Flap surgery is preferable to skin grafting for reconstruction after extensive tissue removal for locally advanced breast cancer, because (1) with grafting, there is a risk of nonhealing surgical wounds and esthetically unacceptable scarring,1 (2) the ribs are exposed after standard radical mastectomy,2 and (3) wound healing can be delayed by postoperative irradiation.3 However, because flap surgery requires a relatively large skin island, deciding which skin flaps should be used remains controversial.4 The divided latissimus-dorsi-musculocutaneous flap procedure, reported by Sawaizumi and Maruyama5 in 1996, involves elevating flaps as 2 skin islands (18 × 7.5 cm each) that were sutured to form a large skin island, was used for coverage of the defect. The flap was sutured without causing excessive tension in the recipient region and the donor site was closed with simple reefing. No skin grafting was necessary. The flap survived completely, shoulder joint function was intact, and esthetic outcome was satisfactory. Quick wound closure allowed postoperative irradiation to be started 1 month after surgery. The technique offered advantages over the conventional pedicled latissimus-dorsi-musculocutaneous flap, but the flap was unable to be used, when the thoracodorsal artery and vein were damaged during extensive tissue removal. Detailed planning before surgery with breast surgeons would be essential. (Plast Reconstr Surg Glob Open 2014;2:e217; doi: 10.1097/GOX.0000000000000190; Published online 24 September 2014.)

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for covering a large defect in the lateral thoracic region (adjacent to the flap donor site) and to allow the simple closure of the donor site to be realized, the maximum width of each flap should be kept as small as possible to avoid skin-tension problems at both the donor and recipient sites.

Therefore, this study developed a 180-degree rotationally divided latissimus-dorsi-musculocutaneous flap for reconstruction after extensive tissue removal from the lateral thoracic region for locally advanced breast cancer. This study reported good outcomes with this technique and discussed these with referencing previously reported techniques.

**OPERATIVE PROCEDURE**

After the oncologists performed extensive tissue resection (Fig. 1A), the patient was placed in the dorsal position for allowing the surgeons to mark the outline of skin defect and then moved to the lateral position. The outlined area was divided roughly in half horizontally and used as 2

![Fig. 1. Schema of the surgical technique with a 180-degree rotationally divided latissimus-dorsi-musculocutaneous flap.](image-url)
skin islands on the latissimus-dorsi muscle along its leading edge (Fig. 1B). Being aligned vertically, 2 skin islands were allowed to be in contact with the dorsal line of defect in the lateral thoracic region. A skin incision to the deep fascia was made following the marks, and the layer above the deep fascia of the latissimus-dorsi muscle around the flap was peeled back in the cranial direction. The latissimus-dorsi muscle was elevated from the caudal end to cranial end, and the musculocutaneous flap was harvested with the thoracodorsal artery, vein, and deep layer adipose tissue. A skin incision to the latissimus-dorsi muscle fascia was made on the dividing line, and the resulting 2 skin islands were rotated (Fig. 1C) and sutured to form the large skin island following the marked outline. The dog ear of latissimus-dorsi muscle appearing upon the rotation of 2 skin islands rotated was placed under the skin suture line of large skin island as spread evenly cranial side and the caudal side. Volume of this muscle body prevented the depressed suture line between 2 skin islands. Then, the caudal donor site was closed in the best possible manner, and the flap was placed according to the design to cover the lateral thoracic region defect and sutured without causing tension in the flaps’ vascular pedicles (Fig. 1D). Two 15-Fr continuous suction-drainage tubes were placed subcutaneously in the dorsal and precordial region. After hemostasis and rinsing, primary closure was performed for the remaining dorsal donor site (Fig. 1E).

**CLINICAL CASE**

A 42-year-old woman with right-sided locally advanced breast cancer (T4bN3bM0, stage IIIC) underwent preoperative chemotherapy to reduce the size of the tumor. However, invasion into surrounding tissues including the pectoral muscle required a complete right mastectomy and the resection of pectoralis major muscle, serratus anterior muscle, and lymph nodes (levels I–III) by breast surgeons. The tissue defect was mainly in the right lateral thoracic region, and the skin defect was 18 × 15 cm. A 180-degree rotationally divided latissimus-dorsi-musculocutaneous flap consisting of 2 skin islands (18 × 7.5 cm each) was designed and elevated (Fig. 2A) for reconstructing the tissue defect. The flap covered the defect without causing excessive tension, the donor site was closed with simple reefing, and no skin grafting was necessary (Fig. 2B). Postoperatively, the flap survived completely, and the esthetic outcome was satisfactory. Quick wound closure allowed postoperative irradiation to be started at 1 month after surgery. Shoulder joint function was intact, and there was no hypertrophic scar or seroma at the donor site (Fig. 2C).

**DISCUSSION**

The pedicled latissimus-dorsi-musculocutaneous flap is an established reconstructive technique after mastectomy,7 but its use after extensive tissue removal for locally advanced breast cancer has been reported in only a limited number of cases. The divided latissimus-dorsi-musculocutaneous flap described in
this study was a useful technique that produced a large skin flap giving the primary closure of donor site.5 The surgical technique has been modified by several investigators for obtaining more stable blood flow and the easy suturing of the skin islands to each other. For example, Miyamoto et al6 have used echographic findings to design 1 island immediately above the lateral branch of the thoracodorsal artery and the other island above its medial branch. Akita et al9 have included the perforating branch of the intercostal artery in the distal skin flap, whereas Zhang et al10 have positioned individual skin islands following the designs of bilobed and trilobed flaps. However, for large lateral-thoracic-regional defects where the dorsal skin is limited, these techniques are unable to give the primary closure of the donor site. For solving the drawback, this study invented 180-degree rotationally divided latissimus-dorsi-musculocutaneous flap consisting of 2 skin islands vertically, which were able to provide sufficient coverage to the defect for minimizing skin reefing. Although the large skin flap was effective for reconstructing the lateral-thoracic-regional defect after the removal of locally advanced breast cancer, a large skin flap, of which thoracodorsal artery and vein were damaged during extensive tissue removal, was unable to be used. Therefore, detailed planning before surgery with breast surgeons would be essential.

CONCLUSIONS

For covering a large skin defect (18 × 15 cm) following extensive tissue resection for locally advanced breast cancer, this study performed reconstruction with a newly designed 180-degree rotationally divided latissimus-dorsi-musculocutaneous flap in a 42-year-old woman. The latissimus-dorsi-musculocutaneous flap, consisting of 2 rotated skin islands (18 × 7.5 cm each) that were sutured to form a large skin island, was used for covering the defect. The flap was sutured without causing excessive tension in the recipient region, and the donor site was closed with simple reefing. No skin grafting was necessary. The flap survived completely, shoulder joint function was intact, and esthetic outcome was satisfactory. Quick wound closure allowed postoperative irradiation to be started at 1 month after surgery.

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