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LYMPHO-DIEP FLAP TRANSFER PERFUSED BY REVERSE-FLOW THORACODORSAL ARTERY: A CASE REPORT

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Summary

Delayed autologous breast reconstruction often presents challenges due to the previous procedure and treatment: patients with axillary dissection and radiation therapy frequently experience compromised recipient axillary vessels due to fibrosis and damage leading the surgeon to explore new possibilities. We present a case report about a 59-year-old patient, who underwent a unique approach involving a combined free DIEP flap and groin vascularized lymph node transfer (Lympho-DIEP) based on the retrograde flow of the thoracodorsal artery as recipient vessel.

Key words: DIEP flap, retrograde flow, thoracodorsal artery, breast reconstruction, gVLNT

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INTRODUCTION

Breast cancer reconstructive options after mastectomy can involve autologous tissues [1] or breast implants [2,3]. The choice of reconstruction method [4] depends on individual factors, preferences, post-mastectomy radiotherapy (PMRT) and consultation with the surgeon to achieve desired outcomes to restore the shape [5] and appearance of the breast following a mastectomy.
The gold standard, when feasible, is represented by the Deep Inferior Epigastric Perforator (DIEP) flap [6], and it can be also performed concomitant with groin vascularized lymph node transfer (Lympho-DIEP) [7], for treatment of breast cancer-related lymphedema [8] of the upper limb [9].
In case of delayed [1] breast reconstruction, previous surgical procedures and radiotherapy can make arduous the dissection of the recipient vessels in the axillary region due to the extensive fibrosis and damages. Microsurgical flaps can be employed using either axillary or internal mammary vessels as recipient sites. Literature has documented cases of free flap reconstruction utilizing retrograde arterial [10] and venous [11] flow from internal mammary vessels. However, there are currently no descriptions of utilizing retrograde flow from the axillary vessels for this purpose.
To the best of our knowledge, this is the first description of retrograde flow perfusion from the thoracodorsal artery of a Lympho-DIEP for delayed breast reconstruction and upper limb lymphedema.

CASE REPORT

A 59-year-old patient, with invasive ductal carcinoma and involvement of lymph nodes, had undergone a radical right mastectomy, axillary dissection and reconstruction with tissue expander in 2019. As part of the treatment she underwent radiation therapy and adjuvant chemotherapy.

Shortly after the surgery, the patient developed lymphedema in the right upper limb because of radical axillary lymph node dissection.

After the oncological approval, in June 2023, the patient was scheduled for the removal of the breast expander, which was hypoexpanded and dislocated cranially in clavicular region, and reconstruction using Lympho-DIEP [12] in order to treat upper extremity lymphedema.

As common use, the patient pre-operatively underwent computed tomography angiography of the abdomen to study the perforator vessels from the deep inferior epigastric artery and vascular topography of groin lymph nodes.

Approximately, 30 minutes before the surgery's commencement, a total of 0.5 cc of methylene blue was injected into each interdigital space on the limb corresponding to the same side of inguinal lymph node harvest. This technique aimed to identify and preserve the lymph nodes responsible for lower limb drainage, preventing consequent secondary lymphedema in the donor area.

The Lympho-DIEP flap (skin paddle 17*10 cm, weight 1070 g) was harvested on a single perforator of the lateral row, with total preservation of the rectus abdominis muscle [13]. The flap harvesting was performed in conjunction with the superficial inguinal lymph node package, which did not exhibit uptake of the previously injected methylene blue (Fig. 1).

A considerable fibrosis was found during the recipient vessels dissection in the axillary region, with extensive fibrosis and damage resulting from the previous lymphadenectomy and radiation therapy. Unfortunately, a complete depletion of arterial recipient vessels was found with both the circumflex scapular artery (CSA) and thoracodorsal artery (TDA) unavailable due to the subscapular artery's (SA) interruption during the patient's previous surgery, about 1 cm from its emergence from the axillary artery.

We firstly performed an end-to-end anastomosis between the deep inferior epigastric artery (DIEA) and the stump of the interrupted subscapular artery, followed by veins anastomoses between the deep inferior epigastric and superficial epigastric veins and the circumflex scapular comitans veins.

Approximately, one hour after surgery, the patient had a significant hypotension with a blood pressure of 60/30 mmHg, showing consequent ischemia of the flap and an absence of the arterial Doppler signal. We promptly took back the patient to the operating room for anastomoses exploration and an arterial thrombosis was found in the stump of the previously interrupted subscapular artery.

