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Surgical Management of Lymphedema

B.B. Lee
With contributions from V. Krylov and C. Becker

Introduction

An ideal treatment for the lymphedematous limb should restore both function and cosmetic appearance. Unfortunately, it is impossible to achieve these goals using current treatment modalities.

Although manual lymph drainage-based complete decongestive therapy (CDT) effectively controls the progression of the disease in most cases and remains the primary management for chronic lymphedema, surgical therapy provides an adjunct to nonsurgical treatments (1–8).

Surgical treatments of lymphedema are usually categorized as excisional (ablative) or reconstructive (9–28). As with all forms of lymphedema treatment, surgical management necessitates a lifetime commitment to treatment. It too has limitations similar to those of conservative treatment, e.g. failure to improve the lymphedematous limb and the inability to prevent progression of the disease (29,30). Surgical treatment, whether ablative or reconstructive, has many advocates and is known to provide control of chronic lymphedema. Reconstructive surgery, in particular, has an attractive theoretical basis that in the future might provide an opportunity for cure. The use of reconstructive surgery, however, remains controversial and unavailable to most clinicians.

A dedicated and experienced microsurgical team for lymphovenous and lympholymphatic anastomoses is a prerequisite for successful long-term results (15,17,19,21,23). Unfortunately, only a limited number of institutions have surgical teams that can meet these conditions.

As stated previously, CDT must accompany any type of surgical treatment, the combination of which may achieve complementary benefits not obtained by CDT alone (31,32).

Excisional/Ablative Surgery

Excisional procedures, often known as reduction or debulking operations, remove scarred and disfigured lymphedematous tissue from the limb. These procedures were condemned for many years because of general morbidity and significant complications; their application had been nonselective and used for any type of lymphedema. Some of these once-abandoned operations, however, have been reassessed and provide alternative palliative operations for chronic end-stage lymphedema. Large numbers of long-term results have yet to be assessed.

Early Debulking Operations

Excisional procedures have been described by Charles in 1912, Sistrunk in 1918, Homans in 1936, and Thompson in 1962 (9,10,12,13,33).

Charles recommended a radical operation for reducing the size of a massively swollen calf or foot (33). The entire skin and subcutaneous fat of the lower leg are removed circumferentially to the muscular fascia. Split-thickness skin grafts are applied over the denuded areas. The excision includes major veins and nerves of the saphenous system in addition to the lymphedematous tissues. The foot can be selectively treated in a similar manner.

Sistrunk described a noncircumferential debulking procedure. It removes a wedge of skin and subcutaneous fat to the muscular fascia (12). Skin grafting is not required inasmuch as the adjacent flaps, created by the excision, are approximated and sutured.

Homans extended Sistrunk's operation (10). He first excised a medial wedge of lymphedematous calf tissue then undermined the flaps to extend the area of tissue removal. Today, these 2 surgical approaches may be combined to reduce the circumference of the thigh.

Thompson's operation is seldom performed today because it failed to provide relief of symptoms. Its thesis suggested that the lymphatics of transected skin (dermis), if buried beneath the deep muscular fascia, would form a bridge between the 2 lymph systems. The anticipated drainage from superficial to deep lymphatics failed to develop (12,13).

Selection of Candidates for Excisional Surgery

Failure to obtain satisfactory control of the lymphedematous process or to prevent disease progression during a year of vigorous nonsurgical treatment is a major criterion for selection for surgical treatment (29,32). Another important criterion, for any type of lymphatic surgery, is a serious commitment to a lifetime of maintenance. Because postoperative maintenance care with CDT relies heavily on a self-initiated, home-based maintenance program, it requires an initial hospital-based educational program for both patient and family (32).

A multidisciplinary team should evaluate all candidates for surgery. The final selection should be made by consensus after a vigorous and critical assessment is performed. Patients with lymphedema in clinical stage IV or those progressing to stage III with profound soft tissue changes, hardened fibrosclerotic tissues with distortion, disfigurement, and/or elephantiasis are ideal candidates for excisional surgery. Sepsis should have recurred more than 3 times during the year, even under adequate antibiotic protection (31,32).

