Vascularized Groin Lymph Node Flap for Treatment of Lymphedema

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Free vascularized lymph node transfer as a groin lymph node flap that contains regional lymph nodes and lymphatic tissues is a new technique that offers an alternative treatment option for lymphedema. It was first described by Chen et al.\(^1\) in a canine model, and Becker et al.\(^2\) and Lin et al.\(^3\) subsequently showed statistically significant clinical improvement using vascularized groin lymph node transfer for upper extremity lymphedema after mastectomy. Clinical outcomes were favorable, because functional lymph nodes and undamaged lymphatic channels restored lymphatic drainage. This latter point is an important advantage of this technique over other lymphatic bypass procedures. This flap is less technically challenging, because supermicrosurgery is not required. Other advantages include low donor site morbidity and good postoperative cosmesis because the donor scar is well concealed.

The mechanism by which vascularized lymph node transfer works is being investigated. Lin et al.\(^1\) hypothesized that the high-pressure arterial inflow and low-pressure, large-caliber venous outflow function with the lymph nodes as an internal pump-suction mechanism to drive lymphatic drainage into the venous system. Through a “catchment” effect, lymph in the surrounding tissues is continuously recruited into the flap. As the subcutaneous compartment pressure improves, old lymphatic channels reopen and lymphangiogenesis recovers.\(^4\) Vascularized lymph node transfer is most effective for patients with stage 2 (moderate) or 3 (severe) lymphedema who are refractory to conservative therapies (Fig. 77-1). Preoperative duplex ultrasound is necessary to verify patency of the venous system in the lymphedematous limb. Infection and cancer recurrence in the affected limb must also be ruled out before surgery.
Fig. 77-1  This 39-year-old woman had right breast cancer and underwent modified radical mastectomy, axillary lymph node dissection, and radiation therapy. She is seen 2 years after her initial surgery, with her arms pronated and supinated. Since the initial surgery, she had developed right upper arm stage II lymphedema above the wrist. She had a poor response to conservative treatment for 1 year and decided to undergo vascularized groin lymph node transfer.

ANATOMY

The superficial groin lymph nodes drain the anterior abdominal wall\(^6\) and therefore can be used for vascularized lymph node transfer without affecting lower extremity lymphatic drainage. There are two groups of superficial groin lymph nodes, as demonstrated in cadaver dissection studies.\(^7\) The first nodal group is supplied by the superficial branch of the superficial circumflex iliac artery (SCIA). This artery arises from the common femoral artery 2.5 cm distal to the inguinal ligament. It divides into superficial and deep branches and travels toward the anterior superior iliac spine. The superficial branch of the SCIA has a 1 to 2 mm diameter and a short pedicle length of 3 cm. It travels superolaterally over the deep fascia of the sartorius muscle proximally, supplies 2 to 3 regional lymph nodes, gives off several perforators to the skin in the anteromedial groin region, and then continues distally in the fatty tissue. The superficial circumflex iliac vein typically accompanies the artery. The deep branch of the SCIA travels deep to the deep fascia of the sartorius muscle and does not supply any nodes. The second nodal group is supplied by a medial branch of the common femoral artery. The medial branch originates from the side of the common femoral artery. It is 1.5 to 2.5 mm in size and has a pedicle length of 2.5 cm. It arises 3 cm distal to the SCIA and runs superolaterally toward the skin, supplying 2 to 3 lymph nodes around the common femoral vein and giving off several perforators in the anterolateral groin region. The medial vein is usually found running vertically at a distance from the medial artery and drains directly into the common femoral vein.
SURGICAL TECHNIQUE
Selection and Preparation of the Recipient Site

The axillary area has been used as a recipient site in vascular lymph node transfer for upper extremity lymphedema. However, this area is usually heavily scarred from previous axillary lymph node dissection and radiation therapy, making the dissection much more difficult and the quality of recipient vessels less healthy. Vein grafts may also be necessary for vascular anastomosis, because the axillary vessels are usually deep and the donor pedicle is short.

We prefer to use the wrist or elbow area as the recipient site. The wrist is frequently the preferred site, because it is at the most dependent position of the upper extremity and therefore harbors the largest reservoir of lymph by gravitational effect for drainage by the vascularized groin lymph nodes. In select cases the elbow can be used as the recipient site for better cosmesis (see Fig. 77-1). These recipient sites have never been operated or irradiated. The recipient vessels therefore are healthier, and the dissection is more straightforward.

