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Case Report

Myocutaneous latissimus dorsi split pedicle flap for simultaneous reconstruction of elbow and breast: a case report

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Abstract: In this article we present a case of a large anterior elbow defect and an ipsilateral post-mastectomy defect reconstructed simultaneously using a single latissimus dorsi pedicle flap, split into two separate skin islands based on its independent vascular branches. To the best of our knowledge, no previous cases utilizing this approach for simultaneous treatment of mastectomy and distal arm tissue defects have been reported. Therefore, it was deemed relevant to share the technical aspects of the surgical procedure. The case involves a 61-year-old woman of Caucasian origin, diagnosed with breast cancer of the left breast. She underwent a modified radical mastectomy. Postoperative radiotherapy and chemotherapy were administered. During a chemotherapy infusion, extravasation of the chemotherapeutic agent led to necrosis in the left elbow and distal upper arm regions. The patient was primarily treated at another facility with skin grafting. We performed a reconstruction with a pre-expanded latissimus dorsi pedicle flap divided into two independent myocutaneous flaps for the upper extremity and mastectomy defects. The left breast underwent delayed combined reconstruction with the myocutaneous flap and a silicone implant. The upper extremity defect was simultaneously reconstructed with the other part of the same flap. The whole reconstruction included three operative stages. The blood supply to the transferred tissues was excellent and no complications occurred. The constant vascular anatomy of the thoracodorsal vessels and their intramuscular distribution pattern provides a robust amount of healthy tissue, which can be successfully used for treating a variety of defects within the flaps rotational arc. This allows for the reconstruction of different anatomical regions. Based on this case we demonstrate that coverage of a large elbow defect and simultaneous breast reconstruction is possible by splitting a pre-expanded pedicle latissimus dorsi flap into two independent flaps.

Keywords: Latissimus dorsi, pedicle flap, reconstruction, breast, elbow

Introduction

The latissimus dorsi (LDM) pedicle flap was introduced for breast reconstruction at the beginning of the 20th century by Tansini [1]. Subsequently, this method was infrequently used until the 1970s when it gained popularity among plastic and surgical oncologists. The LDM flap eventually established itself as a workhorse flap for various types of reconstructions, both as a pedicle or free flap [2-4]. The most common indications include partial or total breast reconstruction, coverage of chest wall defects, and reconstruction of shoulder, upper arm and elbow defects [5]. Its vascular anatomy is constant and flap blood supply is reliable. The flap is classified as type V, according to the Mathes and Nahai classification [6], with a primary thoracodorsal pedicle and secondary segmental intercostal pedicles which are transected during flap elevation. Inside the latissimus dorsi muscle, the thoracodorsal artery divides into two main branches: vertical and transverse, each supplying different parts of the muscle and overlying skin. Therefore, the muscle could potentially be split, creating the opportunity to harvest two separate myocutaneous flaps.

Wong and Saint Cyr [7] described the muscle-sparing LDM pedicle flap based on the descending branch of the thoracodorsal artery for reconstruction of upper extremity and elbow defects. The authors used a narrow lateral part

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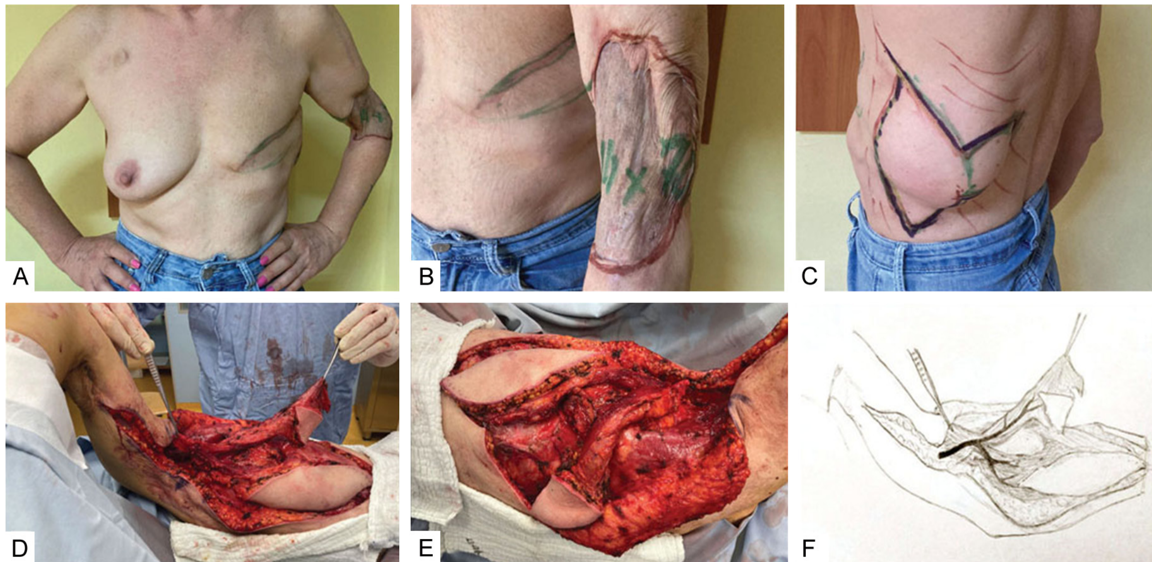

