

## CASE REPORT

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# The use of vertical postero-medial thigh flap as lymphatic flow-through flap for upper thigh defect reconstruction and lymphatic sequelae prevention in sarcoma surgery: A case report

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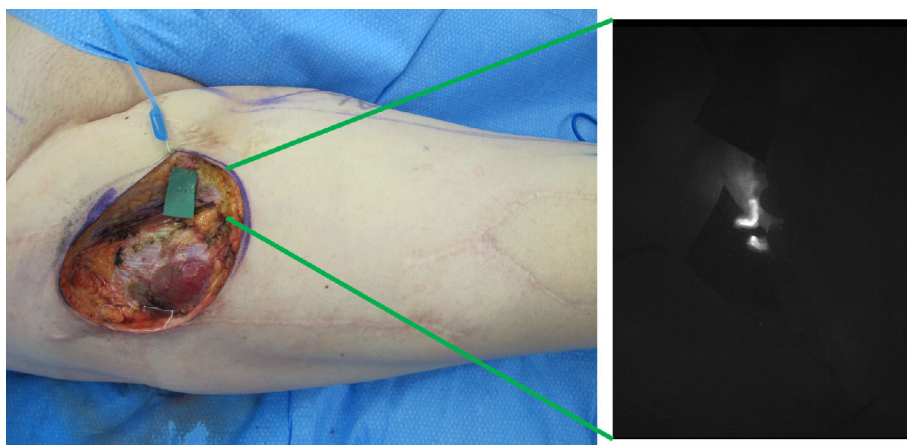
**Abstract**

Among the various histologic subpopulations of soft tissue sarcomas, undifferentiated pleomorphic sarcoma (UPS) is one of the most common subtypes in the adult population. Radical surgery remains the primary treatment for UPS, associated with postsurgical radiotherapy or chemotherapy. We herein report the case of a 65-year-old man presenting a recurrent UPS in his right upper thigh region. The patient received radical resection of the tumor and the remaining defect measured  $\sim 22$  cm  $\times$  18 cm. A soft tissue functional reconstruction with lymphatic-flow-through pedicled postero-medial thigh flap (PMT) was planned. A 24 cm  $\times$  16 cm flap was harvested in vertical fashion (vPMT), carefully preserving a superficial vein for the following lymphovenous anastomosis (LVA) at recipient site. The flap was then rotated and transferred to the defect area through a tunnel under the adductor longus muscle, and LVA was then performed between flap's additional venous pedicle and a nearby leaking lymphatic vessel. The postoperative course was uneventful and at 12 months follow-up no complications were encountered. No signs of lymphedema were reported. When dealing with the groin and upper thigh area, which is notably rich in lymphatic tissue, the possibility of prophylactically re-route lymphatic fluid into the venous system by means of microsurgical anastomosis, lays in the thrilling possibility to prevent secondary lymphedema, instead of curing it. With the described technique, we achieved optimal functional and esthetic outcomes setting at zero both donor and recipient sites morbidity.

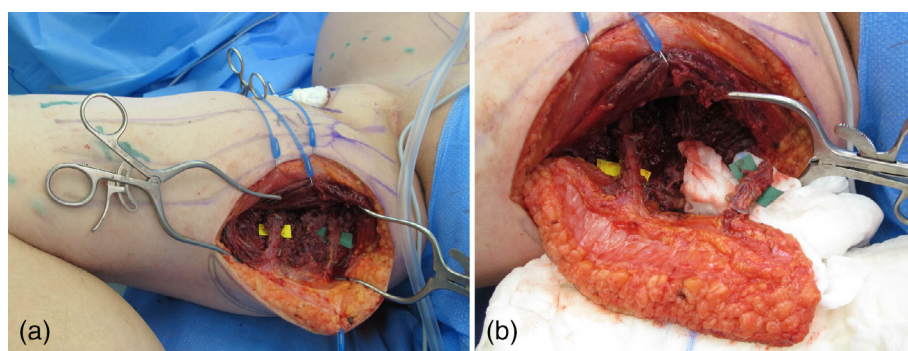
**1 | INTRODUCTION**

Soft-tissue sarcomas (STS), are heterogeneous malignant tumors originating from the mesenchymal tissues, accounting for 1% of malignancies in adults (Singer et al., 2000). Previously known as malignant fibrous histiocytoma (MFH), the undifferentiated pleomorphic sarcoma (UPS) most likely arises from mesenchymal stem cells and affects mainly soft tissues of the extremities, bones, and retroperitoneum. The standard of care for UPS is en-bloc surgical excision with microscopically negative margins, followed by adjuvant radio- or