The dorsal branch of the radial artery is usually selected as the recipient artery when the wrist area is used. A transverse S-shaped incision is made over the dorsal wrist. A 2 to 3 cm distal segment of the cephalic vein is dissected free. The dorsal branch of the radial artery is located in the snuffbox underneath the extensor pollicis longus tendon and abductor pollicis longus tendon. All dense fibrous tissues should be excised around the recipient vessels to create a pocket to allow flap inset without tension. The recipient artery is transposed on top of the extensor pollicis longus tendon to prevent postoperative compression by the tendon after wound closure. Strong spurring from the artery should be confirmed before flap transfer. Flow from the recipient artery may be significantly diminished because of the high intramuscular and subcutaneous compartment pressures. In instances where the blood flow from the dorsal branch of the radial artery is too low, the radial artery can be used as the recipient artery instead in an end-to-side vessel anastomosis.

When the elbow is selected as the recipient site, the anterior recurrent branch of the ulnar artery is the recipient artery (Fig. 77-2). A longitudinal S-shaped incision is made along the medial side of the forearm just below the elbow joint. A venous branch from the basilic vein is typically identified in the subcutaneous level crossing the elbow joint. This is dissected for use as the recipient vein. The anterior recurrent ulnar artery can be found between the flexor digitorum superficialis muscle and flexor carpi ulnaris muscle (Fig. 77-3). Dense fibrotic tissues around the recipient vessels are similarly removed. The wound edges are then undermined to create a pocket for flap inset.
Fig. 77-2  The elbow was selected as the recipient site, because most of the lymphedema was above the wrist and the patient was concerned about cosmesis. A longitudinal S-shaped incision (*solid black line*) was planned to expose the recipient vessels. The *red line* demonstrates the ulnar artery and one of its branches, the anterior recurrent ulnar artery (*ARUA*). This vessel was the recipient artery. A branch of the basilic vein is typically used as the recipient vein (*blue line*). The *dotted line* indicates the location of the skin paddle after groin lymph node flap transfer. A venous branch from the basilic vein.

Fig. 77-3  The anterior recurrent ulnar artery (*left red vessel loop*), which originates from ulnar artery (*right red vessel loop*), and a branch of the basilic vein (*blue vessel loop*) were dissected as the recipient vessels.
Fig. 77-4  The flap was designed on the left groin area. The *dotted line* indicates the inguinal ligament. Using finger palpation, the position of the common femoral artery was identified. The common femoral vein, superficial circumflex iliac artery, and medial artery were then marked in relation to the common femoral artery. Approximate locations of the two superficial lymph node groups around the superficial circumflex iliac artery and medial artery were also drawn. The presence of the skin perforators was confirmed with a pencil Doppler probe. The flap was designed to include the perforators, pedicle, and adequate surrounding soft tissues.

**Surface Landmarks**

A straight line is drawn from the pubic symphysis to the anterior superior iliac spine to indicate the location of the inguinal ligament (Fig. 77-4). The common femoral artery and vein are marked at the location of the palpable femoral pulse. The SCIA branches off 2 cm inferior to and runs parallel to the inguinal ligament. The location of the medial artery is marked 3 cm distal to the SCIA. A pencil Doppler probe is used to confirm the presence of skin perforators. A 5 by 10 cm elliptical skin flap is designed to include the perforators and the vascular pedicle. Either the SCIA or the medial artery can be used as the pedicle. However, the medial artery is preferred because of more available surrounding subcutaneous tissues containing lymphaticovenous connections that can be incorporated in the flap.

