Research Highlight

Microvascular breast reconstruction and lymph node transfer for postmastectomy lymphedema patients

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Lymphedema is the result of an imbalance between capillary filtration and lymphatic drainage. Normal lymphatic function ensures the return of plasma proteins and excess water from the interstitial compartment back into the intravascular circulation. This process is governed by transmural capillary hydrostatic and colloid osmotic pressures and is propelled by smooth and skeletal muscle contraction. Post surgical abnormalities of lymphatic function are usually the result of lymphadenectomy, disruption of the lymphatic channels, or scar. In these situations, plasma proteins will accumulate in the interstitium, interstitial colloidal osmotic pressure increases, fluid shifts from the intravascular to the interstitial compartment, and lymphedema evolves. Early lymphedema is soft, associated with pitting, and reversible. Medical management is often successful. Chronic or untreated lymphedema will result in lymphatic stasis, inflammation, and collagen deposition in the skin and connective soft tissues. Management of chronic lymphedema is more complex and often requires surgical procedures as subcutaneous fibrosis ensues.

Upper extremity lymphedema in the setting of breast cancer and mastectomy can occur in 1-20% of women depending on the nature of the lymphadenectomy (sentinel or total). The etiology of lymphedema is presumed secondary to disruption of lymphatic pathways, excision of lymph nodes, and scar formation. Scar formation may be exacerbated by radiation therapy. Medical management includes intermittent pneumatic compression, decongestive physiotherapy, and elevation. These options usually require lifetime behavior modification. Surgical management has included lymphatic bypass via lymphatic grafts, lymphatic-venous anastomoses, and surgical excision. Results from these procedures have been mixed.

The transfer of musculocutaneous flaps or viable lymph nodes for the correction of lymphedema is innovative and continues to be investigated. These techniques have been studied both experimentally and clinically. In an experimental study, Slavin *et al*. demonstrated that transfer of the rectus abdominis musculocutaneous flap to the lymphedematous tail of a rat resulted in lymphatic drainage with resolution of lymphedema (1). This was confirmed via lymphoscintigraphy and fluorescence microlymphangiography. In another experimental study, Tobbia *et al*. demonstrated that the transfer of avascular lymph nodes is not as effective as the transfer of vascularized lymph nodes utilizing a lymphedema model in sheep (2). In a clinical study, Lin *et al*., demonstrated that the microvascular transfer of an inguinal adipocutaneous flap containing superficial inguinal lymph nodes to the dorsal wrist in 13 lymphedematous arms successfully improved lymphatic drainage in all patients (3). There were no donor or recipient site complications. In a similar clinical study, Becker used microvascular techniques to transplant inguinal adipocutaneous flaps that included the superficial inguinal lymph nodes into the axilla of 24 patients with lymphedema (4). Arm measurements demonstrated return to normal in 10 patients, reduction in 12 patients, and no change in 2 patients.

In the present study, Saaristo *et al*. have incorporated elements of all of the above studies and designed a clinical application with promise (5). They have utilized the lower abdominal flap (DIEP or MS free TRAM) and incorporated the superficial inguinal lymph nodes

as a single unit and transferred the tissues to the breast and axillary region as a free tissue transfer. The vascular anastomosis was to the antegrade thoracodorsal vessels and the lymphatic anastomosis was to the retrograde thoracodorsal vessels. Postoperative lymphoscintigraphy demonstrated improved lymphatic flow in 5/6 patients. Upper extremity measurements were decreased in 7/9 patients. Decompressive physiotherapy and compression was no longer necessary in 3/9 patients. The authors have demonstrated the feasibility of this technique and demonstrated success in the majority of patients.

Caveats to the described technique are that it is feasible only for those women who have had prior mastectomy and suffer from lymphedema who desire delayed reconstruction. It seems to be more effective in women with early or soft lymphedema rather that chronic or fibrotic lymphedema. The severely scarred axilla following radiation therapy may pose additional problems related to the exposure of the recipient vessels and the anastomosis. There are donor site risks that include lower limb lymphedema and seroma. For that reason it is important to identify the lymphatic pathways preoperatively in order to avoid removing the lymph nodes that drain the lower extremity. The authors used lymphoscintigraphy pre and postoperatively to assess drainage. Another technology that is currently available to assess lymphatic flow is fluorescent angiography using indocyanine green (6). This has demonstrated success in the clinical setting of lymphedema for lymphatic mapping.

In summary, this study represents an important next step in the surgical management of lymphedema. There is a considerable amount of enthusiasm regarding these techniques that include microsurgical transfer of lymph nodes to the dorsal wrist or to the axillary region. Early outcomes are encouraging. As the global experience increases, results will surely become more predictable and reproducible.

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