chemotherapy (Delisca et al., 2015). When the oncological procedure involves the groin area, the unavoidable lymphatic tissue disruption and consequent possible impairments (such chronic lymphedema, recurrent inflammation and cellulitis, erythema and range of motion limitation) must be addressed (Scaglioni, Meroni, & Fritsche, 2022). For many years the first line treatment of lymphedema has been conservative management with complete decongestive therapy (CDT). If not controlled, surgical care of lymphedema may benefit from: (1) *physiologic procedures*, which attempt to augment the clearance of lymphatic fluid by anastomosing lymphatic channels to nearby



**FIGURE 1** Intraoperative picture of the defect at the end of the tumor resection procedure with leaking lymphatic vessel identification by means of ICG lymphography



**FIGURE 2** Intraoperative picture of the pedicled vPMT flap harvesting with two pedicles isolations: One for the flap's vascular supply and one intended for the lymphovenous anastomosis (a, b)

subdermal veins, lymphatic tissue transfer and vascularized lymph node transfer; (2) *ablative procedures*, which remove the excessive subcutaneous fibro-adipose tissue to improve patient comfort and facilitate conservative therapies; (3) *the combination* of the above-mentioned techniques. Nevertheless, most recently the efforts of microsurgeons have focused on secondary lymphedema prevention rather than cure, in reason of an immediate restoration of the lymphatic flow of the affected region right simultaneously to the soft tissue coverage.

Here, we present a case of a complex functional reconstruction of the inguinal area following recurrent UPS resection in a 65 years-old male patient. To cover the defect, a pedicled vertical postero-medial thigh flap was used, implemented with a lymphatic flow-through procedure (Lymph-FT-vPMT) to restore an adequate lymph flow at the recipient site.

The described technique allowed for an adequate soft tissue replacement after the oncologic debulking surgery together with a functional restoration of the loco-regional lymphatic drainage.

## 2 | CASE REPORT

A 65-years old man with no history of smoking or alcohol abuse presented with a recurrent UPS of the right thigh. Three years prior to this report, he underwent radical resection of the primary tumor

located at the knee and immediate reconstruction with lower medial thigh (p-LMT) propeller perforator flap. One year afterwards, for the first UPS recurrence at the groin area, inguinal lymph node dissection was performed and the defect covered by means of a pedicled anterolateral thigh perforator flap (p-ALT).

At 12 months follow-up control, the clinical examination revealed an asymptomatic enlarging mass confirmed by CT and MRI subsequently performed. After extensive discussions between the patient and treating physicians, the decision was made to perform radical excision of the recrudescing tumor followed by soft-tissue coverage using a pedicled vertical postero-medial thigh flap (vPMT). To address the lymphatic disruption issue, a lymphatic flow-through procedure was planned, in order to immediately re-route the locoregional lymph flow to a second donor vein suitable for the lymphatic venous anastomosis (LVA). Before surgery, a CT-angiography was done to localize the perforators of the vPMT flap, and the assessment was completed by means of handheld US probe. In addition, to enhance the lymphatic physiological procedure success, we consider ICG lymphography as mandatory for an adequate assessment of the lymphatic pathways of the affected area. After the tumor was extirpated according to the radicality rules, the remaining defect was circa 22 cm × 18 cm (Figure 1).

