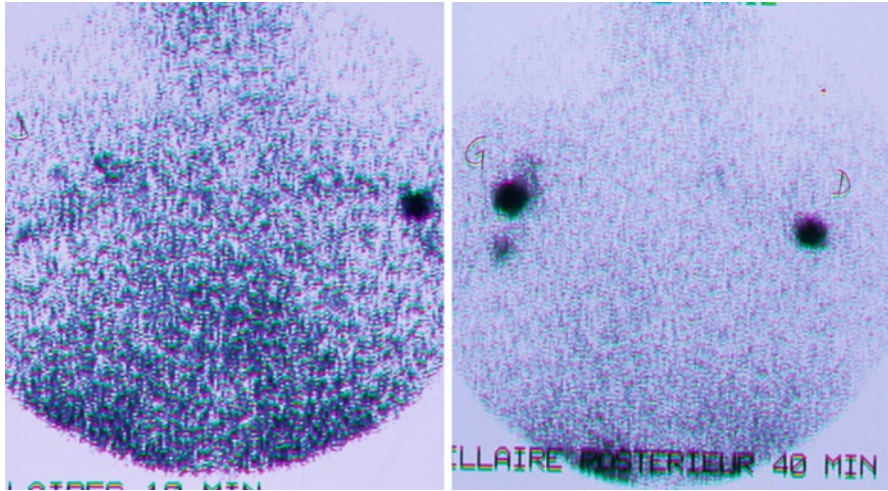


Fig. 44.2 Lymphoscintigraphic findings before (*left*) and after (*right*) lymph node transplantation to the right axilla



Fig. 44.3 Deep inferior epigastric perforator (DIEP) flap elevated together with internal mammary vessels (*left*), with nodes ready to implant to the adenectomy site (*right*)

Lymphedema of the Leg: Lower Extremity

The lymphadenectomy and radiotherapy in the inguinal and iliac region can induce either unilateral or bilateral leg lymphedema.

- Pelvic surgery combined with radiotherapy: extended hysterectomies, extended prostatectomy for cancer management
- Lymph node resections in the inguinal region for melanoma
- Radiotherapy and adenectomy to inguinal lymph nodes for Hodgkin's disease

The release of the fibrotic tissues followed by transplanting lymph nodes also seems a logic approach to improving the lymphedema if the cases are unilateral, so that use of the contralateral iliac drainage can be expected.

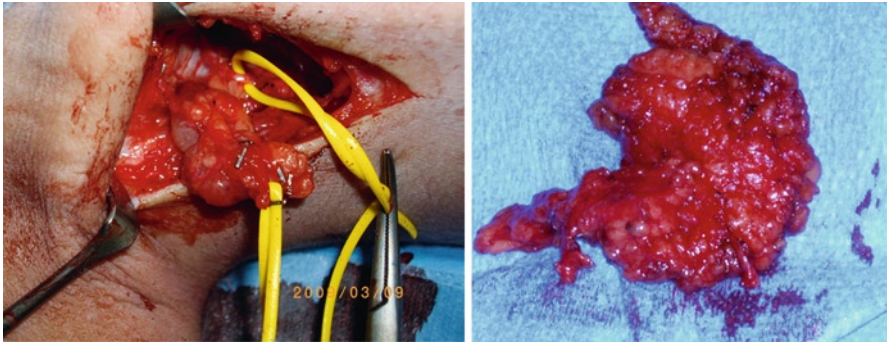


Fig. 44.4 Thoracic flap based on branches of the thoracodorsal vessels

Operative Technique

The inguinal region is opened. The scars are evaluated and all the fibrotic tissues are released. The inguinal ligament region is explored. Recipient vessels – mainly the circumflex iliac or superior epigastric vessels – are isolated for microanastomosis.^{18,19}

The donor flap is obtained either from the thoracic region (90%), or the cervical region.

The thoracic flap is isolated along the thoracodorsal vessels, giving a vascularization to an average of four to five nodes, just under the branch for the dorsalis muscle. This flap does not include the nodes around the axillary vein and thus does not interfere with the drainage of the arm (Fig. 44.4).

The cervical flap depends on the branch of transverse cervical artery, and is elevated just under the sternocleidomastoid muscle (Fig. 44.5).

The flap is then elevated with the vessels and isolated to make microscopic anastomosis to the receiving/recipient vessels.

