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Breast

Lower Pole Breast Reconstruction Using Muscle-sparing Latissimus Dorsi Flap in Postburn Breast Deformity

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Background: Full-thickness burns of the anterior chest wall during childhood are a devastating problem that results in significant distortion of the developing breast. This deformed burnt breast represents a serious aesthetic problem, and can lead to functional impairment as well as severe emotional trauma for patients.
Methods: Patients with postburn scarring affecting the lower pole of the breast were included. Only patients with small to medium-sized breasts were targeted. The lower breast pole was reconstructed using muscle-sparing latissimus dorsi flap. All patients had been subjectively assessed, including overall patient satisfaction regarding breast aesthetics, donor site morbidity, and functional deficits of latissimus dorsi muscle, 3 months postoperatively.
Results: Six patients (seven breasts) were included in this study. Muscle-sparing latissimus dorsi flap was used to reconstruct lower breast pole in all patients. A horizontally-oriented skin paddle was used in five patients, whereas a vertically oriented skin paddle was used in one patient. Average patient satisfaction was 9.1 (SD 0.6) for the reconstructed lower breast pole. For the donor site, average overall satisfaction was 9.1 (SD 0.8). Latissimus dorsi muscle function was objectively confirmed in 90% of cases after 3 months postoperatively. Patients had an average score of 3.9 (SD 0.4) for the activity score as well.
Conclusions: The muscle-sparing latissimus dorsi flap is a good reconstructive tool for lower breast pole in postburn breast reconstruction. It has a reliable versatile skin paddle that can resurface the whole lower breast pole, while avoiding many of the latissimus flap morbidities. *(Plast Reconstr Surg Glob Open 2021;9:e3835; doi: 10.1097/GOX.0000000000003835; Published online 22 September 2021.)*

INTRODUCTION

Full-thickness burns of the anterior chest wall during childhood are a serious and devastating problem that results in significant distortion of the developing breast.[1] Thermal injuries prevent the breast from normal development due to severe cutaneous envelope scarring and contractions, as well as breast mound deficiency, rather than actual breast bud damage. Hence, distortion of the nipple–areola complex (NAC) or even its total loss due to full-thickness burns do not necessarily indicate underlying glandular damage that can result in a breast failing to develop or lactate.[2] Moreover, many authors had reported that even loss of NAC does not rule out the regeneration of the nipple from the lactiferous ducts' epithelial regeneration.[2]

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The deformed burnt breast represents a serious aesthetic problem, and can lead to functional impairment as well as severe emotional trauma for patients.[3] In those patients, the breast is usually hidden underneath the tight, scarred skin.[4] The development of breast shape and contour are dependent on many factors; however, the skin and connective tissue complement represent the most important factor: the natural skin pliability that allows the breast to reshape and become ptotic with increased glandular volume and with age.[5]

From the aesthetic point of view, the lower pole of the breast as well as the inframammary folds (IMF) represent key zones in the final breast shape and contour. In burnt breasts, there is usually a loss of lower pole contour, which becomes flatter than the normal lower pole convexity. Also, loss of skin compliance will hinder any farther lower pole expansion, which in turn will lead to loss of breast projection as well as contraction and down displacement

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of the NAC toward IMF, which, in most cases, becomes indistinguishable. In addition, the loss of clear demarcation between the breast and anterior abdominal wall augments the deformity.

Postburn breast reconstruction can be quite challenging, with the spectrum ranging from release and skin grafting, artificial dermal substitutes, Z-plasty, regional flaps, and pre-expanded flaps, up to free flap reconstruction. Additionally, many adjunctive procedures could be also utilized in severe deformities, including fat graftng to the deformed areas as well as breast prostheses in some cases.[4]

The muscle-sparing latissimus dorsi (MSLD) flap has been described frequently in the literature, particularly for postoncological reconstruction.[6] However, to our knowledge, this flap had not been previously described for postburn breast reconstruction. The aim of this study was to describe our experience of postburn lower breast pole reconstruction using the MSLD flap in women with ill-defined IMF, breast mound deficiency, and loss of lower pole projection.