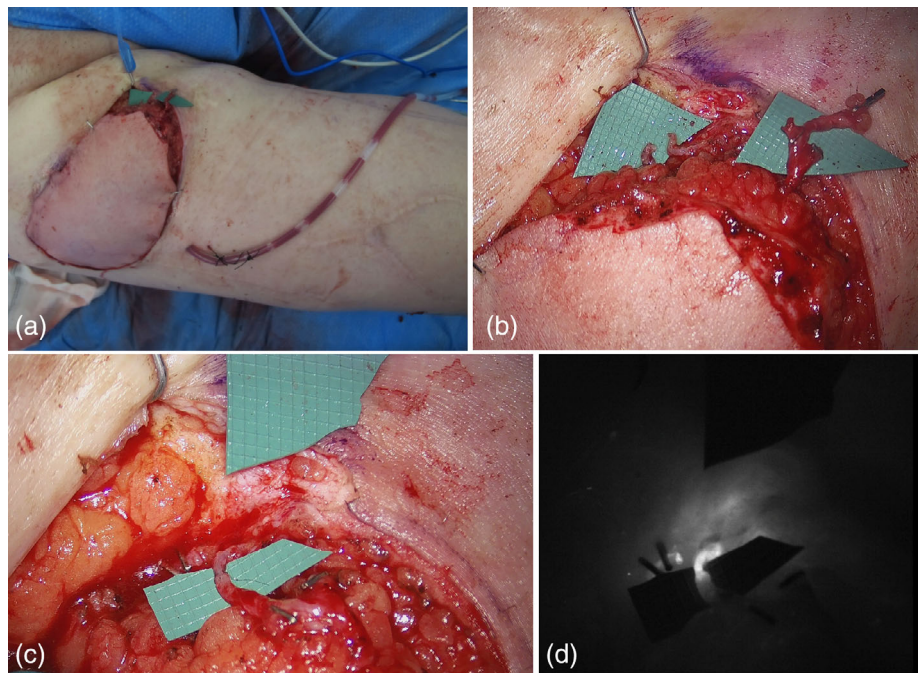
The pedicled vPMT flap was designed vertically according to size and shape of the defect, thus measuring 24 cm × 16 cm, and harvested as previously described (Wishart et al., 2021), based on its

more distal perforator vessels in order to achieve a greater arch of rotation. The proximal perforator donor vein was identified and carefully dissected for the subsequent planned LVA (Figure 2). The flap island was then rotated of circa  $110^\circ$  and inset into the site of the defect through a subcutaneous tunnel avoiding any pedicle kinking and/or tension. Right after proper preparation for LyFT flap-LVA, a lympho-venous anastomosis was performed in end-to-end fashion between the second venular flap pedicle and the nearby leaking lymphatic vessel which was previously identified. Proof of anastomosis patency and function was obtained using intraoperative ICG fluorescence imaging (Fluoptics Fluobeam device) (Figure 3). Both donor and recipient sites were closed primarily. Postoperative course was uneventful, immediately after surgery no signs of lymphocele were noted, and at 12 months the patient developed neither tumor recurrence nor lymphatic sequelae. (Figure 4). Lymphatic drainage was confirmed by Tc-99 m lymphoscintigraphy.

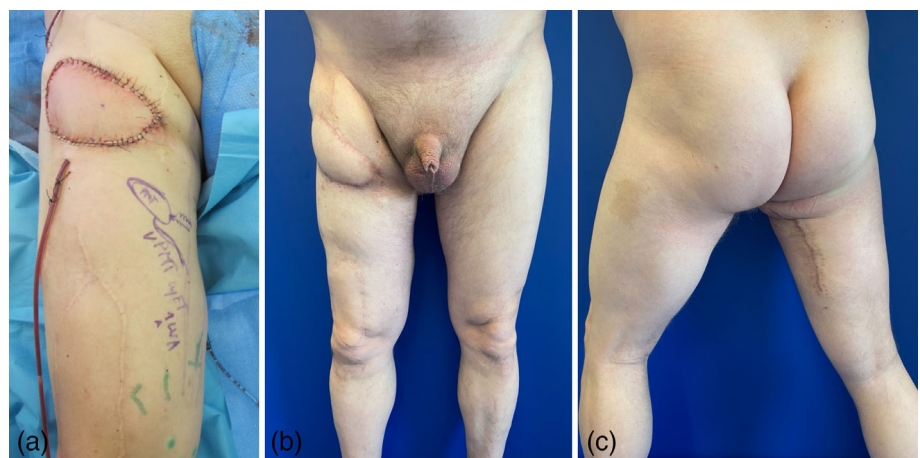
### 3 | DISCUSSION

Limb sparing surgery is the mainstay treatment for extremity soft tissue sarcoma. Adjuvant and neoadjuvant treatment (radio- and chemotherapy, systemic or regional) are integral components of the multimodal therapy for primary localized sarcoma (Singer et al., 2000). For a given defect, the often-cited rigid algorithm of the *reconstructive ladder* has been replaced by the newer concepts of the *reconstructive elevator* and *clockwork* (Knobloch & Vogt, 2010), which allows freedom to choose a more complex reconstruction to accomplish better function and esthetic outcome.