Since the remaining portion of the SA was unusable due to its shortness and friability, we decided to pursue an alternative approach. We opted to use the reverse arterial flow from the distal stump of the thoracodorsal artery (Fig. 2). This artery showed good arterial

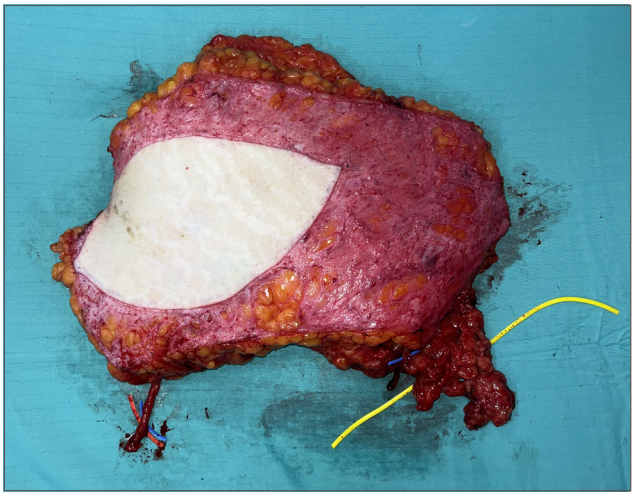

Figure 1. Intra-operative DIEP flap harvested with the superficial inguinal lymph node package (**yellow loop**).

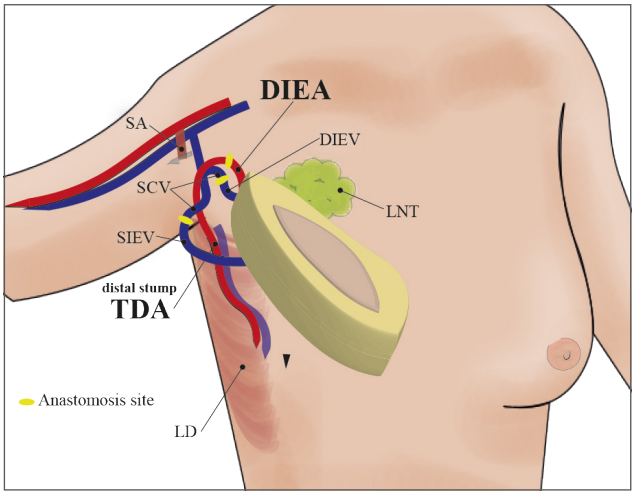

Figure 2. Schematic illustration of the anastomosis between the Deep inferior epigastric artery (DIEA) and the distal portion of the Thoracodorsal artery (TDA).
SA: subscapular artery; DIEV: deep inferior epigastric vein; SIEV: superficial inferior epigastric vein; SCV: circumflex scapular vein; LD: Latissimus dorsi muscle; LNT: lymph node transfer.

retrograde flow coming from the latissimus dorsi muscle and the vascular branch of anterior serratus muscle. The venous anastomoses exhibited no signs of thrombosis, so they were left intact. After end-to-end anastomosis between the deep inferior epigastric artery (DIEA) and distal stump of thoracodorsal artery, a good arterial flow and valid venous drainage were assessed using patency test (Video 1. Intra-operative view of the arterial and venous anastomoses. DIEA: deep inferior epigastric artery; TDA: thoracodorsal artery; DIEV: deep inferior epigastric vein; SIEV: superficial inferior epigastric vein; SCV: circumflex scapular vein). At the end of the procedure the flap was well perfused and confirmed by the Doppler evaluation with no signs of venous congestion.

Post-operative course was uneventful, and the patient was discharged 5 days after the operation.

Three months after surgery, the patient is in good general and local conditions (Fig. 3). The flap remains viable, there have been no complications at the donor and recipient site. The effectiveness of Lympho-DIEP is evaluated through 7 circumferential measurements of the limb affected by lymphedema, comparing the pre-operative values [8]. At current time, there is an average decrease of 15% in the measurements taken at predetermined points (Fig. 4), demonstrating effective good drainage of the lymph node engraftment.

DISCUSSION

Microsurgical breast reconstruction offers several benefits compared to implant-based reconstruction [14], including a natural look result and nice aesthetic outcome. The use of patient's own tissue as the DIEP flap provides long-lasting results and can be performed concomitantly with the lymph node transplantation for lymphedema treatment.

