

The Boomerang-shaped Pectoralis Major Musculocutaneous Flap for Reconstruction of Circular Defect of Cervical Skin

Shuchi Azuma, MD
Masaki Arikawa, MD
Shimpei Miyamoto, MD

Summary: We report on a patient with a recurrence of oral cancer involving a cervical lymph node. The patient's postexcision cervical skin defect was nearly circular in shape, and the size was about 12 cm in diameter. The defect was successfully reconstructed with a boomerang-shaped pectoralis major musculocutaneous flap whose skin paddle included multiple intercostal perforators of the internal mammary vessels. This flap design is effective for reconstructing an extensive neck skin defect and enables primary closure of the donor site with minimal deformity. (*Plast Reconstr Surg Glob Open* 2017;5:e1579; doi: 10.1097/GOX.0000000000001579; Published online 20 November 2017.)

The pectoralis major musculocutaneous (PMMC) flap has been a workhorse flap, even in a free-flap era since its first report in 1979 by Ariyan.¹ However, the main drawbacks of this flap include the vulnerability attributable to unstable blood supply of the skin paddle and less flexibility compared with free flap transfer. Detailed three-dimensional vascular networking of the PMMC flap had been investigated for the purpose of preparing a stable flap, and the results show that the intramuscular vascular network between the pectoral branches of the thoracoacromial vessels and the intercostal perforators of the internal mammary vessels played a key role in stabilizing skin paddle of this musculocutaneous flap.^{2,3}

In this report, we describe a successful reconstruction of an extensive neck skin defect using a boomerang-shaped PMMC flap. This novel flap design enabled transfer of a well-vascularized large skin paddle and primary closure of the donor site.

CASE REPORT

A 68-year-old man with oral squamous cell carcinoma had undergone right hemiglossectomy, ipsilateral neck dissection, and tongue reconstruction with a free anterolateral thigh flap. Four months after the first opera-

tion, the tumor was found to have recurred in a cervical lymph node and clearly invaded the neck skin. Wide resection of the tumor resulted in a circular neck skin defect 12 cm in diameter (Fig. 1). To reconstruct the defect, right PMMC flap with a boomerang-shaped skin paddle was elevated based on the thoracoacromial vessels. This skin paddle was harvested to include the first to fourth intercostal perforators of the internal mammary vessels (Fig. 2). The flap was transferred to the neck through the subcutaneous route. The 2 wings of the boomerang were bent in a U shape to cover the skin defect (Fig. 3). The donor site was closed primarily without a skin graft. The postoperative course was uneventful except a hematoma of the donor site, which was successfully managed with local anesthesia at his bedside. The bleeding point was easily found at the edge of pectoralis major muscle that was ligated with silk. Fourteen months after the operation, he was alive with no evidence of disease. The aesthetic results of the recipient and the donor sites were satisfactory, and there was no contracture of the neck (Fig. 4).

DISCUSSION

The PMMC flap is mainly fed by the pectoral branches of thoracoacromial vessels. Ariyan had described that the intramuscular course of the branches is along a line from the tip of the shoulder to the xiphoid process.¹ The skin island of the PMMC flap is usually designed along this estimated line. However, the blood supply of the skin islands with this conventional design is known to be unstable, and a significant number of partial necroses have been observed.^{4,5}

From the Division of Plastic and Reconstructive Surgery, National Cancer Center Hospital, Tokyo Japan.

Received for publication March 31, 2017; accepted September 29, 2017.

Copyright © 2017 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal. DOI: 10.1097/GOX.0000000000001579

Disclosure: The authors have no financial interest to declare in relation to the content of this article. Article Processing Charge was paid for by the authors.



Fig. 1. The defect after tumor excision (excised skin size 90 × 75 mm) and the design of the skin island, including the second and third intercostal perforators of the internal mammary vessels (arrow heads) and the IV-A perforator (arrow). Black star shows the upper wing and asterisk shows lower wing.

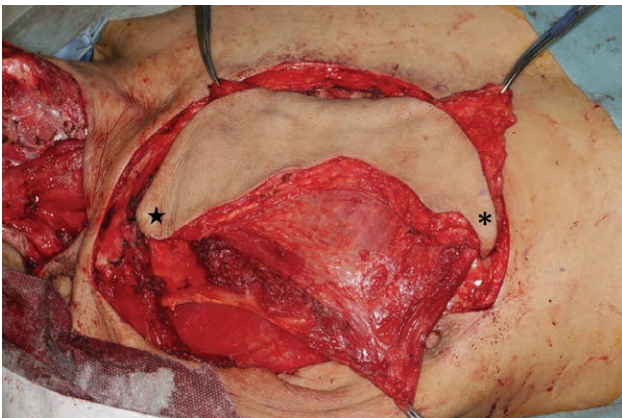


Fig. 2. Same area immediately after the elevation of boomerang-shaped pectoralis major musculocutaneous flap.