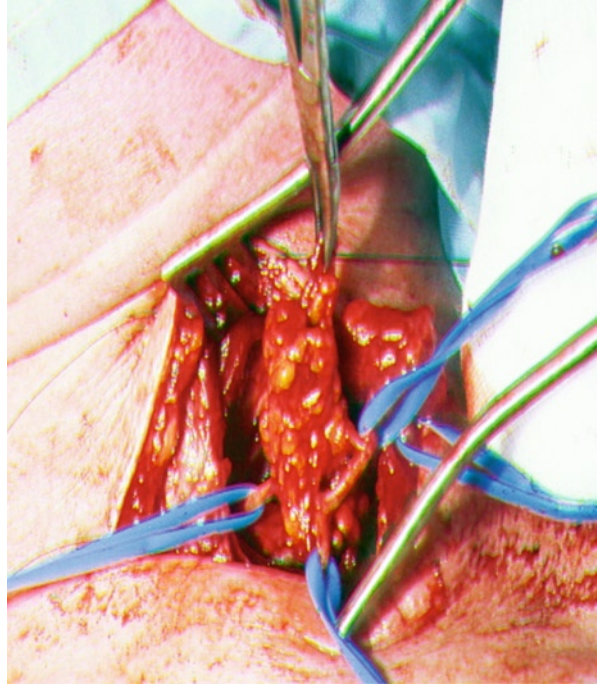
Results

The results are similar to those of the arm, but, because the pathways are longer, it takes more time to show clinical improvement. On average, the perimeter of the leg decreases 1–2 cm/month, but lymphedema with recent onset or with no radiotherapy involved is relieved more quickly.

The bandages and manual drainage are important as postoperative care, especially during the first 3 months following the surgery (Fig. 44.6). Compression stockings are also useful later to maintain the outcome when sitting or standing for a long time.

Moderately advanced lymphedema can have substantial benefit if the skin was not destroyed, and the infection rates decreases to 2% among patients with previous chronic infections.

Fig. 44.5 Cervical flap based on the transverse cervical artery



Primary Lymphedema

The principle and concept of lymph node transplantation among primary lymphedema as a clinical manifestation of (congenital) lymphatic malformation²⁰⁻²³ are the same as those for secondary lymphedema. However, primary lymphedema involving the lymphatic vessels (e.g., aplasia, hypoplasia, and hyperplasia) is well known for being difficult to manage because of variations in lymphatics and lymph nodes; surgery outcomes are generally known to be variable and the procedures are generally not as effective as those seen in patients with secondary lymphedema. Depending upon the extent and severity of the defect involving lymphatic system-collecting and transporting vessels and nodes, though, the new lymph node grafting could be the optimal solution with a chance of permanent cure.

At the same time, the fatty tissue around the grafting nodes is known to contain various cytokines that induce the regeneration of lymphatic vessels. The addition of lymph nodes would help not only the lymphatic drainage of the limb, but also the overall function of the immune system.