Surgery should be considered only when the epifascial (superficial) lymphatic system has been irreversibly damaged. As with all debulking operations, the surgical goal is to reduce the amount of fibrosclerotic lymphedematous tissue, to reduce the incidence of sepsis, and to improve the effectiveness of CDT.

Lymphoscintigraphy should demonstrate a progressive deterioration of the lymphatic system's residual function, e.g. increased dermal backflow, decreased lymph node uptake, decreased radiotracer clearance, and the disappearance of collaterals (34–36). Exclusion criteria include factors that interfere with conservative treatment and negate positive long-term results, such as poor compliance, lack of family support, age over 70 years, and infrequent infections.

Excisional Surgery

Our institution* uses a modified Auchincloss-Homans operation (9,10). It is usually performed on the lower limb and excises damaged skin and subcutaneous tissue to the muscular fascia. This procedure helps prevent tissue necrosis observed with procedures requiring more extensive undermining. Tissue edges are approximated and sutured immediately. As with many surgical procedures, morbidity consists of infection, hematoma, poor healing, skin loss, and recurrent swelling from lymphatic damage (11) (Figure 6-1).

Postoperatively, clinical evidence suggests increased lymph absorption through the deep subfascial lymphatic system, although lymphoscintigraphy has yet to confirm this clinical observation (29,32).

Liposuction

The swelling in a limb is often a combination of lymph fluid and edematous fat globules. It seems logical that removing at least 1 portion of the problem—the edematous fat—should improve the limb's condition.

Liposuction is a surgical technique that inserts a tiny cannula into the subcutaneous tissues and aspirates the surrounding fat (27,28). The imagined ease of performing liposuction (actually ablation by aspiration) created an intense inter-

*SamSung Medical Center & SungKyunKwan University, Seoul, Korea.

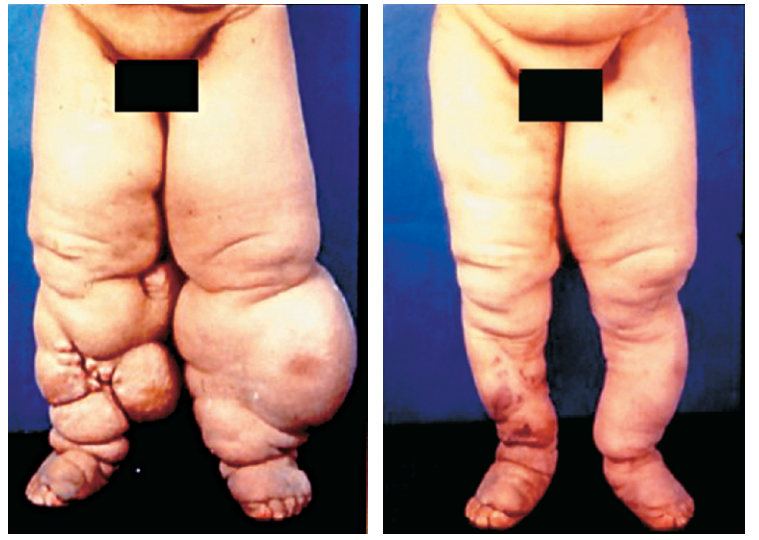

Figure 6-1. (A) Ablative (excisional) surgery might be considered when chronic lymphedema has reached end stage IV, as depicted here. These grossly disfigured legs create a problem in walking, hygiene, and social contact. Frequent infections and progressive lipodermatosclerosis have distorted the skin and subcutaneous structures. (B) Following excision of the fibroedematous tissue, an acceptable contour has been created. The patient now wears regular clothes and shoes and walks without a cane. Her response to CDT-based therapy has markedly improved, allowing her compression garments to be more easily fitted.

est within the surgical world when introduced in the 1980s. However, surgeons found that the procedure and its results were not always as satisfactory as hoped.