MATERIAL AND METHODS

Following ethical committee approval, patients with postburn (scald, flame, or chemical burns) scarring affecting the lower pole of the breast were included in our study. Patients with small- to medium-sized breasts were targeted to avoid any bias due to large breast volumes. Patients with scarring in the back or previous flap harvest or previous tissue expansion in the back were excluded.

The routine preoperative evaluation was done for all patients, including proper history taking, detailed physical examination, laboratory tests, and breast imaging (in the form of bilateral sono-mammography). On the day of the surgery, preoperative markings were done in the standing position, which includes the midline, breast meridian, the inframammary fold, lines from the suprasternal notch to the nipple, and nipple to the inframammary fold line. The contralateral breast was used as a guide, and its measurements were considered for symmetry in patients with unilateral breast burn.

The flap markings and skin paddle design were preplanned and marked according to the anatomical deficiency in the ipsilateral lower breast pole. The anterior border of the latissimus dorsi muscle (LD) was identified as well as the tip of the scapula. The descending branch of the thoracodorsal artery was identified and marked using an audible hand-held Doppler device. Although a skin paddle could be designed vertically or horizontally in all patients except for one case, we utilized the horizontally-oriented pattern, placing it within the natural back role crease with special attention to the bra strapline. In this single case, the patient was reluctant to add a scar to her back, and accordingly, the vertical design was utilized, placing the scar along the lateral margin of the torso burn. The skin pinch test was performed to assess the width resection and to ensure safe tension-free closure. The anterior edge of the skin paddle was designed 2 cm anterior to the anterior border of LD muscle. This ensured adequate perfusion from perforators of the descending branch. Intraoperatively, surgical steps were done similar to those described by Cook et al[7] (Figs. 1, 2).

Three months postoperatively, all patients had been subjectively assessed for overall patient satisfaction regarding breast aesthetics with a scale from 1 to 10, with 1 representing the least satisfaction degree and 10 representing the highest grade of satisfaction. Donor site overall satisfaction was assessed by checking back scar satisfaction rate as well as deformity or morbidity, using a similar satisfaction scale from 1 to 10. For LD functional deficits, patients were examined for active range of motion of the shoulder girdle, and muscle strength testing was also done by comparing the operated and nonoperated side, as described by Saint-Cyr et al.[6] Also, patients' ability to perform daily activities with the side of the burn and reconstructive surgery was checked using a scale from 0 to 4, with 0 representing the least ability to carry on daily functions and 4 representing the maximum.

RESULTS

A total of six patients (seven breasts) were included in this study: five patients had unilateral burned breasts, and one patient suffered from bilateral burned breasts (Figs. 3, 4). Five patients had suffered from scald burns, while in one patient, burns were due to flame. The patient ages ranged from 25 to 45 years, with an average of 33 years at the time of presentation. All of them had been

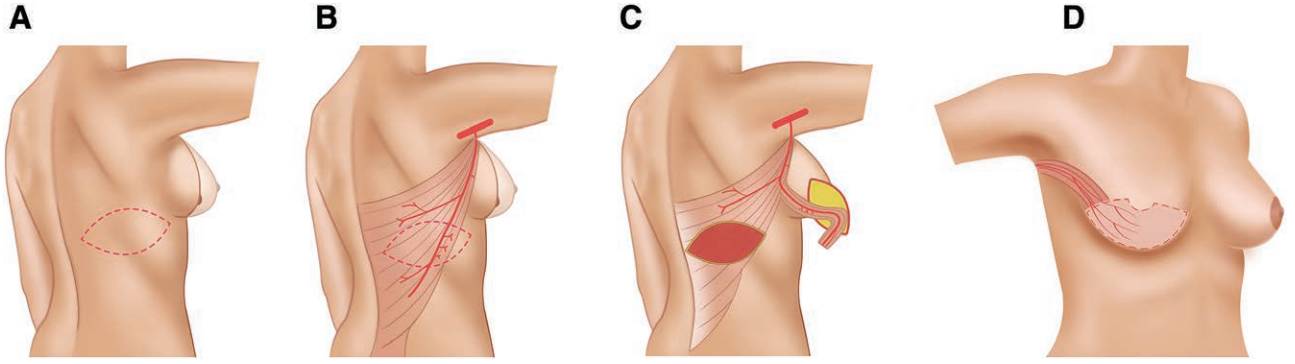

Fig. 1. An illustration showing preoperative planning of the skin paddle position in relation to dorsal skin crease (A) and in relation to descending branch of thoracodorsal pedicle (B). Flap elevation based on the descending branch of thoracodorsal vessels and surrounded by a strip of LD muscle (C). Final flap positioning following release of the breast lower pole (D).