The axillary dissection during the preparation of recipient vessels can be challenging, especially if the patient has undergone previous extensive surgery and radiotherapy in the axillary region.

The situation we faced presented several challenges: firstly, the vessels commonly set up as recipients were unusable, so we had to adapt the subscapular artery stump as recipient vessel. Moreover, dealing with arterial thrombosis [15] demanded the development of an alternative plan.

This kind of situation may limit the availability of suitable recipient vessels [16] and this can force the surgeon to explore other solutions during the procedure.

The internal mammary vessels are potential recipients for DIEP breast reconstruction and even if they are a viable alternative, in our context they would have required lymph node removal and compromised flap's shape with a suboptimal surgical outcome. Furthermore, internal mammary artery (IMA) and veins have been associated with prolonged operative times and less consistency in terms of localization and diameter. In the context of a flap salvage procedure, time is of utmost importance and having a readily available reverse flow with a well-pulsating thoracodorsal artery (TDA) can be crucial in avoiding additional ischemia time required to prepare IMA.

After evaluating the impossibility of performing a second anastomosis on the remaining SA stump, we assessed the retrograde flow of the distal stump of the thoracodorsal artery that received blood from the latissimus dorsi muscle and the branch of the anterior serratus muscle, and, after careful consideration given to the flow, size, and suitability of this vessel, we decided to perform an end-to-end anastomosis between the DIEA and the distal TDA resulting in good flap perfusion.

To the best of our knowledge, the application of reverse

Figure 3. Post-operative course was uneventful. Patient before surgery (**left**) and at 3 months post-op following contralateral breast reduction mammaplasty (**right**). Pre-operatively, the patient had a breast expander dislocated cranially in clavicular region and hypo-expanded, condition that denied sufficient expansion to the breast skin envelope.

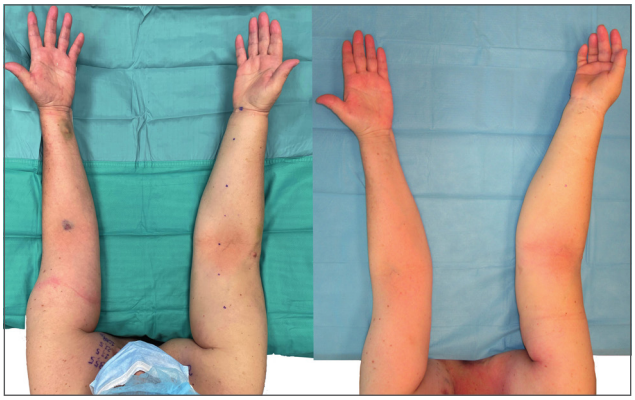

Figure 4. Evaluation of the upper limb lymphedema and lymph node transplantation. The monitoring was made through measurements, and demonstrates a notable reduction before surgery (**left**) and 3 months post-op (**right**) of the affected arm.

flow from the thoracodorsal artery for free flap transposition is actually an undocumented procedure in literature. While techniques involving reverse flow from the IMA have been described in breast reconstruction [17], our procedure represents the first described case of DIEP flap reconstruction with lymph node transplantation relying on reverse flow recipient vessels from the TDA.

CONCLUSIONS

To the best of our knowledge, this is the first reported case of retrograde flow from the thoracodorsal artery as a potential alternative for perfusion of a Lympho-DIEP in the setting of microsurgical breast and lymph node reconstruction.
Its finding opens up new possibilities [18] for surgeons performing autologous breast reconstruction, providing an alternative solution when the traditional axillary vessels are unavailable or unsuitable.
In our experience, the utilization of the retrograde flow from the thoracodorsal artery as a recipient vessel has shown effectiveness results, enhancing the success and viability of Lympho-DIEP flap for combined breast and lymph node reconstruction, ultimately benefiting patient in need of this surgical procedure [19].

Conflict of interest statement

Conflict of interest disclosure statement: We, hereby certify, that to the best of our knowledge no financial support or benefits have been received by author or any co-author, by any member of our immediate family or any individual or entity with whom or with which we have a significant relationship from any commercial source which is related directly or indirectly to the scientific work which is reported on in the article. None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript.

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Author contributions

BL: A, W
AP: A,W
GD'O: D, W
EG: D, DT
LV: D, DT
VC: A, W

Abbreviations

A: conceived and designed the analysis
D: collected the data
DT: contributed data or analysis tool
S: performed the analysis
W: wrote the paper
O: other contribution (specify contribution in more detail)

Ethical consideration

Not applicable.

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