



Case study:

Microvascular Breast Reconstruction with Lymph Node Transfer for Postmastectomy Lymphedema Patient

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History

A female patient in her 40s discovered a lump measuring 3.6 by 3.3 by 2.5 centimeters in her left breast and was diagnosed with stage 2B, triple-negative breast cancer. She was initially treated with neoadjuvant chemotherapy. Then she underwent bilateral mastectomies and a left axillary node dissection with a bilateral immediate tissue expander placement. This was followed by left breast adjuvant radiation.

Unfortunately, her postoperative course was complicated by seroma and multiple infections in her left breast, leading to the loss of her tissue expander and reconstruction. Subsequently, she also developed grade two left upper extremity lymphedema due to axillary node dissection and the radiation required for her treatment.

Presentation and examination

The patient was referred to Rush for the salvage of her reconstruction and lymphedema treatment. She suffered from intermittent swelling in her left breast and left arm, which was debilitating and painful. She wore a compression sleeve and used an at-home lymphedema pump. Also, she had weekly lymphedema therapy with an occupational therapist. However, despite these therapies, her lymphedema had improved only minimally.

During an examination, her left arm was found to be enlarged compared to the right arm, with swelling concentrated mainly in her wrist and arm. Indocyanine green lymphangiography (ICG) was performed in the office to determine if she was a candidate for microvascular lymphatic reconstruction. Her imaging showed a delayed uptake of dye with dermal backflow at the mid-arm level.

Treatment

To provide the patient with adequate breast reconstruction and treat her lymphedema concurrently, she was offered delayed bilateral deep inferior epigastric perforator (DIEP) free flaps with a microvascular lymph node transplant to the left axilla. Given the patient's previous chest wall radiation and the failure of her tissue expander due to an infection, she was counseled that a conversion to an autologous reconstruction would have the highest chance of success.

DIEP flap breast reconstruction uses skin and subcutaneous fat is taken from the patient's abdomen, along with its blood supply, to create a natural breast without the use of implants. The flap is named for the vessels that provide its vascularity, which run beneath the rectus muscle. The deep inferior epigastric artery and vein give off small perforating blood vessels that are traced with loupe magnification through the muscle to the skin, and using them avoids having to remove any of the abdominal wall musculature with the flap. Thus, the integrity of the abdominal wall is preserved.

For patients who also suffer concurrently from lymphedema, the DIEP flap can be harvested with groin lymph nodes to improve their lymphedema symptoms. When performing the DIEP flap reconstruction with lymph node transfer, reverse sentinel groin lymph node mapping is used to avoid harvesting the sentinel lymph nodes that drain the leg, thus minimizing the risk of donor site lymphedema. To ensure that the transferred lymph nodes remain viable over time, an additional anastomosis is performed in

the axilla to provide the blood supply to the lymph nodes. This blood supply is provided by the deep circumflex iliac artery and vein.

In addition to routine postoperative care, we also recommended that the patient continue to wear her compression sleeve for one year after transplantation to ensure the best results.

Outcome

It has been more than a year since we performed the patient's initial flap surgery. The patient has subsequently completed the reconstructive process with a secondary flap revision procedure for symmetry and bilateral nipple reconstruction. She is very happy with the reconstructive outcome. Her lymphedema and the quality of her life have improved significantly, with a 27% reduction in limb volume and a decrease in pain and swelling at the end of the day. She also has much less difficulty performing the activities of daily life.

Analysis

Breast reconstruction

DIEP flap reconstruction is a superior but more complicated surgical approach to transverse rectus abdominis (TRAM) flap surgery. A TRAM flap is also considered a mainstream surgical approach that takes fat and skin from the abdomen, but unlike the DIEP flap, it uses the rectus abdominal muscle for the reconstruction, thus violating the integrity of the abdominal wall and potentially requiring the placement of abdominal mesh reinforcement.

Patients undergoing DIEP flap surgery tend to have fewer complications, such as less muscle weakness and a decreased risk of hernia, and they have a faster recovery since the muscle tissue is undisturbed.

Post-mastectomy lymphedema treatment

We can perform one of two microsurgical approaches to treat lymphedema: (1) lymphovenous bypass (LVB), which bypasses the non-working lymphatics to return the lymph nodes to the venous system

and ultimately drain into the thoracic duct, and (2) vascularized lymph node transfer (LNT), which places the functioning lymph nodes and lymphatic vessels contained within a segment of vascularized tissue into an affected area to siphon or bypass excess lymph fluid.

In this particular case, we used an LNT for the groin since this procedure can be easily combined with microvascular breast reconstruction to treat two problems during one operation. Should the patient develop worsening symptoms of lymphedema in the future, she can also be offered LVB, and lymphatic bypass targets could be identified with a preoperative ICG lymphangiograph.

In general, LVB is typically utilized for patients with early-stage lymphedema (stages 0 or 1), who have lymphedema in their upper or lower extremities and functioning, non-leaky venous system valves. LVB can be used to circumvent the problem posed by the difference in pressure between the higher venous backflow pressure and the lower pressure of the lymphatic system.

On the other hand, LNT is typically used for patients with more advanced cases of lymphedema, providing them with a significant reduction in discomfort and swelling compared to conservative, non-surgical management treatments. In this case, the patient only needs the intermittent use of a compression garment to manage the side effects of her lymphedema.

In severe cases, LVB can be combined with LNT to provide the best results.

We are not entirely certain why LNT works, but researchers hypothesize that either (1) orthotopically placed lymph nodes act like a sponge or pump to absorb lymphatic fluid and direct the lymph into the vascular network or (2) transplanted nodes induce a lymphangiogenesis that bridges lymphatic pathways. The best success rates are achieved

with a vascularized lymph node transplant over the placement of non-vascularized nodes. Therefore, it is imperative that the lymph nodes are harvested with their own artery and vein and that microvascular connections are made to allow for the long-term survival of the lymph nodes.

Preventive lymphedema treatment (immediate lymphatic reconstruction)

Even better than the treatment of lymphedema is preventing the development of the disease at the time of mastectomy. Rush microvascular surgeons offer immediate lymphatic reconstruction for high-risk patients. These are patients who are undergoing axillary node dissection with subsequent adjuvant radiation since the risk of developing lymphedema in this cohort can be as high as 30%. To try to prevent the onset of lymphedema, microvascular surgeons inject fluorescein dye in addition to ICG in the upper arm following the axillary node dissection. Any leaking lymphatic channels that were severed at the time of lymph node dissection are identified and bypassed into a nearby vein. Rush plastic surgeons are working alongside the breast surgical oncology team to perform immediate lymphatic reconstruction as part of a randomized clinical trial.

Deana S. Shenaq, MD, is an assistant professor in the Division of Plastic & Reconstructive Surgery and program director of the Integrated Plastic and Reconstructive Surgery Residency Program. Dr. Shenaq specializes in both implant-based and autologous reconstruction after breast cancer and in microvascular techniques for lymphedema treatment, including lymph node transfer and lymphovenous bypass procedures. She has advanced training in limb salvage and oncologic reconstruction following cancers of the head and neck, skin, perineum and lower extremity. She also performs aesthetic surgery of the face, breast and body.

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