Delayed breast reconstruction using the inverted latissimus dorsi musculocutaneous flap: A novel approach to create ptosis and projection

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TA Alrasheed, J Ahmad, T Zhong, SOP Hofer. Delayed breast reconstruction using the inverted latissimus dorsi musculocutaneous flap: A novel approach to create ptosis and projection. Can J Plast Surg 2012;20(1):47-50.

The latissimus dorsi musculocutaneous flap is commonly used for delayed breast reconstruction. The authors present several technical refinements to better address the requirements for an aesthetically pleasing breast in delayed breast reconstruction including flap recipient site preparation, flap inset and breast shaping. The authors describe their modified technique using the inverted latissimus dorsi musculocutaneous flap and their experience in 27 consecutive patients following this type of delayed breast reconstruction. This novel approach provides improved breast ptosis and projection in delayed breast reconstruction.

Key Words: *Autologous; Breast reconstruction; Flap; Implant; Latissimus dorsi*

Une reconstruction mammaire tardive par lambeau inversé du grand dorsal : une démarche novatrice pour créer une ptose et une projection

Le lambeau du grand dorsal est souvent utilisé dans le cadre des reconstructions mammaires tardives. Les auteurs présentent plusieurs améliorations techniques pour mieux répondre à la nécessité de reconstruire un sein agréable sur le plan esthétique dans le cadre de la reconstruction tardive du sein, y compris la préparation du foyer du lambeau, l'enchâssement du lambeau et le modelage du sein. Les auteurs décrivent leur technique modifiée au moyen du lambeau inversé du grand dorsal et leur expérience auprès de 27 patientes consécutives après ce type de reconstruction tardive du sein. Cette démarche novatrice assure une meilleure ptose et une meilleure projection du sein après une reconstruction tardive du sein.

The latissimus dorsi (LD) musculocutaneous flap is commonly used for delayed breast reconstruction (1-19). Herein, the authors present a change in technique from the traditional methods of LD musculocutaneous flap recipient site preparation, flap inset and breast shaping, to better address the requirements for an aesthetically pleasing breast in delayed breast reconstruction. The authors describe their modified technique using the inverted LD musculocutaneous flap and review 27 consecutive patients following this type of delayed breast reconstruction.

METHODS

Patients

Following research ethics board approval, a review of demographic, clinical and surgical data collected in a prospectively maintained database was performed for all patients who had undergone delayed LD musculocutaneous flap breast reconstruction between November 2007 and August 2010.

Surgical technique

Skin markings: Patients were marked preoperatively in the standing position. The key markings on the chest were the new inframammary fold (IMF) and the footprint of the breast, and on the back the key marking was the horizontal skin paddle with the transverse axis at the level of the IMF (click here to view supplementary video demonstrating the technique for inverted LD musculocutaneous flap for delayed breast reconstruction). In a unilateral reconstruction, the vertical height of the LD skin paddle (length C) corresponds to the difference in skin deficit in the vertical dimension between the contralateral native breast (length A) and the mastectomy side (length B), ie, A–B=C (Figure 1). If the contralateral breast has significant ptosis, the maximum skin paddle height is typically limited to 6 cm to 9 cm to allow for primary closure of the donor site. The patient will require contralateral mastopexy or breast reduction to achieve symmetry during tissue expander (TE) exchange with implants as a second stage. In bilateral cases, the maximum skin paddle height is designed bilaterally to maximize projection and ptosis in the reconstructed breast. The length of the inferior border of the skin paddle is equal to the length of the entire IMF.

Recipient site preparation: Recipient site preparation is performed by incising the preoperatively marked IMF in all cases. The previous mastectomy scar is disregarded. This approach has been previously described by Hammond for selected cases (20); however, Hammond has noted the risk of mastectomy flap ischemia when the native mastectomy flaps are undermined extensively. To provide more robust skin flaps, the breast skin is elevated with the underlying pectoralis major muscle as a composite musculocutaneous flap. Dissection stops medially just before the pectoralis major muscle fibres are fully detached from the sternum; superiorly at the clavicle; and laterally to the lateral mammary fold. Care must be taken not to connect the anterior and posterior chest wall pockets, because the lateral border of the breast is a very distinctive aesthetic line similar to the IMF.

The LD musculocutaneous flap is elevated in the standard fashion and without denervation of the muscle. The insertion of the LD is almost entirely released to minimize tension while protecting the vascular pedicle.