**Flap Dissection and Elevation**

The incision is made along the upper margin of the groin lymph node flap down to the deep fascia of the sartorius muscle, beveling away from the flap edges to include more superficial lymph nodes and lymphatic channels in the subcutaneous fatty tissue with the flap (Fig. 77-5). This is especially important in areas around the common femoral artery, where most of the lymph nodes are along the vessel. The dissection is then carried out on the suprafascial plane to identify the pedicle artery and vein. The common femoral artery and vein are first identified. The SCIA and medial artery can be found branching off of the common femoral artery. Both of these vessels can be used as the pedicle for the flap. As mentioned previously, we prefer to use the medial artery. Meticulous dissection around the common femoral artery is important to avoid inadvertent injury to these small and short vessels. The pedicle artery and vein do not necessarily
Fig. 77-5  Elevation of the vascularized groin lymph node flap. Note the inclusion of abundant soft tissues with the flap. The red vessel loops were placed around the superficial circumflex iliac artery and medial artery. The blue vessel loops were placed around the great saphenous vein and the medial vein.

Fig. 77-6  After the pedicle artery and vein were identified, the inferior incision was made and the flap was elevated completely.

run parallel together. This is particularly true for the medial artery and vein system (see Fig. 77-5). During flap dissection, a branch from the great saphenous vein can also be found. This vein mainly drains the blood and lymph from the lower extremity but not the groin area. It is not necessary to include the great saphenous vein, because it only passes through the flap without providing significant venous drainage of the groin area. After the pedicle artery and vein are identified, the inferior incision is made and the flap is elevated completely (Fig. 77-6). Meticulous hemostasis using bipolar electrocautery is recommended to prevent postoperative hematoma and lymph leakage at the donor site. The donor site is closed primarily over a suction drain.
Flap Inset and Microvascular Anastomosis

The pedicle of the vascularized groin lymph node flap is short (Fig. 77-7); therefore vessels should not be anastomosed before complete flap inset. The flap is placed into the recipient site pocket with the long axis of the flap along the length of the incision. The course of the donor vessels to the recipient vessels should be smooth and without twists, kinks, or tension. Two stitches are made to secure the flap to the recipient site. Part of the flap is then elevated to expose the vascular pedicle (Fig. 77-8). Care should be taken to confirm that there is adequate arterial spurt before the anastomosis. If not, adventitiectomy is required to remove all fibrotic tissues around the dorsal branch of the radial artery. Occasionally, if the dorsal branch of the radial artery cannot provide good arterial flow to the flap or if there is a large size discrepancy between donor and recipient arteries, an end-to-side anastomosis of the donor artery to the radial artery is suggested. After the arterial anastomosis, the back flow from the pedicle vein is carefully evaluated. Good back flow from the pedicle vein indicates good arterial perfusion into the flap. Venous anastomosis to a branch of the basilic vein is then carried out. Microanastomoses are performed using 9-0 or 10-0 nylon sutures.

Fig. 77-7  The harvested groin lymph node flap is shown before flap transfer. The yellow arrow points to the medial artery, and the blue arrow indicates the medial vein.

Fig. 77-8  The donor medial artery and vein are ready to be anastomosed to the recipient anterior recurrent ular artery and a branch of the basilic vein.
Wound Closure

Tension-free wound closure at the recipient site helps avoid compression of the pedicle artery and vein. The skin paddle provides wound coverage and allows postoperative flap monitoring (Fig. 77-9). In cases where the skin flap is inadequate for complete wound closure, the pedicle is covered entirely with the flap, and a split-thickness skin graft is used to cover the residual open areas. Open wounds that are left for secondary healing are prone to infection from the surrounding protein-rich lymph media.

![Image of wound closure](image)

**Fig. 77-9**  Final flap inset is shown after microvascular anastomosis. The skin paddle allows postoperative flap monitoring and a tension-free wound closure, which helps avoid compression of the pedicle.

The donor site wound can usually be closed primarily. A suction drain such as a Jackson-Pratt is placed to drain postoperative seroma fluid.
POSTOPERATIVE CARE

After surgery, patients are monitored in the intensive care unit for 48 to 72 hours. Anticoagulation agents, such as low-molecular-weight dextran, heparin, or PGE1, are not routinely prescribed. The flap is monitored every hour for Doppler signal, skin texture, temperature, color, and capillary refill. Swelling of the flap and surrounding tissues is common, necessitating careful observation of the flap circulation. If swelling is significant, stitches are removed to release the tension on the flap pedicle to prevent venous congestion. Moist dressing changes to the open wound are performed two to three times a day until flap viability is stable, at which point the wound may be closed with secondary primary closure or a skin graft as necessary. The wrist or elbow joint is also immobilized in a splint for 2 weeks to prevent accidental disruption of the microvascular anastomosis.