Figure 1. Preoperative view of the patient and LDM split flap planning and dissection. A. Front view of the patient; B. Close-up view of the defects; C. Pre-operative markings of the pre-expanded donor area; D, E. Intraoperative pictures of the two separate myocutaneous flaps; F. Schematic drawing of the split flap.

after splitting the muscle. In the following case, we utilized the possibility to reconstruct two distant anatomical regions with one pedicle flap, divided into two myocutaneous flaps with independent blood supply, based on the descending and transverse branches of the thoracodorsal artery. This technique is suitable only when the defects are located on the same side of the body, for example the left breast and left elbow, as we present in our patient. The LDM flap might also be successfully applied as a functional muscle transfer to restore mobility of the elbow joint as reported by Oda [8].

Case presentation

This technique was applied to a 61-year-old female patient who had surgery for breast cancer, a modified radical mastectomy of the left breast, followed by adjuvant radio- and chemotherapy. During chemotherapeutic treatment she developed a large soft tissue defect of the left elbow and distal upper arm area, resulting from extravasation of the infused agent. She was treated initially at another facility by surgical debridement and coverage with split-thickness skin grafts, one year prior to presenting to us. However, the patient considered the result aesthetically unacceptable and experienced disturbed sensations in the elbow area and mild limitation of movements. Moreover, the mastectomy defect required correction. The patient was and continues to be a heavy smoker.

The patient was admitted to our facility and planned for a staged combined reconstruction with a pre-expanded pedicle LDM flap. At the first stage a 400 cc expander with a distant port was inserted under the latissimus dorsi muscle in order to gain more skin surface for coverage and to enhance the vascularity. Five weeks post-expansion, the second operative stage was performed. The LDM flap was marked. The thoracodorsal artery and vein, and their two main branches were identified and preserved. The flap was elevated and divided into two separate flaps (**Figure 1**). The latissimus dorsi muscle insertion at the humerus was transected. The larger lateral flap was used to reconstruct the elbow defect, measuring 14×10 cm. The smaller medial flap was used for breast reconstruction, combined with a tissue expander. The donor site was closed primarily without tension. The postoperative period was uneventful and both flaps survived completely (**Figure 2**).

Finally, a third surgical stage followed seven months later. The expander was removed and a permanent implant was inserted in the left breast. Augmentation and mastopexy were performed on the right breast to achieve breast symmetry. Minor scar revision and flap remod-

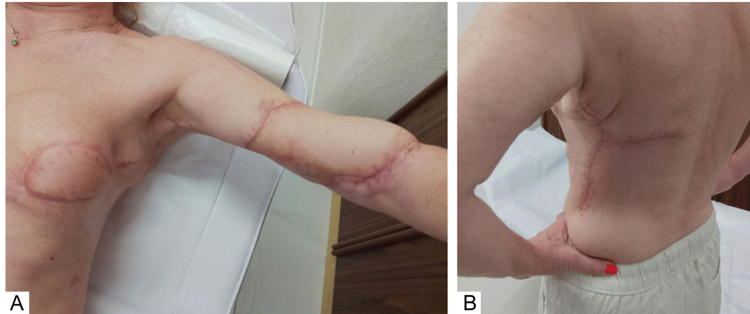

Figure 2. Postoperative result three months after the flap transfer. A. Anterior view; B. Posterolateral view of the donor area.

