U·P·O·J

Tips and Tricks: Latissimus Dorsi Free Flap for Tumor-related Soft Tissue defects: A Case Report

Tensae Assefa, MD
Sand Mastrangelo, MD
Caroline Granruth, MD
Scott Levin, MD FACS
Cara Cipriano, MD

Department of Orthopaedic Surgery
University of Pennsylvania

Introduction

Large soft tissue defects resulting from malignant tumor resection can pose significant challenges to orthopaedic and plastic surgeons. Soft tissue deficiencies caused by trauma, infection, and tumors can result in nonviability of vital skin structures. The goal of soft tissue reconstruction is to restore function while maintaining optimal cosmesis. Frequently, staged treatments are necessary to minimize post-operative infection, facilitate healing, and reduce complications.[1]

Free flap surgery, or microsurgical tissue transfer, refers to a microvascular reconstruction that involves the transfer of autologous skin, fat, bone, and/or muscle from one area of the body to another. The tissue that is transferred (donor tissue) maintains its vascular supply and is re-anastomosed to an area (recipient site) to provide soft tissue coverage or functional reconstruction.[1] Common free flap donor sites include the anterolateral thigh (ALT) flap, radial forearm (RF), lateral arm (LA), gracilis muscle, rectus abdominis (RA), and the latissimus dorsi (LD).[2,3] In this case study, we present the use of a latissimus dorsi myocutaneous free flap to cover a large soft tissue defect of the left hemipelvis.

Case Presentation

Our patient is a 64-year-old male with a history of undifferentiated pleomorphic sarcoma (UPS). He received his initial diagnosis in 2002 following a right axillary/chest wall mass biopsy and subsequently completed 4 cycles of neoadjuvant chemotherapy with etoposide, ifosfamide, doxorubicin, and mesna. Four months after his diagnosis, he underwent wide surgical excision of the chest wall mass. Secondary excision was indicated due to positive surgical margins, so he underwent a secondary tumor bed resection one month following his initial excision. During postoperative surveillance visits in 2007, an enlarging right parascapular axillary nodule was identified and biopsied; pathology was consistent with recurrent UPS. In 2007, the patient underwent radical resection of the right axillary tumor bed with rectus abdominus free flap reconstruction. UPS recurrence in the right axilla was again noted during postoperative surveillance visits in 2010, and the patient underwent a fourquarter radical upper extremity amputation.

In 2012, the patient was found to have metastatic UPS in his left thigh and buttocks which were treated initially with chemoradiation, but then ultimately with left buttock resection in 2014. A secondary metastatic UPS left thigh mass was detected in 2018, and the patient underwent radical resection 3 months later. The surgery was complicated by persistent wound drainage which was operatively managed with prompt irrigation and debridement. Given the dependent location of the patient's wound, he endured significant surrounding skin breakdown resulting in a large wound about his left hip. He was offered a hip disarticulation at an outside institution but returned to our care for limb salvage.

In 2019, the patient underwent anterolateral thigh free flap reconstruction from his right thigh to cover his large left hip wound. This was followed by skin grafting to the posterior aspect of the free flap. Intraoperative pathology was negative for malignancy. However, routine surveillance imaging in 2020 revealed a heterogenous enhancing mass in the left thigh and iliac wing. A biopsy was performed in 2021 and was consistent with MDM2 positive dedifferentiated liposarcoma (DD LPS) and the patient elected treatment with serial cryoablation and radiation therapy. In 2023, he enrolled in the SARC041 blinded trial (placebo vs abemaciclib); however, the fungating mass about his left thigh and ilium continued to grow. Shortly thereafter, he was unblinded from the clinical trial and elected to proceed with surgical resection and staged soft tissue reconstruction given the tumor's continued growth on abemaciclib.

On 1/24/2024, the patient underwent wide excision of the left hip fungating mass with Dr. Cipriano. Intraoperative pathology confirmed negative margins. A wound vac was applied over the 25 cm × 6 cm × 20 cm open left hip and flank wound while the patient awaited definitive soft tissue coverage (Figure 1).