ADVANTAGES AND PITFALLS

The major pitfall of the vascularized groin lymph node flap procedure is inadequate inclusion of soft tissues with the groin flap. In addition to the superficial lymph nodes, the lymphatic channels that are present in the subcutaneous tissues around the pedicle are important to reestablish lymphatic connections at the recipient site. Another mistake commonly made is to take insufficient skin paddle (or no skin paddle) with the flap, assuming that the recipient site can be closed primarily. Even if it appears that primary closure of the recipient site is possible by skin reapproximation, this temptation must be resisted. Venous congestion primarily from pedicle compression is the most common cause of flap complications. The skin of a chronic lymphedematous limb does not have the same compliance as normal skin. A wound that closes fine on postoperative day 1 will most likely become too tight 24 to 48 hours later.

Nevertheless, with proper planning and execution, this flap is reliable and effective for treating lymphedema (Figs. 77-10 and 77-11). It has a constant vascular anatomy, and flap dissection is straightforward without the requirement of supermicrosurgery. The tough fibrotic skin and subcutaneous tissues make wound closure difficult after surgery. The skin paddle that is taken with the flap allows tension-free wound closure after surgical treatment, which is critical in preventing pedicle compression. The transferred vascularized lymph nodes and lymphatic channels restore lymphatic drainage and local immune function to the lymphedematous limb. Improvement is slow and gradual, but sustainable. In most instances, postoperative rehabilitation therapy is not necessary after vascularized lymph node transfer. Usually, patients show clinical improvement 1 week after flap transfer and report a feeling of softness with less heaviness in the hand and forearm. Wrinkles of the skin in the hand and wrist may become visible gradually. However, the objective reduction of the circumferences of the forearm and upper arm is observed 3 months after surgery. These results make the vascularized groin lymph node flap procedure a promising new technique for treating this very difficult situation.
Fig. 77-10  This patient is seen 9 months postoperatively with her arm pronated and supinated. The reduction rate of the circumference is reduced by 14% and 52% above and below the elbow, respectively. The reduction rate is defined as the change in the difference between the circumferences of the affected and normal arm preoperatively and postoperatively, divided by the preoperative difference.

Fig. 77-11  This 48-year-old woman with right breast cancer underwent modified radical mastectomy, axillary lymph node dissection and radiation therapy. A, After treatment, she developed stage II lymphedema and recurrent cellulitis of her right upper extremity, which progressed for 1½ years despite rehabilitation and conservative therapy. She underwent vascularized groin lymph node transfer from her left groin area to her right wrist. B, Twenty-one months postoperatively, the patient had 78% and 92% reduction rates of the circumferences above and below the elbow, respectively, and no more episodes of cellulitis.
References


The authors investigated the efficacy of transferring vascularized lymph nodes into lymphedematous limbs. Stable below-knee lymphoedema was established in one hind limb of 10 dogs. Histologic examination at 3 and 6 months revealed normal architecture in 9 of 10 nodes, although areas of lymphocyte depletion were common. Vascularized lymph node transfer to a lymphedematous leg reestablished lymphatic continuity and resulted in partial reduction of limb size. The addition of lymphaticolymphatic anastomosis to vascularized node transfer is neither necessary nor beneficial.


Lymphedema complicating breast cancer treatment remains a challenging problem. Twenty-four women with lymphedema for more than 5 years underwent lymph node transplantation. They were treated by physiotherapy, but the lymphedema was resistant to it. Lymph nodes were harvested in the femoral region, transferred to the axillary region, and transplanted by microsurgical procedures. Long-term results were evaluated according to skin elasticity, decrease, or disappearance of lymphedema assessed by measurements, isotopic lymphangiography, and ability to stop physiotherapy. Upper limb perimeter returned to normal in 10 cases, decreased in 12 cases, and remained unchanged in two cases. Ten patients were considered cured, important improvement was noted in 12 patients, and only two patients were not improved.


Results of an experimental study in the rat showed that a healthy gland transplanted into a lymphedematous zone can function for a sustained period and improve the edema. Therefore it is possible, without adversely affecting the lower limb lymphatic circulation, to transplant the superior external group of inguinal glands into the axilla of a “big arm.”