LD flap inset and breast mound creation: Following LD flap elevation, a 5 cm skin incision is made just posterior to the anterior axillary line to facilitate flap transfer. Once the LD flap is brought into the recipient site, the skin paddle of the flap is completely inverted or twisted 180° such that the superior margin of the skin paddle on the back becomes the inferior margin on the breast (Figure 2). This flap inversion is a key manoeuvre that enables the skin paddle to project outwards from the IMF thereby creating a crisp IMF and excellent lower pole projection. The LD muscle is then inset along the IMF using permanent sutures, creating a hammock for the TE. The TE is inserted underneath the pectoralis major muscle superiorly and rests on the LD hammock inferiorly.

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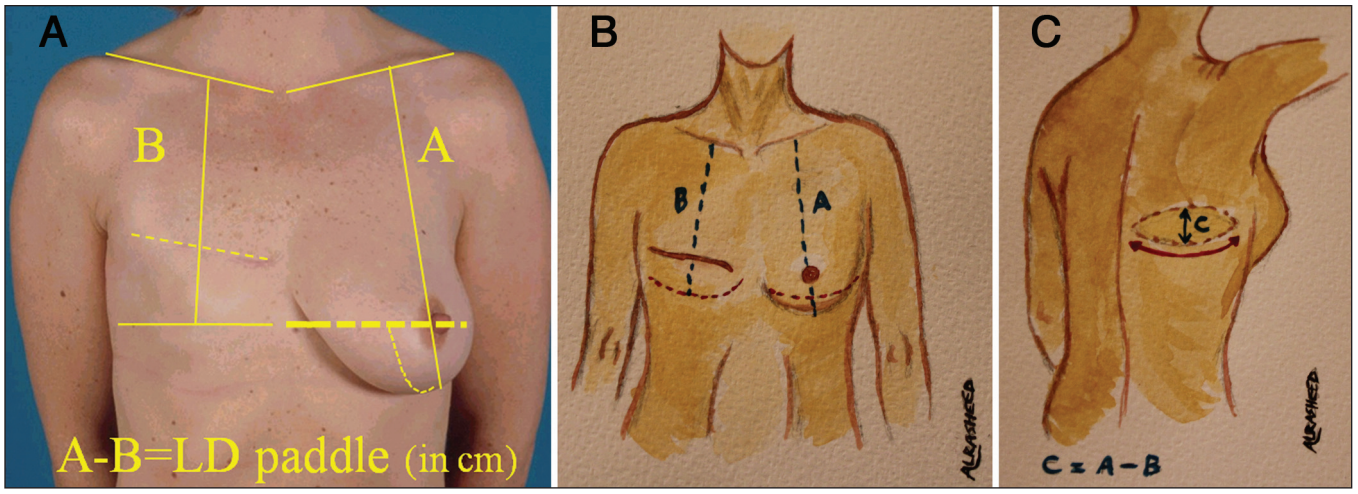

Figure 1) A *Skin markings for the inverted latissimus dorsi (LD) musculocutaneous flap for delayed breast reconstruction*. **B** *and* **C** *The vertical height of the LD skin paddle (length C) corresponds to the difference in skin deficit in the vertical dimension between the contralateral native breast (length A) and the mastectomy side (length B), ie, A–B=C*