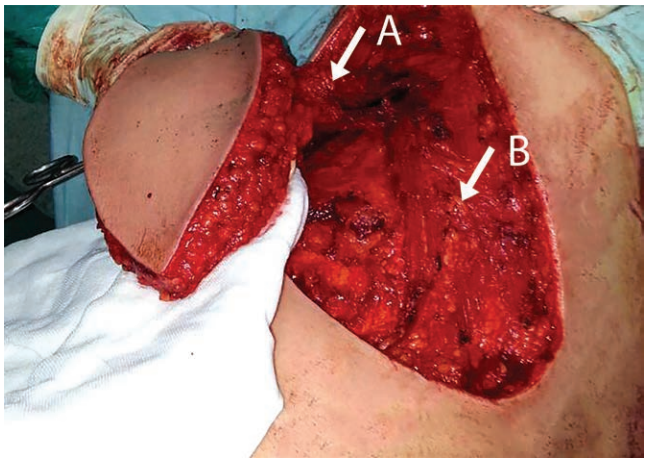

Fig. 2. Intraoperative photograph following flap harvesting based on the descending branch of thoracodorsal vessels and surrounded by a strip of LD muscle (A), while the rest of LD muscle is still in place (B).

Fig. 4. Postoperative frontal photograph of the same patient 3 weeks postreconstruction of her left breast, and almost 6 months postoperative reconstruction of the right side. As noticed in this picture, we achieved adequate NAC repositioning on both sides.

burned before the age of 10 years and none of them had received any breast reconstructive surgery until the time of presentation. All patients had ill-defined IMF, flat lower breast pole, and projection deformities.

In this study, the MSLD flap was used to reconstruct the lower breast pole in all patients. We utilized a horizontally oriented skin paddle in five patients, while in one patient with unilateral burned breast, a vertically oriented skin paddle was used. (**See figure, Supplemental Digital Content 1,** which displays postoperative photographs of the back of the same patient 3 weeks postoperatively. The scar was designed to be hidden within the bra line. **http://links.lww.com/PRSGO/B787**.) The skin paddle dimensions range from 7 to 13 cm in width and from 16 to 23 cm in length. All patients had achieved well-defined IMF, convex lower breast poles, increased breast mounds, and adequate projection. The results were satisfactory in all patients, and all of them showed a high level of satisfaction following a smooth postoperative recovery. None of the patients had any serious complications apart from some minor wound dehiscence in either the breast or back wound, which healed spontaneously without any further surgeries. Another patient complained of medial minimal superficial sloughing, which responded to repeated dressings. All patients showed complete recovery, with no functional deficits over the LD range of motion at 3 months postoperatively.

Results were assessed up to 3 months postoperatively. Patient satisfaction was 9.1 on average (SD 0.6) for the reconstructed lower breast pole. For the donor site,

