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CASE REPORT

Breast

A Clinical Case of Breast Reconstruction with Greater Omentum Flap for Treatment of Upper Extremity Lymphedema

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Summary: Patients presenting with complications regarding breast cancer surgery require individualized surgical protocol for correction and reconstruction. This clinical case summarizes our clinical experience in the application of the free greater omentum flap for treatment of upper extremity lymphedema and breast reconstruction. This method combines aesthetic reconstruction of the breast with functional correction. The presented clinical vignette features a patient with post-biquadrantectomy upper extremity lymphedema. A free greater omentum flap was chosen for the purpose of breast reconstruction and vascularized lymph node transfer to treat upper extremity lymphedema. Upper extremity circumferences were monitored before and after surgical correction. The revascularized flap survived well after the operation and the reconstructed breast had a natural appearance. Six months after the operation, the patient's upper extremity circumferences decreased significantly, and the pain and swelling were also alleviated. The patient was satisfied with the results. The use of the free greater omentum flap for breast reconstruction and treatment of upper extremity lymphedema provides both aesthetic and functional patient rehabilitation. The application of this technique requires proper patient selection and thorough surgical planning. *(Plast Reconstr Surg Glob Open 2019;7:e2402; doi: 10.1097/GOX.0000000000002402; Published online 30 September 2019.)*

Breast cancer affects the wellbeing of women around the world, having become the most common cancer among women.[1] Patients face significant posttreatment difficulties, both aesthetic and functional deficiencies and rehabilitation struggles. Postmastectomy syndrome is a common complication, including pain, upper extremity lymphedema, and anterior chest wall deformation.

Studies have shown that nearly 10% of tissue fluid normally returns to the circulatory system via lymphatic drainage. Upper extremity lymphatic drainage is often damaged as a result of extensive lymph-node dissection during breast cancer treatment. In some cases, this can occur during lymph-node biopsy, including excision biopsy and fine-needle aspiration.[2] Lymphedema occurs at a rate of up to 65% based on current data.[3–5] There is no standardized treatment protocol for lymphedema. In our clinical vignette, we apply a department treatment protocol for patients suffering from upper extremity lymphedema, pain, and anterior chest wall deformation after radical surgery with lymph node dissection. The patient selected for this treatment received breast reconstruction with a free greater omentum flap. The efficacy of the procedure was evaluated according to lymphoscintigraphy results, patient satisfaction, and upper extremity circumference changes.

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CASE REPORT

A 55-year-old woman was referred to our hospital with a history of stage IIA cancer of the right breast (T2N0M0G2, located on the border of upper outer and lower outer quadrants) in October 2018 (Fig. 1). She was diagnosed in early 2017 and underwent complex treatment, including a biquadrantectomy with full axillary dissection and postoperative radiotherapy. As a result of surgical treatment the patient was left with a visible anterior chest wall deformity, including asymmetry of breasts, deformation of right nipple-areola complex, loose and empty right breast skin envelope, and scar tissue contracture of the right axillary region. Apart from aesthetic deformity, the

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Fig. 1. Patient status upon admission. Right breast reconstruction and right upper extremity lymphedema treatment required.

Fig. 2. Intraoperative view of greater omentum flap.

patient had significant functional impairments, including right upper extremity lymphedema, pain syndrome, and muscle weakness. Conservative treatment did not yield positive results. Upon admission, the patient was selected for delayed breast reconstruction with a revascularized greater omentum flap. The greater omentum was the flap of choice as it provides a large surface with fluid absorbing capability, and the lymphatic and vascular architectonics of the omentum significantly improve local drainage in the recipient region, according to several studies.[6–8]

Patient preparation included lymphoscintigraphy, during which dermal back-flow was visible in the axillary region. Regional ultrasound showed deep scarring of the axillary region with partial compression of neurovascular structures, turbulent blood flow in the axillary vein, and a seroma in the projection of the upper outer breast quadrant. After preoperative evaluation, the patient underwent surgical intervention.

The patient received axillary contracture release, breast reconstruction with a greater omentum flap with lymphatic component, formation of venous flow through, and mastopexy of contralateral breast. Mobilization of the greater omentum flap was performed through an umbilical access via laparoscopic technique. The flap was separated from the edge of the transverse colon, splenic, and hepatic flexures, the gastroepiploic vascular arch was separated along the wall of the greater curvature of the stomach and the gastrocolic ligament. As a result, the entire greater omentum flap on the gastroepiploic vascular pedicle was mobilized. The flap weighed 760 g (Fig. 2).