Treatment results of the arm with liposuction have been far better than those of the leg (28). A number of reasons have been given to explain the difference in results. The arm contains a greater percentage of fat per volume of tissue, thus permitting a greater volume removal, and there is usually less fibrosis in the arm's subcutaneous tissues, so fat removal can be more complete. Unfortunately, the desire for an easy outcome has been moderated by differing long-term results.

Each reported study emphasizes the need for continued compression to maintain the reduction of fluid. Brorson, having performed extensive studies of liposuction, has shown that arms treated with liposuction have retained their reduction in size at 5 years (27,28).

Many objections continue to be voiced to the use of liposuction, including that it damages normal lymphatics, there is little fat to be removed, and CDT alone may give equally good results (37).

Lymphatic Reconstructive Surgery

Of the various approaches to reconstructive surgery of the lymphatic system, procedures known as bypass operations have maintained credibility in the surgical community (14–16, 19–26). Occluded lymph-collecting vessels are bypassed with lymphovenous anastomoses. Normal distal lymphatics are anastomosed to proximal veins whose valvular functions appear normal.

Lympholymphatic anastomoses use normal distal lymph vessels attached to normal proximal lymphatics. These techniques are ideal for relieving obstructive lymphopathies and restoring normal lymphatic function (with the theoretic possibility of cure).

It is difficult, however, to intervene at the most efficacious time during the lymphedematous process, i.e. before lymph-collecting vessels are permanently damaged by lymph stasis (29,32). If one expects to reverse the functional paralysis in proximal lymph channels, the transposition of lymph vessels with normal peristaltic function is

essential. Before reconstructive surgery can be widely accepted, either as an independent or an adjunctive therapy, positive long-term results must be demonstrated.

Selection of Candidates for Anastomotic/Reconstructive Surgery

In view of the massive financial, medical, and surgical commitments for reconstructive surgery, the screening of candidates for lymphovenous (19,20) or lympholymphatic (15,16) anastomotic surgery must be stringent (32).

To be considered for surgery, candidates must meet at least 3 criteria:

- show substantial clinical progression of the disease, from stage I to stage II or from stage II to stage III, in spite of an adequate 12-month CDP treatment program
- demonstrate progressive lymph fluid accumulation, especially below the knee, by lymphoscintigrams that show dermal backflow
- show decreasing effectiveness of manual lymph drainage-based CDT, especially below the knee

Treatment failure should be documented at least twice within a 6-month interval during a 2-year period.

Preoperative Evaluation

Before reconstructive lymphovenous or lympholymphatic anastomotic surgery is contemplated, the anatomic and functional status of the proximal lymph nodes and lymph-collecting vessels must be adequately assessed. Determination of function is necessary to identify normal, unparalyzed vessels (29,32).

Response to manual lymph drainage can be an indirect indication of the vessels functional status. Lymphoscintigraphy should be included in the preoperative evaluation to confirm these evaluations; additional information may be required from duplex ultrasonography. The newly available ultrasonographic lymphangiography and magnetic resonance lymphangiography (both in the investigative stage) are sometimes required to more accurately identify malfunctioning lymph-collecting systems; their findings help confirm or rule out paralyzed lymph vessels (32).

Lymphovenous Anastomotic Surgery

Lymphovenous reconstruction is ideal for treating secondary lymphedema, which develops after cancer surgery or radiation, by restoring a more normal lymphatic function (21,30). Here there is selective damage to proximal lymph nodes, while distal lymph-collecting vessels remain intact. However, primary congenital lymphedema, with dysplasia of lymph nodes, is best treated by free lymph node transplantation (17,18).

The technique of lymphovenous anastomosis requires a microscopic end-to-end or end-to-side anastomosis between healthy, well-functioning lymphatic vessels and healthy veins (23,24). At minimum, 3 to 4 lymph-collecting vessels are anastomosed to defunctionalized branches of the saphenous or adjacent veins in the lower limb (19,20,25,26).