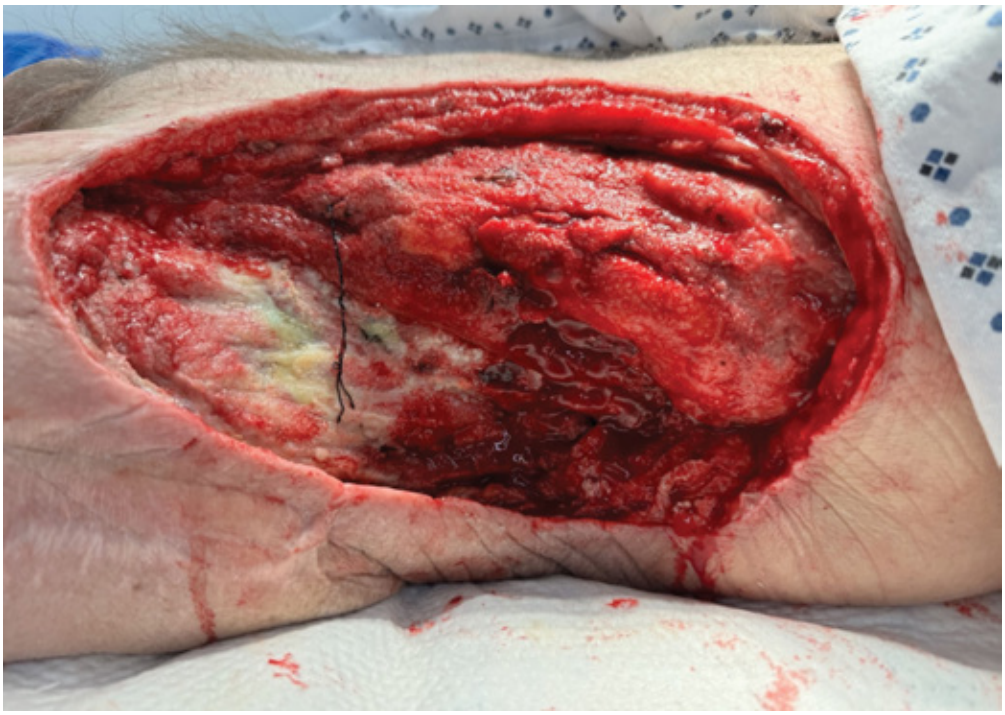

Figure 1. Open wound over the left hip and left flank following radical tumor resection.

Latissimus Dorsi Free Flap (LDFF)

On 2/1/2024, the patient underwent LDFF reconstruction of the open left hip wound with Dr. Levin—his third free flap in the treatment of this tumor. To ensure adequate vascularity, ultrasound dissection of the left thigh arteriovenous (AV) loop from his prior ALT free flap procedure was performed prior to the reconstruction. An oblique, myocutaneous latissimus dorsi flap measuring 22 cm × 12 cm was harvested from the patient's left chest wall (Figure 2). The serratus branch of the thoracodorsal artery was taken down with double hemoclips and the dissection proceeded to the level of the circumflex scapular artery. The flap was then divided and repositioned to cover the flank wound; it was inset over the transversalis and external oblique muscles to prevent herniation. Mesh was used to reinforce the abdominal wall. The flap was then anastomosed to the previous AV loop vessels using microsurgical technique, resulting in excellent inflow, outflow, and perfusion of the overlying skin pedicle (Figure 3). A skin graft was harvested from the patient's left thigh, meshed, and applied over the muscle of the myocutaneous latissimus dorsi free flap (Figure 4).

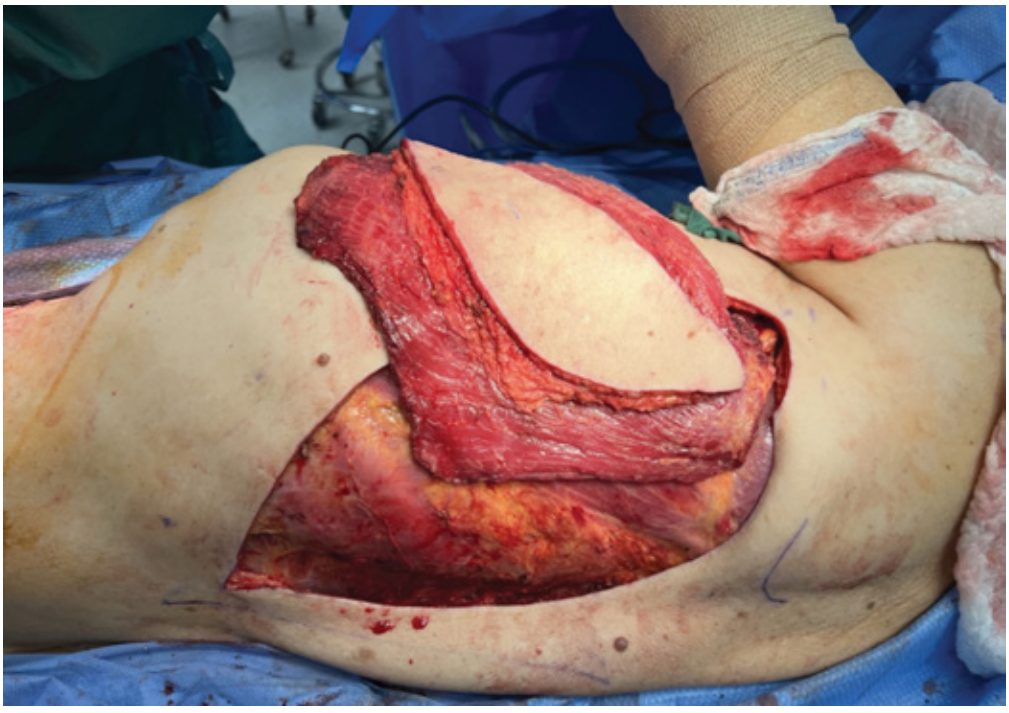

Figure 2. Donor site oblique skin paddle including the entire latissimus dorsi muscle.