The recipient zone was prepared. Primarily, the postoperative scar tissue was excised, after which seroma excision and skin flap mobilization was performed. Axillary decompression was performed. The axillary vein and internal thoracic artery and vein were prepared as acceptor vessels. Microsurgical revascularization of the greater omentum flap was performed, as a result 3 vascular anastomoses were placed: end-to-end internal thoracic artery and left gastroepiploic artery anastomosis, end-to-end internal thoracic vein and left gastroepiploic vein anastomosis, and end-to-side axillary vein (right) with right gastroepiploic vein. As a result, venous through-flow was achieved in the flap, decreasing venous pressure in the right upper extremity. Essentially this caused the flap lymphovenous communications (LVCs) to open, according to the theory that decreased venous pressure in areas of disrupted lymphatic flow causes intranodular LVCs to function.[9–11] After flap revascularization, the superior border of the omentum was fixed along the projection of the breast

Table 1. Right and Left Upper Extremity Circumferences 1, 3, 6 Months after Surgery

	Right Arm Circumferences (cm)				Left Arm Circumferences (cm)			
	Wrist	Forearm Middle Third	Humerus Middle Third	Humerus Upper Third	Wrist	Forearm Middle Third	Humerus Middle Third	Humerus Upper Third
Pre-surgery	17.5	25	28.5	35	21	29.5	37.5	38
1 month postoperatively	17.5	25	28.5	35	19	28	33	36
3 months postoperatively	17.5	25	28.5	35	17.5	26	32	36
6 months postoperatively	17.5	25	28.5	35	16.5	25	31	35.5

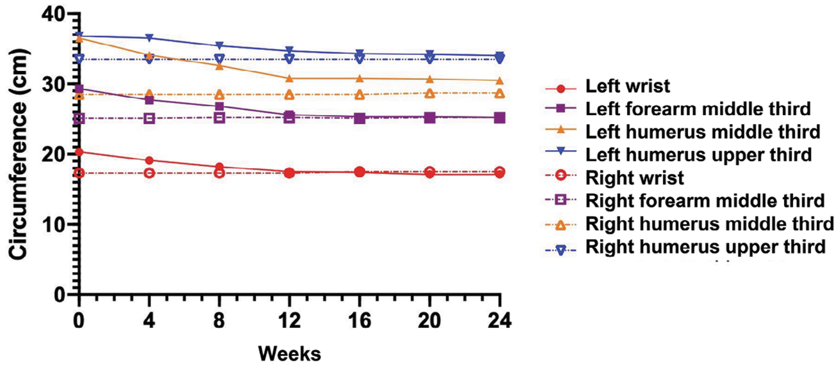

Fig. 3. Right and left upper extremity circumference dynamics: 0–6 months postoperatively.

upper pole. Subsequently, the flap was modeled to replace breast tissue defect with regard to vascular positioning. Lastly, skin envelope modeling was performed.

The patient was hospitalized postoperatively for 7 days. After discharge, the patient continued ambulatory visits to the hospital for follow-up examinations every day up to 14 days postoperatively, then 1, 3, and 6 months after surgery. The circumferences of the upper extremities on the affected and unaffected sides were measured and recorded during each visit (Table 1).

RESULTS

No perioperative complications occurred. Breast volume was examined using liquid displacement, overall volume loss after surgery was 40 cc (680 cc 1 month postoperative; 640 cc at 6 months after surgery). Doppler ultrasound examination was routinely used to assess blood supply and blood flow dynamics in the flap. Venous flow from the axillary vein through the flap into the internal thoracic vein and arterial flap supply remained consistent.

The circumferences of the upper extremities on the affected and unaffected sides were measured at 4 different levels (wrist, middle third of forearm, middle third of humerus, and upper third of humerus), respectively. Examination showed that the upper extremity circumferences on the affected side decreased significantly since the fourth week, and the differences between the circumferences on the affected side and those on the unaffected side gradually decreased. By the eighth week after surgery, upper extremity circumferences nearly matched (Fig. 3).

Six months after surgery, the reconstructed breast was soft, with natural ptosis occurring, overall aesthetic effect is satisfactory. Upper extremity lymphedema significantly reduced, pain syndrome was absent. The patient expressed satisfaction with the results (Fig. 4).

Fig. 4. Treatment results. Reconstructed right breast and mastopexy of the left breast: 6 months postoperatively.

DISCUSSION

The importance of this case is defined by careful patient selection, thorough operative planning and surgical procedure, which yielded positive aesthetic and functional results. Flap positioning requires special regard, due to the need to fold the omentum in the recipient zone. This causes an increased risk of venous congestion. To reduce the risk of venous complications, we recommend inward folding of the peripheral omentum tissue, thereby forming a "dumpling" style flap. Careful flap positioning and taking care not to compress the vasculature of the omentum is necessary for perfusion stability.

Relatively high rates of lymphedema have caused increased interest of the medical community to conservative and surgical treatment. Advances in microsurgical technique and visualization have accounted for evolution of surgical treatment of lymphedema. Vascularized lymph node transfer (VLNT) and lymphatic-venous anastomosis

(LVA) are the most commonly used methods of surgical lymphedema correction. Inconsistency of treatment results with VLNT and LVA, as well as a lack of significant evidence-based trials undermine the efficacy of these procedures. It is therefore necessary to properly select patients to undergo VLNT or LVA, or the combination of the 2 methods.