The operation can be performed at the inguinal (19,20) or popliteal level (23,24). The classic inguinal approach is preferred during the early stages of lymphedema, when good long-term results can be expected, e.g. in stage I before the collecting vessels are irreversibly paralyzed. A popliteal anastomosis may be necessary if the disease has progressed to a clinical stage II or early stage III. Evidence of progressive damage and paralysis of lymph-collecting vessels at the inguinal level further recommends a popliteal anastomosis (Figure 6-2).

Lympholymphatic Anastomotic Surgery

Lympholymphatic anastomotic reconstruction uses similar surgical principles and procedures (15,16). It is theoretically superior to a lymphovenous anastomosis, because it avoids the possibility of blood regurgitating into the lymph vessel and clotting.

Free Lymph Node Transplantation

The free lymph node transplantation technique is based on the principle of the free-flap autotrans-

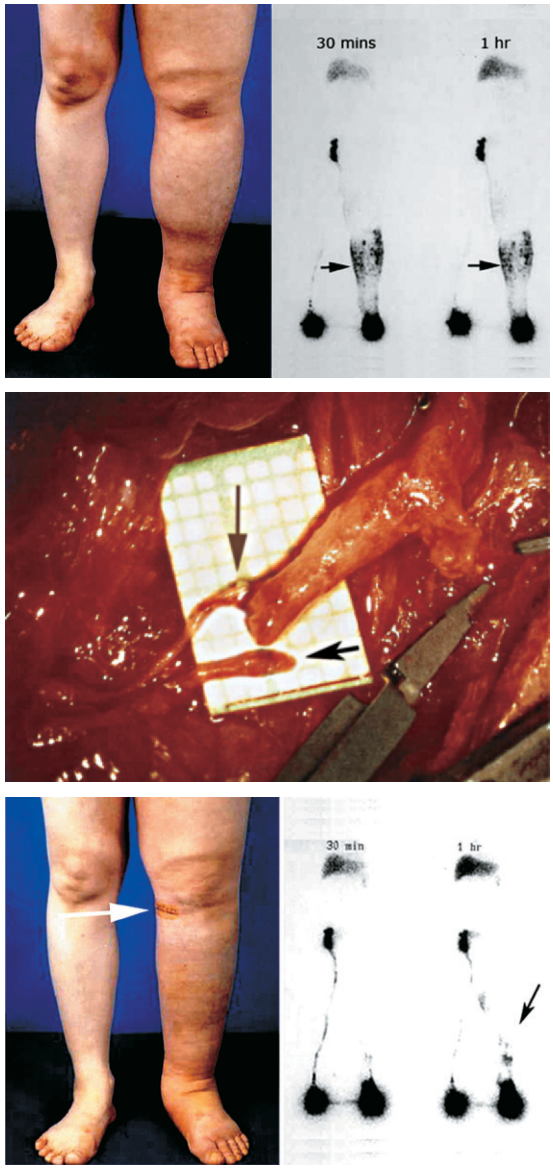

Figure 6-2. (A) Lymphovenous reconstructive surgery was performed on the left leg for progressive lymphedema, still in an early clinical stage. A preoperative lymphoscintigram shows marked dermal backflow (arrows). (B) This operative view of the popliteal area reveals functioning lymph-collecting vessels (arrows) that are to be anastomosed end-to-end to the defunctionalized vein above. (Russian method, modified by Krylov.) (C) One month after surgery, a good clinical response is noted, with less edema and improved skin turgor in the leg. The arrow points to the healing incision. A year later, dermal backflow is markedly diminished, as the scintigram demonstrates.

plantation technique (17,18). A vascularized pedicle flap is taken from the donor site, and a microscopic anastomosis is created between the flap and 1 or 2 sets of arteries and veins at the recipient site.

Lymphoscintigraphic evaluation is necessary to select the appropriate lymph node group for transplantation, e.g. inguinal, cervical, or axillary group (32). Adequate numbers of nodes must be left at the donor site, so that normal function can be maintained after harvesting. Selection of the best donor site is as important as selecting the best recipient site for transplantation. Otherwise, iatrogenic lymphedema may be induced by an unnecessarily aggressive nodal harvest. The patency and function of the patient's arterial and venous systems should be confirmed with ultrasonography as well. Local disease status at ankle, popliteal, or inguinal regions helps determine the recipient site.