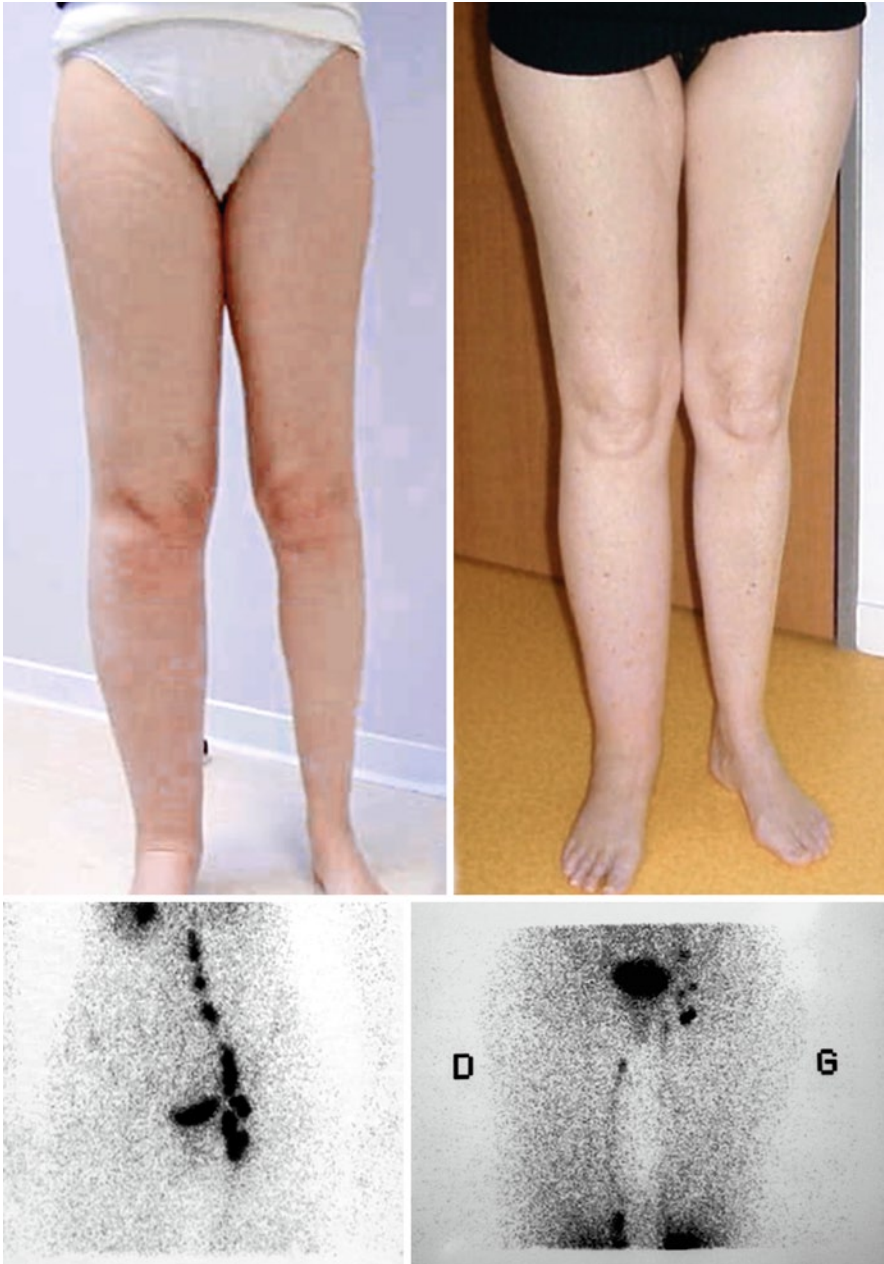


Fig. 44.6 Secondary (post-hysterectomy) lymphedema: *Left two photos* show preoperative clinical and lymphoscintigraphic findings. *Right two photos* show clinical and lymphoscintigraphic findings following the lymph node transplant in the inguinal region (1-year result)

Indications

When lymphedema appears at birth, or in the first years of life, physiotherapy is very important, but compressive bandages are often difficult for a growing child, and subsequently the skin can become thickened very early. Therefore, if the donor flap is technically feasible, and there is no additional illness, free node transplant must be carried out as soon as possible.^{24,25}

If the lymphedema occurs in puberty and is resistant to conventional physiotherapy the free flap of node transplantation should be considered as soon as possible to avoid recurrent infections. If the edema involves the lower part of the leg, the flap will be placed at the knee. Combination with resection is sometimes indicated.

Operative Technique

The recipient site of the node transplantation should be chosen based on the type of lymphedema and the lymphangioscintigraphy findings.

If the whole leg is swollen, the inguinal level will be preferred to the knee level as the first site of implantation of the nodes. If the lymphedema is limited below the knee, the free flap will be inserted into the popliteal region of the knee level. For the free flap to the inguinal region, the circumflex iliac vessels are preferred for the anastomosis. However, if the flap is inserted at the knee level, the venous anastomosis is performed to one of the branches of greater saphenous vein. The donor free flap can be best harvested with the thoracic flap based on branches of the thoracodorsalis vessels, but the cervical flap is still another option when use of the thoracic flap is not feasible.

Results

For the moderately advanced lymphedema limited to below the knee level that appeared at puberty, full recovery to restore normal lymphatic function can be expected in 40%.

All other cases are improved to various degrees and the majority experience less pain and less infection. Quality of life is also improved substantially within 2 years following the surgery in the majority (Fig. 44.7).

All the patients showed a reduction in the diameter of the treated limb at 2 years postoperative follow-up assessment: 7.5 at the ankle level and 10 cm at a 10-cm higher level.

Postoperative lymphoscintigraphy showed well functioning transplanted lymph nodes with new lymph drainage pathways²⁶ (Fig. 44.6). The inguinal nodes, not visible before the operation, became visible in some cases as well (Fig. 44.2).

When the lymphedema is improved following node transplantation, it also brings about a substantial change in lipedema; the biopsies show normal fat.



Fig. 44.7 Primary lymphedema since the age of 20 years. Pre-operative (*left*) and post-operative (1 year; *right*) clinical findings following lymph node transplantation

Conclusion

This new approach with free lymph node grafting can provide substantial benefit to either primary or secondary lymphedema. For the surgeon who is well-trained in microscopic anastomosis, the failure rate does not exceed 2% of the cases. If the lymphedema has not advanced to too fibrotic a condition, complete, or near complete, relief can be expected. This flap can be included in the DIEP or TRAM to combine lymphedema treatment with reconstruction of the breast. Complications of plexopathy can also be improved by neurolysis through this free flap surgery.

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