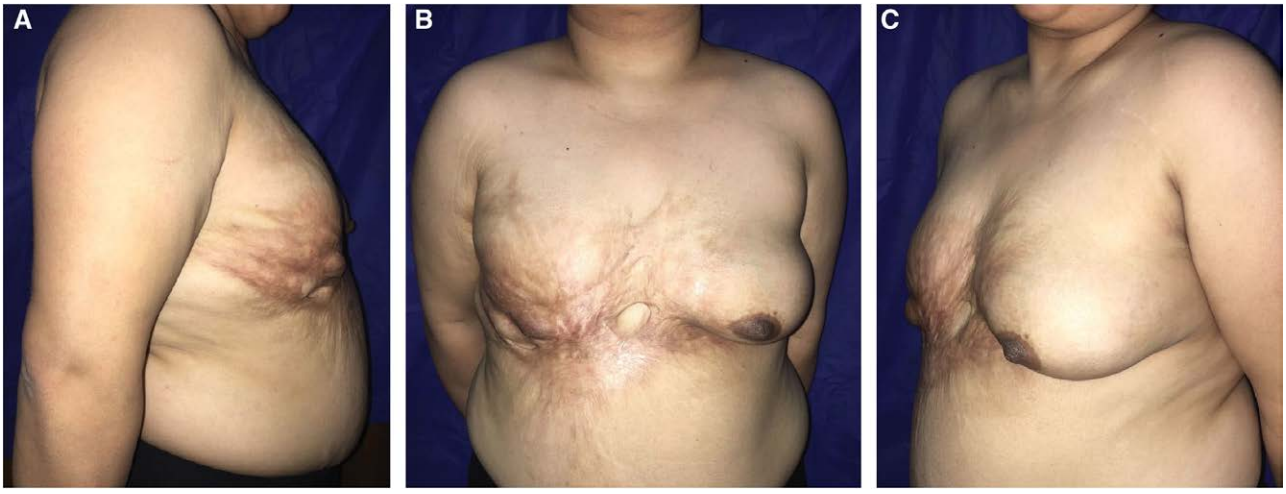

Fig. 3. Preoperative photographs of a 28-year-old woman who suffered from a scald burn at the age of 5. There is severe constriction of the right breast, particularly the lower pole, with severe distortion of the NAC. On the left side, there is less severe lower pole constriction, which is more obvious on the lower inner quadrant. A, Laterial view. B, Frontal view view. C, oblique view.

overall satisfaction was 9.1 on average (SD 0.8). Overall average satisfaction lied at an average of 9.1 (SD 0.1). LD function was objectively confirmed in 90% of cases after 3 months of flap reconstruction of the lower pole of the breast. Patients had an average of 3.9 scores (SD 0.4) for the activity score as well.

DISCUSSION

In patients with major burns, the trunk represents the second most commonly affected body area, with the breasts being frequently affected in women.[8] The current advances in major burn management and increased survival rates had led to an increased number of patients with postburn breast deformities to seek breast reconstruction. In those patients, complex reconstructive procedures are usually required, due to the natural three-dimensional topography of the breast. Postburn breast reconstructive procedures are challenging because none of them can evade the burned scar tissues.[4] The spectrum of reconstruction might pass through the whole reconstructive ladder options.[9]

The goals of postburn breast reconstruction include the release of contracted scars, NAC repositioning, restoration of breast volume and shape, and allowance of normal breast growth. However, one of the most difficult problems to solve during postburn breast reconstruction is the restoration of the breast mound deficiency, which enhances the breast projection while ensuring harmonious breast contour.[10] Thus, the selection of the proper reconstructive procedure will depend on the amount of tissue lacking, the quality of the residual skin envelope, as well as the distribution and amount of burned surface area.[11]

The lower breast pole plays a significant role in giving the female breast its aesthetically pleasant morphology, since the ideal breast shape has a convex lower pole with slight breast ptosis. Previously, the lower pole was subjectively designed roughly by using a nipple-IMF distance of 8–10 cm. Later on, Mallucci described the nipple-IMF distance as 55% of the vertical height of the breast,[12] whereas Tebbetts used a horizontal correlation to breast width, in which he considered the nipple-IMF distance to be 0.66 of breast width.[13]

According to MacLennan et al, for restoration of the adequate breast mound and to permit normal breast growth in toddlers, the proper release of IMF with the reconstruction of the lower breast pole is essential.[14] He recommended complete lower pole release with a thick split-thickness or a full-thickness skin graft whenever possible.[2] However, in severe scarring and contracture of the whole breast, this would not be enough, and multiple releases might be necessary at different breast zones.[15] Additionally, the aesthetic quality of grafting remained inferior to more natural supple coverage as well as match afforded by flap coverage in general.[16]