The indications our institution adopted for free lymph node transplantation are more liberal than those for lymphovenous reconstructive surgery. The authors recommend free lymph node transplantation when lymphedema control is only minimal, or when there is suspicion of disease progression and increased sepsis (29,32) (Figure 6-3).

Vein Grafting

Another microsurgical technique uses free vein grafts to bridge lymphatic obstructions, either congenital or acquired. As with free nodal transplantation, long-term results are improved if the surgery is performed in the earlier stages of lymphedema. Campisi reported an 81% improvement, although the exact outcome criteria were not expressed (20).

Postoperative Management

After excisional or reconstructive surgery, continued CDT and compression are mandatory (32). When a successful free lymph node transplant is performed in stage II, CDT may be needed for 12 months or less (18). However, lymphovenous anastomotic surgery, performed for the

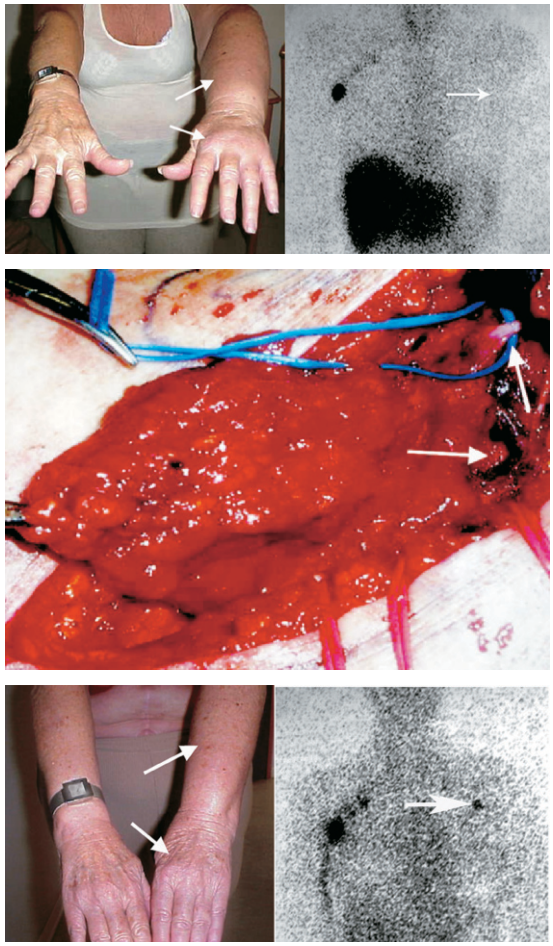

Figure 6-3. (A) Lymphedema in the left arm (arrows) followed a mastectomy and irradiation. A preoperative lymphoscintigram failed to demonstrate a viable lymph node in the left axilla. Reconstructive surgery with free lymph node transplantation was recommended. (B) Donor lymph node-bearing tissue harvested from the right axilla has intact feeding arteries and draining veins making it suitable for free-flap transplantation. It was transplanted from the right to the left axilla using microscopic end-to-end anastomoses (arrows) between donor and recipient arteries and veins. (French method, modified by Becker.) (C) Clinical improvement is evident after surgery (arrows). The patient reported less edema and demonstrated improved range of motion. Lymphoscintigraphy highlighted the newly transplanted lymph nodes in the left axilla (arrows). (Photos courtesy C Becker.)

progression of the disease from stage II to III, often requires a semipermanent commitment to CDT (19).

This need is accentuated when advanced disease dictates a lymphovenous anastomosis at the popliteal level, rather than a standard anastomosis at the inguinal level, which is used in earlier disease stages (24,29). Proximal inguinal lymphatic paralysis would require supplemental CDT to assist in evacuating accumulated proximal edema (29,32).