Understanding of pathophysiological and physico-anatomical aspects of lymphedema after breast cancer treatment provides surgeons with a basis for surgical protocol development and categorization of patients. It is known that lymph nodes contain high endothelial venules in their paracortex. These vessels account for direct circulation between the lymphatic system and bloodstream. It has been shown by several experimental studies that high endothelial venules provide anatomical basis for LVC. Pressman et al[12,13] first demonstrated the existence and physiological aspects of LVC by injecting air into the venous system and observing its presence in the lymphatic system. The LVC would function inside the lymph nodes under certain circumstances, which could be observed during lymphedema. Increased interstitial fluid pressure in the surrounding tissue causes compensational opening of LVC, providing movement of lymph into the circulatory system.[14] High intravascular pressure, exceeding interstitial pressure, causes blockage of LVC in the lymph node.[15] It is the authors' opinion that this mechanism often occurs in patients who underwent extensive axillary lymph node dissection. Therefore lymphedema treatment must include reduction of venous hypertension in the upper extremity, as well as introduction of new lymphatic tissue, capable of compensating excessive interstitial pressure through passive LVC.

Authors Cheng et al[16] have demonstrated the functioning of LVC in transferred lymphatic tissue in VLNT. In their article, they showed presence of subcutaneously injected ICG in the venous system of the transferred flap. Overall, the greater omentum has been proven to be an effective flap with excellent reconstructive and functional characteristics.[17,18] The described method should be applied in patients requiring breast reconstruction with treatment of upper extremity lymphedema.

CONCLUSIONS

Our understanding of the pathophysiological mechanisms of LVC and pressure-related lymphedema helped us apply a highly effective treatment method for properly selecting a patient presenting with upper extremity lymphedema. This clinical case report outlines the algorithmic approach in a patient with above-satisfactory treatment results. Breast reconstruction with a venous-through-flow and highly lymphatic greater omentum flap facilitated correction of disrupted fluid drainage in the upper extremity. Further research is necessary to prove the statistical significance of personalized lymphedema treatment in selected patients.

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REFERENCES

1. Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: sources, methods and major patterns in Globocan 2012. *Int J Cancer.* 2015;136:359–386.
2. Wrone DA, Tanabe KK, Cosimi AB, et al. Lymphedema after sentinel lymph node biopsy for cutaneous melanoma: a report of 5 cases. *Arch Dermatol.* 2000;136:511–514.
3. Amore M, Tapia L, Mercado D, et al. Lymphedema: a general outline of its anatomical base. *J Reconstr Microsurg.* 2016;32:2–9.
4. Gärtner R, Jensen MB, Kronborg L, et al. Self-reported arm-lymphedema and functional impairment after breast cancer treatment–a nationwide study of prevalence and associated factors. *Breast.* 2010;19:506–515.
5. Lan M. Current status and trends of breast reconstruction with simultaneous treatment and prevention of upper limb lymphedema. *Chin J Plast Surg.* 2018;34:247–251.
6. Scaglioni MF, Arvanitakis M, Chen YC, et al. Comprehensive review of vascularized lymph node transfers for lymphedema: outcomes and complications. *Microsurgery.* 2018;38:222–229.
7. Nakajima E, Nakajima R, Tsukamoto S, et al. Omental transposition for lymphedema after a breast cancer resection: report of a case. *Surg Today.* 2006;36:175–179.
8. Suami H, Chang DW. Overview of surgical treatments for breast cancer-related lymphedema. *Plast Reconstr Surg.* 2010;126:1853–1863.
9. Cheng MH, Huang JJ, Wu CW, et al. The mechanism of vascularized lymph node transfer for lymphedema: Natural lymphaticovenous drainage. *Plast Reconstr Surg.* 2014;133:192–198.
10. Miranda Garcés M, Mirapeix R, Pons G, et al. A comprehensive review of the natural lymphaticovenous communications and their role in lymphedema surgery. *J Surg Oncol.* 2016;113:374–380.
11. Dayan JH, Voineskos S, Verma R, et al. Managing venous hypertension in vascularized omentum lymphatic transplant: restoring bidirectional venous drainage. *Plast Reconstr Surg.* 2018;141:326e–327e.
12. Pressman JJ, Simon MB. Experimental evidence of direct communications between lymph nodes and veins. *Surg Gynecol Obstet.* 1961;113:537–541.
13. Pressman JL, Burtz MV, Shafer L. Further observations related to direct communications between lymph nodes and veins. *Surg Gynecol Obstet.* 1964;119:984–990.
14. Miranda-Garcés M, Pons G, Mirapeix R, et al. Intratissue lymphovenous communications in the mechanism of action of vascularized lymph node transfer: intratissue lymphovenous communications. *J Surg Onc.* 2016;115:27–31.
15. Anderson ND, Anderson AO, Wyllie RG. Specialized structure and metabolic activities of high endothelial venules in rat lymphatic tissues. *Immunology.* 1976;31:455–473.
16. Li N, Zheng Z, Li J, et al. Immediate breast reconstruction with omental flap for luminal breast cancer patients: ten clinical case reports. *Medicine (Baltimore).* 2017;96:e7797.
17. Zaha H, Abe N, Sagawa N, et al. Oncoplastic surgery with omental flap reconstruction: a study of 200 cases. *Breast Cancer Res Treat.* 2017;162:267–274.