Although this is the most frequent scenario met by plastic surgeons,[3] in some patients with severe burns (particularly flame burns), the growing breast tissues might be affected or severely damaged either by the burn itself or during surgical excision of eschars.[14] In those patients, just release and skin grafting would not be enough; a reconstructive procedure to add more supple skin and subcutaneous tissue should be anticipated.[17] This is particularly valuable in the lower breast pole where soft tissue deficiency will negatively affect the whole breast contour. A wide range of surgical procedures had been described in the literature to deal with such problems. However, LD flap remains the workhorse flap in breast reconstruction. In burned patients, the back is often unburned, and thus LD flap can create a smooth and natural breast mound, while its skin paddle can be used to replace scarred lower pole skin and add the required soft tissue coverage to the contracted area. Nevertheless, the postoperative morbidity in the form of severe hindrance in the patients' daily activities with the utilization of the musculocutaneous flap, as well as the postoperative contour defects caused and seroma. Additionally, the main problem does not lie with the actual breast volume but rather with its displacement and compression by the nonpliable burnt overlying envelope.[18]

In 2003, Schwabegger et al described the MSLD flap.[19] In his technique, he included a strip of the muscle to act as a protective cuff surrounding the descending branch of thoracodorsal vessels, aiming at reducing the complication rates associated with thoracodorsal artery perforator flap, with preservation of the LD muscle functionally and decreased donor site morbidity as well.[19] The MSLD flap being a pedicled flap and not dependent on a particular perforator, the skin paddle can be freely designed anywhere along the axis of the descending branch of the thoracodorsal vessels.[20]

In our study, the etiology, burn distribution, and age of burns were similar to those mentioned frequently in the literature. However, in our case series, patients had not received any reconstructive procedures in the acute phases or during puberty. In those patients, we used MSLD flap for lower breast pole reconstruction, and the skin paddle was preferably horizontally oriented, placing it within the natural back role crease. Apart from a single case in which the patient did not wish to add more scarring to her back, in all other patients, a vertically oriented skin paddle was utilized. In our series, the average skin paddle dimensions were 10 × 20 cm. These dimensions ensure adequate lower pole reconstruction with sufficient NAC repositioning. In addition, these large skin paddles can easily address volume deficiency, especially in patients with small- and medium-sized breasts. This however entails proper preoperative assessment and patient selection. The bulk of LD muscle left uninjured in place also plays a crucial role in the minimal postoperative morbidity. The LD function fully returns in most cases in less than 3 months. Also, the muscle flap itself can be used later in cases requiring salvage.

Using MSLD flap not only ensures adequate resurfacing of the lower pole only but also adds a fresh nonscarred skin to the breast mound, which permits breast expansions and enlargement. However, we have to keep in mind that even with this resurfacing of the scarred areas, the burned breast cannot be stretched and enlarged to the same extent

as the unburned side.[14] Other advantages of using MSLD include preservation of the LD muscle and its normal function, as well as the versatility and dimensions of its skin paddle, which can be used to resurface the whole lower pole. An added benefit of the MSLD is the ability to use the pre- served LD muscle as a salvage procedure if needed.

The selection of a donor site from the back is based on the fact that in most burned patients seeking breast reconstruction during or immediately after puberty, there is still not enough abdominal laxity that permits the use of pedicled abdominal flaps (eg, TRAM flap). Additionally, many of those patients also suffer from the burned abdominal wall, thus eliminating the idea of its usage for just breast mound resurfacing.

Once the burned breast has been reconstructed and the scars have settled, patients with unilateral burned breasts would benefit from symmetrizing procedures. These symmetrizing procedures will differ according to breast size and NAC position on the contralateral side.

CONCLUSIONS

In properly selected cases, the MSLD technique offers burn patients a satisfactory result, with less morbidity involving the donor area and functional outcome. This technique proved superior to the standard LD flap, especially while dealing with active and fit patients. MSLD also has the advantages of local flaps in comparison with microvascular options, which tend to be lengthy and carry more morbidity, requiring more postoperative care. The aesthetic results were considered superior to cases that depended on grafting or local flaps.

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