Evaluation of Bypass Surgery Results

The multidisciplinary care team should evaluate the patient's clinical and laboratory treatment response at least twice annually. Postoperative assessment of treatment response includes infrared optic limb volumetry of the extremity on each visit; lymphoscintigraphy is obtained at 6 months and at each anniversary thereafter. If indicated, an ultrasonographic scan of the limb's veins is added at the end of the follow-up period. When episodes of cellulitis or other sepsis intervene, additional tests may be necessary (32).

Ideally, the results of treatment should be recorded at 1, 2, 3, 6, 12, 18, and 24 months after surgery. It should then be extended from 24 to 48 months, and long-term results should be based on an 8- to 10-year experience.

Clinical Experience

From January 1995 to December 2002, 1065 patients with chronic lymphedema were treated at the Samsung Medical Center in Seoul, South Korea.

Of these, 65 limbs of 54 patients were accepted for surgical treatment because of documented medical treatment failure—disease progression in spite of adequate manual lymph drainage and compression therapy performed for at least a year (11,29,31,32).

Their diagnoses were made with a variety of testing methods—ultrasonography, radionuclide lymphoscintigraphy, magnetic resonance imaging (MRI), and laboratory studies.

Treated limbs were divided into 3 groups:

Excisional surgery group = 22 patients
mean age, 46 years

F = 19, M = 3
primary disease = 5, secondary disease = 17
unilateral disease = 11, bilateral disease = 22

- Lymphovenous anastomotic surgery group = 19 patients
  - mean age, 49 years
  - F = 18, M = 1
  - primary disease = 4, secondary disease = 15

Free lymph node transplantation group = 13 patients

  - mean age, 34 years
  - F= 10, M = 3
  - primary disease = 6, secondary disease = 7

Excisional Surgery Group

Using a modified Homans operation, 6 patients in clinical stage III and the remaining 16 patients in stage IV underwent excisional surgery in a total of 33 lower limbs.

Twenty-eight of the 33 limbs showed an overall improvement at 12 months; of these 28 limbs, 18 were able to retain satisfactory improvement at 24 months only when the patients were compliant with compression therapy. Others in patients with poor compliance failed to maintain improvement. Eight limbs among patients with good compliance to compression therapy maintained good results at 48 months; as with the other groups, poorly compliant patients showed deterioration of their legs, both locally and systemically.

Lymphovenous Anastomotic Surgery Group

All 19 patients in clinical stages I to II selected as candidates for lymphovenous anastomotic surgery met the criteria for progression of disease under adequate treatment. Follow-up assessment was conducted at 24 and 48 months.

Sixteen of the patients, who complied with postoperative CDT, demonstrated clinically satisfactory improvement. The remaining 3 noncompliant patients showed continued deterioration of the limb.

Postoperatively, vigorous CDT was required for all patients as part of the total care management program.

Free Lymph Node Transplantation Group

According to the evaluation criteria, 13 patients, mostly in clinical stages I to II, were selected for surgery. Lymph node-bearing tissue, mainly from the posterior axilla, was transplanted to the inguinal region.

Ten patients compliant with postoperative CDT programs showed clinical evidence of a successful graft at 12 months. The remaining 3 poorly compliant patients failed to prosper.

Summary

When combined with CDT, surgical therapy remains an adjunctive intervention that can help improve the treatment results of selected lymphedema patients. This management approach, however, has lacked popular support because the microsurgical technique demands unerring surgical expertise and a tremendous amount of time and effort. The results remain equivocal as well.

Both excisional and reconstructive surgeries appear to control the progression of lymphedema, at least in early postoperative periods. During follow-up periods ranging between 24 and 48 months, the authors' findings have always shown that long-term results improve when patient compliance with self-initiated CDT is optimal. Free lymph node transplantation-treated limbs also show an improved outcome when accompanied with postoperative CDT, although it is necessary only until transplanted lymph node survival is assured.

To better understand the role of surgical operations in the management of chronic lymphedema, well-constructed trials are warranted. They must consist of well-organized multicenter studies that use similar protocols and incorporate peer-reviewed outcome results. For the future, surgery remains the only possible treatment method capable of providing a cure.

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