Figure 3. Preparation of flap anastomosis at the recipient site.

Figure 4. Latissimus dorsi free flap reconstruction with skin grafting.

Post-operatively, the patient was extubated and taken to the surgical intensive care unit (SICU) for hourly neurovascular flap checks. The patient remained in bed until post-operative day two to protect the anastomosis and facilitate adequate soft tissue rest. At this point, the patient was tolerating a regular diet and receiving oral pain medications with adequate pain control. His neurovascular checks were stable, and he was transferred to the floor on post-operative day three. Physical and occupational therapy were initiated, and the patient demonstrated the ability to perform assisted transfers with expected improvement in his strength and endurance. His hospital course was uncomplicated, and he was discharged to an acute rehab facility on post-operative day nine.

Discussion

Undifferentiated pleomorphic sarcoma (UPS) is a high-grade sarcoma that is especially challenging to treat. Despite a multidisciplinary approach to treatment, approximately 30% of patients experience distant metastasis within 5 years of initial diagnosis.[4,5] Patients with recurrent malignancies often require multiple surgeries for adequate tumor resection. Neoadjuvant radiation to the tumor is an important factor in local control that plays a critical role in limb salvage surgery for sarcoma; however, it does compromise wound healing and increase rates of soft tissue complication to approximately 30%.[6,7] This further contributes to the need for repeated operations and secondary soft tissue coverage.

In this article, we present a patient with a large soft tissue defect involving his left thigh and hemipelvis secondary to UPS successfully treated with LDFF. Microsurgical techniques were employed intraoperatively to maintain the donor tissue vascular supply and subsequently re-anastomose it to the recipient site. These microsurgical skills were particularly important in this case, as the anastomosis was to the prior AV loop vessel from his prior ALT flap. Thus, fastidious technical skill and microsurgical technique were necessary to ensure flap viability.

Postoperative care for free flaps includes strict adherence to a protocol designed to optimize soft tissue healing and patient function. This includes graduated neurovascular checks, positioning restrictions, and a carefully selected nutrition plan. Physical and occupational therapy sessions should be started early in the postoperative course to facilitate functional recovery.

The patient's flap continued to function during the patient's post-operative course. Clinical photos taken three weeks post-operatively demonstrate adequate wound healing and soft tissue recovery (Figure 5).

Two months post-operatively, the patient has continued to heal well. Both his LDFF and his skin graft recipient sites are healthy-appearing and progressing well.

Conclusion

Latissimus dorsi free flap reconstruction provides a versatile and technically suitable option for large soft tissue defects requiring staged reconstruction. The free myocutaneous tissue transfer can be used in a tension free fashion to provide coverage to larger areas of soft tissue defect and is a useful technique for orthopaedic and plastic reconstructive surgeons.

Figure 5. Post-operative day twenty-one (A) Latissimus dorsi free flap donor site incision; (B) LDFF recipient site; (C) Left thigh skin graft donor site; (D) Left thigh skin graft recipient site.

Figure 6. Post-operative week 8.

References

1. Tu YK, Yen CY, Ma CH, *et al.* Soft-tissue injury management and flap reconstruction for mangled lower extremities. *Injury*. 2008 Oct;39 Suppl 4:75-95.

2. Kozusko SD, Liu X, Riccio CA, *et al.* Selecting a free flap for soft tissue coverage in lower extremity reconstruction. *Injury*. 2019 Dec;50 Suppl 5:S32-S39

3. He J, Qing L, Wu P, *et al.* Variations of Extended Latissimus Dorsi Musculocutaneous Flap for Reconstruction of Large Wounds in the Extremity. *Orthop Surg*. 2022 Oct;14(10):2598-2606.

4. Fletcher CD. Diagnostic histopathology of the tumors. Vol. 2. New York: *Curchill Livingstone*; 1995. p 1049–52

5. Graves L, Jeck WR, Grilley-Olson JE. A League of Its Own? Established and Emerging Therapies in Undifferentiated Pleomorphic Sarcoma. *Curr Treat Options Oncol*. 2023 Mar;24(3):212-228.

6. Shoham Y, Koretz M, Kachko L, *et al.* Immediate reconstruction of the chest wall by latissimus dorsi and vertical rectus abdominis musculocutaneous flaps after radical mastectomy for a huge pleomorphic liposarcoma. *J Plast Surg Hand Surg*. 2013 Apr;47(2):152-4.

7. Tashiro K, Arikawa M, Fukunaga Y, *et al.* Free latissimus dorsi musculocutaneous flap for external hemipelvectomy reconstruction. *Microsurgery*. 2019 Feb;39(2):138-143.