Functional restoration appears relevant when dealing with the upper medial thigh district, as the postoperative morbidity can have an incidence of complications as high as 40% (Exton & Galland, 2007). This area, which is extremely rich in lymphatic tissue, is often involved in STS debulking procedures, lymph node dissections, and various



**FIGURE 3** Flap inset after tunneling the pedicled vPMT-LyFT flap under adductor longus muscle (a), vessel preparation for LyFT flap-LVA (b), completed LyFT-LVA (c), and intraoperative proof of patency with ICG (d)



**FIGURE 4** Immediate postoperative picture at the end of the procedure (a); final result at 12 months follow up (b, c)

other surgical interventions that may jeopardize lymph flow and induce secondary chronic lymphedema (Wu et al., 2020).

Over the years different attempts have been done trying to solve the lymph stasis problem. A first interesting surgical hint was proposed in the early 50s by Sir Harold Gillies with the so-called “lymphatic wick” (Gillies, 1950). This solution consisted in implementing lymphatic vessels from the forearm to the trunk (or vice-versa) in order to bypass a definite drainage block. Nowadays, a growing body of evidence supports the effectiveness of modern surgical strategies to ameliorate the long-term disability and functional impairment related to lymphedema. Among them, supermicrosurgical LVA has gained popularity for its least invasiveness and its effectiveness in the dramatic reduction of severe cellulitis episodes (Scaglioni et al., 2017). Nevertheless, the in-depth knowledge of the anatomy and pathophysiology of the complex lymphatic system based on the several cadaveric studies recently reported in the English literature (Classen & Irvine, 2005), has prompted microsurgeons to shift the focus from treatment to prevention of iatrogenic lymphedema. On this ground, the concept of “lymphatic flow-through” flap developed (DiSumma & Guillier, 2020). Since its initial proposal, this procedure did not exactly match the definition of “flow-through,” like we were used to intend for example in case of arterial flow-through flaps. This is because the re-routed lymph drainage does not reach another lymphatic vessel, instead it usually joins the venous system. The mentioned technique was recently reported in this form to be used within ALT (Guillier et al., 2022), DIEP (Scaglioni, Meroni, Fritsche, & Fuchs, 2022), and SCIP (Scaglioni, Meroni, & Fritsche, 2022) perforator flaps. To the best of our knowledge, this is the first report of a postero-medial vertical thigh flap combined with a lymphatic flow through procedure (Lymph-FT-vPMT) which was successfully used after the excision of a recurrent UPS of the groin area. A functionally-similar, but conceptually-different procedure is microsurgical lymphatic vascular grafting. This technique allows to anatomically reconstruct a portion of the lymphatic network resorting to patient's own vessels and it showed encouraging results as described by Baumeister et al. (2020).

In a current retrospective study of 319 patients from three tertiary care centers, UPS recurrences rate accounts for 14.1%. Although in patients with extremity soft tissue sarcoma local recurrence does not affect overall survival (Winchester et al., 2018), the treatment of tumor recurrence is often very complicated and limited especially in elderly patients which need to receive multiple reconstructive attempts.

In the reported case, the patients underwent two successful reconstructive procedures with pedicled lower medial thigh flap (LMT) and anterolateral thigh (ALT) flap. At the second tumor recurrence, flap choice for coverage was intricate as the patients had multiple scars, less reconstructive opportunities due to the previous surgeries and we did not want to risk a microsurgical procedure on irradiated recipient vessels. The PMT flap represented a valid alternative because of its vascular consistency and favorable localization (Haddock et al., 2012). We therefore decided to exploit it for a lymph flow-through flap with the double aim of soft tissue replacement and

lymphatic flow restoration. Although more studies with large cohorts of patients are necessary to better assess the long-term effectiveness of the described procedure, lymphatic flow-through flaps are promising composite reconstructive tools which expand the use of both free and pedicled perforator flaps.

#### CONFLICT OF INTEREST

The authors have no financial conflicts or commercial associations to disclose.

#### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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