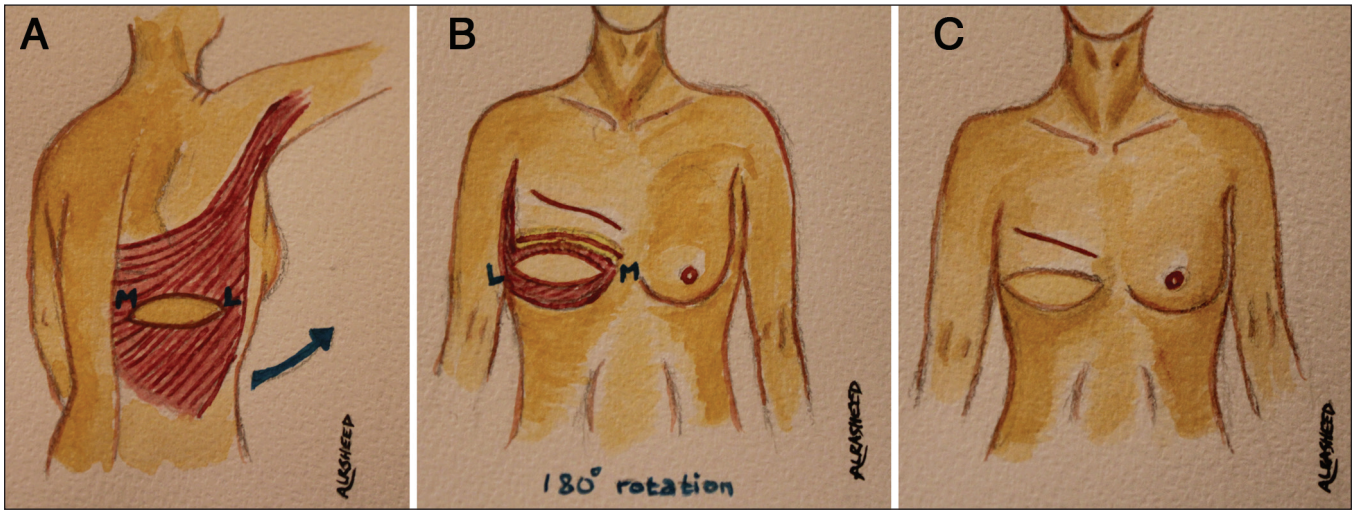

Figure 2) A *Orientation of the latissimus dorsi flap on the back (M, medial; L, lateral)*. **B** *During transfer to the breast, the skin paddle of the flap is completely inverted or twisted 180° such that the superior margin of the skin paddle on the back becomes the inferior margin on the breast*. **C** *The superior margin is inset into the inframammary fold*

TABLE 1
Patient demographics and clinical characteristics

Patients, n	27
Flaps, n	30
Age, years	47.7±8.5
Bilateral breast reconstruction, n (%)	3 (11)
Body mass index, n (%)	
<25 kg/m^2	15 (55)
25 kg/m^2 to 29 kg/m^2	8 (30)
≥30 kg/m^2	4 (15)
Active smokers, n (%)	2 (7)
History of radiation therapy, n (%)	22 (81)
History of chemotherapy, n (%)	23 (85)
Latissimus dorsi skin paddle height, cm	7.6±1.4
Tissue expander	Moderate height, base width 12–14 cm, 20%–30% overfill
Tissue expander volume, mL	378±94
Implant size (Form stable cohesive gel), g	301±117
Time interval between mastectomy and delayed breast reconstruction, months	33±24
Time interval between tissue expander insertion and implant exchange, months	6±3
Length of hospital stay, days	4±1

Data presented as mean ± SD unless otherwise indicated

RESULTS

Twenty-seven patients underwent 30 inverted LD musculocutaneous flap delayed breast reconstructions. Patient demographics and clinical characteristics are summarized in Table 1. The majority of the patients (81%) underwent prior breast irradiation, and the mean time from mastectomy to breast reconstruction was 33 months. All patients underwent two-stage breast reconstruction with the initial TE insertion replaced by a form stable cohesive gel anatomical implant. The mean follow-up was 18 months. Seven patients (26%) had minor complications. Five patients (18%) experienced either recipient site superficial wound dehiscence or infection that all resolved with conservative management. There was one case of donor site seroma and one case of late TE deflation. No complications required reoperation. Figure 3 shows a typical result following inverted LD musculocutaneous flap breast reconstruction.

DISCUSSION

The 'inverted' LD musculocutaneous flap technique differs from traditional descriptions of the LD flap in the following key points:

Recipient site preparation

Irrespective of its location, the old mastectomy scar is disregarded, and the new IMF is opened at the delayed mastectomy site along its entire length. The chest wall skin is then elevated with the pectoralis major