The vulnerability of the PMMC flap stems from the musculocutaneous perforators of the pectoral branches of the thoracoacromial artery being small and inconsistent.⁶ Detailed anatomic studies have recently revealed that the skin paddle of the PMMC flap should be designed not on the pectoral branch of the thoracoacromial vessels but on the intercostal perforators of the internal mammary vessels to improve the circulation. Rikimaru et al reported that not only including the fourth intercostal perforator that locates 1–2 cm medial to the nipple but also including first, second, and third intercostal perforators of the internal mammary vessels are important when harvesting the PMMC flap.^{2,3,7} The concept can be applied to the design of the PMMC flap, which has a large skin island with a complex shape. Miyamoto et al⁸ reported a T-shaped PMMC based on these findings for successful reconstruction of circumferential pharyngeal defect.

Our design of a boomerang-shaped PMMC flap was based on the concept described above and totally different from traditional design of the PMMC flap. We

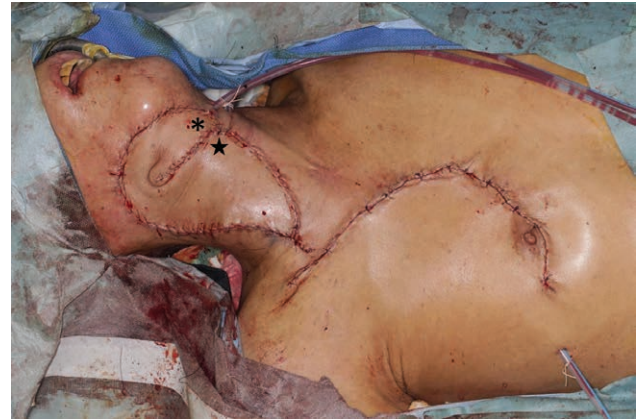


Fig. 3. Immediate postoperative appearance. The upper wing came to the caudal side (black star), and the lower wing (asterisk) came to the cephalad side.



Fig. 4. Appearance of the patient after 14 months.

ignored the musculocutaneous perforators of the pectoral branch of the thoracoacromial vessels and focused on including multiple intercostal perforators of the internal mammary vessels to the skin paddle. Our design can capture the first to fourth intercostal perforators. Two wings of the boomerang-shaped skin island can be bent or twisted to meet each other into a circular shape without the marginal circulation being compromised. The donor site has an acceptable cosmetic result because it can be closed primarily, and deviation of the nipple can be kept minimal. We believe that this flap design can be a versatile option for the reconstruction of an extensive neck skin defect.

CONCLUSIONS

Boomerang-shaped PMMC flaps, based on multiple intercostal perforators, have stable blood supply and enable coverage of a large area without a skin graft. This flap design can be a versatile option for the reconstruction of an extensive neck skin defect in the vessel-depleted neck.

Shimpei Miyamoto, MD

Division of Plastic and Reconstructive Surgery
National Cancer Center Hospital
Tokyo 104-0045

Japan

E-mail: shimiyam@ncc.go.jp; s-miya@hh.ijj4u.or.jp

PATIENT CONSENT

The patient provided written consent for the use of his image.

REFERENCES

1. Ariyan S. The pectoralis major myocutaneous flap. A versatile flap for reconstruction in the head and neck. *Plast Reconstr Surg.* 1979;63:73–81.
2. Rikimaru H, Kiyokawa K, Inoue Y, et al. Three-dimensional anatomical vascular distribution in the pectoralis major myocutaneous flap. *Plast Reconstr Surg.* 2005;115:1342–1352; discussion 1353.
3. Kiyokawa K, Tai Y, Tanabe HY, et al. A method that preserves circulation during preparation of the pectoralis major myocutaneous flap in head and neck reconstruction. *Plast Reconstr Surg.* 1998;102:2336–2345.
4. Shah JP, Haribhakti V, Loree TR, et al. Complications of the pectoralis major myocutaneous flap in head and neck reconstruction. *Am J Surg.* 1990;160:352–355.
5. Kroll SS, Goepfert H, Jones M, et al. Analysis of complications in 168 pectoralis major myocutaneous flaps used for head and neck reconstruction. *Ann Plast Surg.* 1990;25:93–97.
6. Geddes CR, Tang M, Yang D, et al. An assessment of the anatomical basis of the thoracoacromial artery perforator flap. *Can J Plast Surg.* 2003;11:23–27.
7. Rikimaru H, Kiyokawa K, Watanabe K, et al. New method of preparing a pectoralis major myocutaneous flap with a skin paddle that includes the third intercostal perforating branch of the internal thoracic artery. *Plast Reconstr Surg.* 2009;123:1220–1228.
8. Miyamoto S, Fukunaga Y, Shinozaki T, et al. T-shaped pectoralis major musculocutaneous flap for reconstruction of an extensive circumferential pharyngeal defect. *Plast Reconstr Surg Glob Open.* 2014;2:e129.