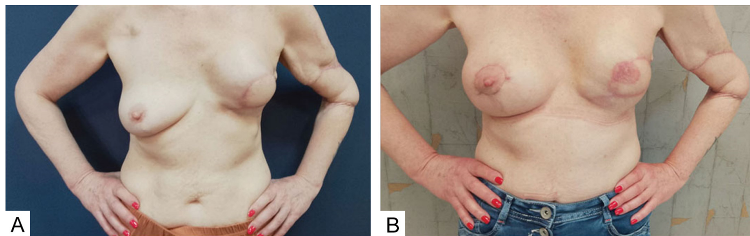

Figure 3. Front view of the patient before the final reconstructive stage (A) and two months later (B).

eling was performed on the left upper arm and elbow. Postoperative results at 7 and 9 months after flap transfer are shown (**Figure 3A**, **3B**). At follow-up, the patient reported high satisfaction with the aesthetic outcome of the surgery.

Discussion

During the 1970s, significant progress in plastic surgery practice was registered through the introduction of microsurgical techniques utilizing free vascularized flaps. Nelson Olivari [2] and Maxwell GP [3, 4, 9] were among the most prominent surgeons and scientists that popularized the LDM pedicle and free flap reconstructions. Half a century later, the pedicle LDM flap still remains a workhorse flap, not only in the context of breast reconstruction, but also for thoracic wall, shoulder, upper arm and elbow complex defect coverage [5, 7, 10-12]. Different flap type variations have been introduced over the years including extended LDM flap [13, 14], muscle-sparing [7] and Fleur-de-Lis skin flap design. All of them have their place and indications for autologous or combined breast reconstruction in both immediate and delayed settings. The idea of splitting the latissimus dorsi muscle was reported far back in 1981, by Tobin [15], in a detailed study of the neurovascular anatomy of the latissimus dorsi muscle. Nowadays we apply the split muscle LDM technique regularly with a very low complication rate. Therefore, when combined complex defects involving the ipsilateral body site are present, harvesting two pedicle flaps based on the main branches of the thoracodorsal vessels, by splitting the latissimus dorsi muscle and including the overlying skin is a good reconstructive option. If a widespread skin area requires reconstruction, pre-expanding the flap is suitable. In essence, flap pre-expansion increases the flap coverage area [16], avoiding the need for additional skin grafts. Therefore, it is not uncommon in our practice to pre-expand flaps in selected patients, as in the case we hereby present. According to the literature, and our own experience with over 200 flaps, the overall rate of complications and donor site morbidity of LDM flap remains low. Seroma was encountered in approximately one third of our patients when the whole width of the latissimus dorsi was included in the flap.

At present, we use the split muscle and muscle-sparing flap technique much more frequently and we have not encountered seroma in over 50 cases. There are two disadvantages of the technique that ought to be mentioned. On one hand, the unsightly donor area scars are a common drawback and on the other, the necessity to reposition the patient intraoperatively prolongs the operative time. Our approach to breast reconstruction in this case was to apply combined reconstruction with an LDM flap and implant, taking into account the fact that the patient was irradiated. This is a common reconstructive protocol for such cases because it is well documented that purely implant-based breast reconstruction in irradiated patients is associated with a higher risk of complications such as high-grade capsular contracture. LDM pedicle flap was previously reported by Fraisse et al. [17] to be successfully applied for coverage of a large chest wall defect resulting from chemo-necrosis. The eti-

ology of the elbow defect in our patient is similar and we are in agreement with the authors that extravasation of a chemotherapeutic is a very severe complication that requires close attention by oncologists and plastic surgeons in the best interest of the oncological patient.

Conclusions

With the present case, we demonstrate that by splitting the muscle and overlying skin and preserving the two main branches of the thoracodorsal vascular pedicle, two separate myocutaneous flaps can safely be harvested to reconstruct two defects located in distant anatomical regions. This approach eliminates the necessity to raise and transfer two different flaps from separate donor areas and thus markedly reduces overall donor site morbidity. The surgical technique is tailored to the individual requirements of the patient, but nevertheless it is reproducible, safe and does not require special microsurgical skills and equipment.

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Disclosure of conflict of interest

None.

Abbreviations

LDM flap, Latissimus dorsi myocutaneous flap; BR, Breast reconstruction.

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