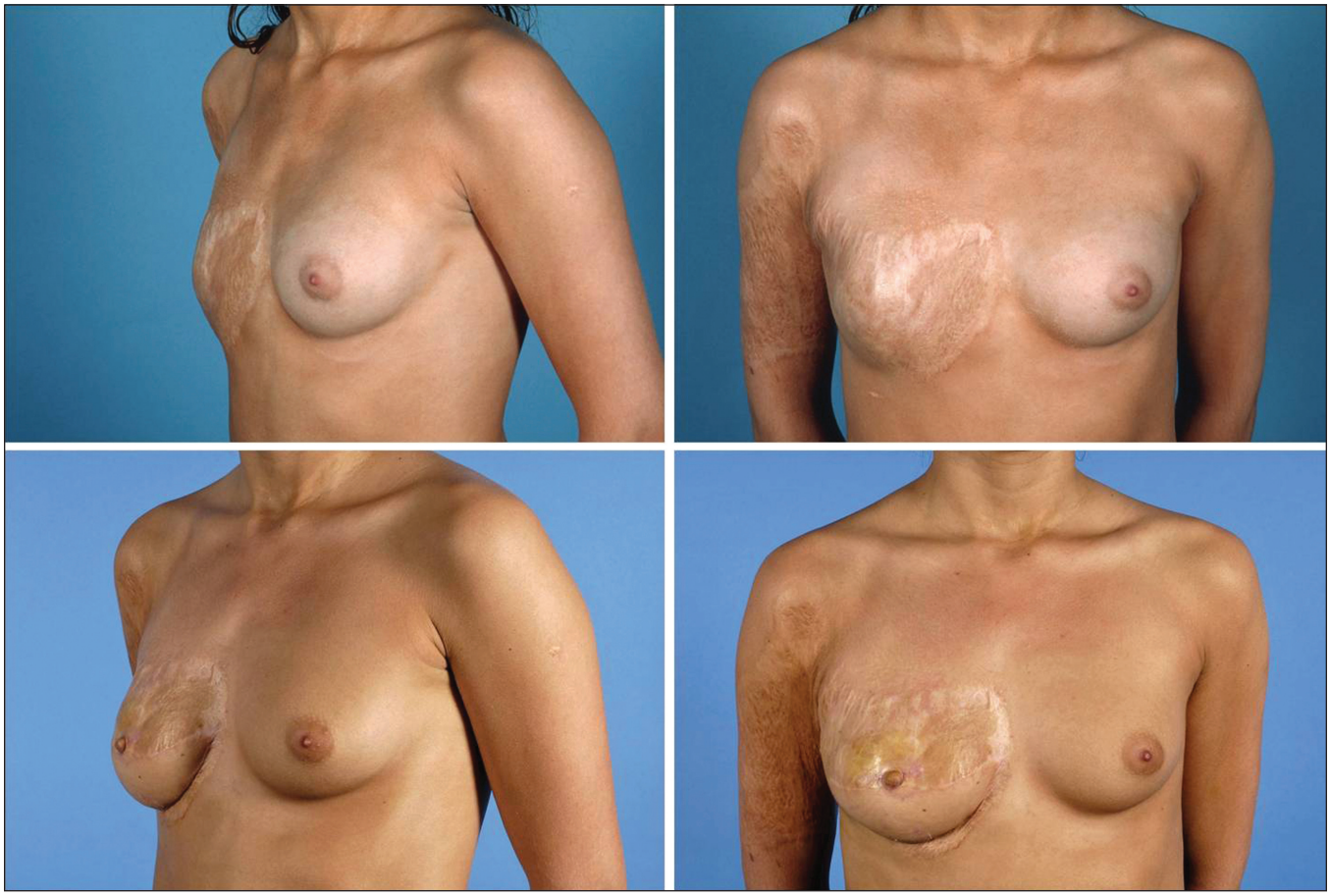

Figure 3) *A 21-year-old woman who had burn scars of the right breast since childhood (top); Follow-up 1.5 years after right breast reconstruction using the inverted latissimus dorsi musculocutaneous flap with a tissue expander followed by exchange to a breast implant and nipple reconstruction (bottom)*

muscle as a composite musculocutaneous flap to maximize vascularity, especially in radiated patients.

Flap inset

The LD skin paddle is inverted 180° such that the superior margin of the skin paddle on the back becomes the inferior margin on the breast. This manoeuvre forces the skin paddle to project outward from the IMF, thereby creating a crisp IMF and excellent lower pole projection.

Breast mound creation

The inferior edge of the LD muscle is fixed to the IMF on the chest wall to further define this key breast landmark while creating an inferior hammock for the TE.

The present series showed comparable complication rates with other studies (13-15,19) following LD musculocutaneous flap delayed breast reconstruction. Of the five patients with minor complications, two had a body mass index greater than 30, one was a type II diabetic and one was an active smoker. Four of the five patients had received prior breast radiotherapy. In two patients, these complications occurred at the skin bridge between the IMF and the old mastectomy scar, which may be due to compromised blood supply. Based on this, we suggest waiting at least one year to allow the mastectomy skin flaps to adequately heal, especially in the setting of prior breast irradiation.

Two caveats to this procedure should be discussed with the patient. First, there will be three scars on the breast and the patient should be informed of this beforehand. Second, it is more prudent to place a TE rather than a permanent implant with this technique because at the level of the mastectomy scar, there is generally a horizontal skin deficit that can be corrected with postoperative tissue expansion.

Limitations to the present study include lack of a comparison group and patient-reported outcome measures. Future evaluations should assess patient satisfaction, as well as quantify the degree of breast ptosis and projection accomplished by this technique.

CONCLUSIONS

The inverted LD musculocutaneous flap uses new recipient site preparation, flap inset and breast shaping strategies to generate improved ptosis and projection in the setting of delayed breast reconstruction.

DISCLOSURES: None of the authors have any financial interest with any of the products, devices, or drugs mentioned in this article.

SUPPLEMENTARY DATA: Supplementary video demonstrates the technique for inverted latissimus dorsi musculocutaneous flap for delayed breast reconstruction. Click here to view the video.

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