Case Report

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악성말초신경피복종 절제 후 발생한 광범위 등 결손의 등능간동맥 천공지 프로펠러 피판술을 이용한 재건: 증례보고

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Propeller Dorsal Intercostal Artery Perforator Flap for an Extensive Defect on the Back Following Malignant Peripheral Nerve Sheath Tumor Resection: A Case Report

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Posterior trunk defects have been a challenging anatomical area to cover in reconstructive surgery. The use of local myocutaneous flaps has been described extensively in the literature to cover these defects, but these techniques are associated with significant donor-site morbidity, including functional loss of muscle units. Freestyle perforator flaps enable local tissue recruitment with skin of a similar color and texture in diverse anatomic areas, but there is a shortage of case series on posterior trunk defects using propeller dorsal intercostal artery perforator (DICAP) flaps, particularly when the defects are extensive. In this report, the authors present a successful case of a DICAP propeller flap for an extensive defect on the upper back following a malignant peripheral nerve sheath tumor resection.

Keywords: Perforator flap, Neoplasms, Reconstructive surgical procedures

INTRODUCTION

Posterior trunk defects result from diverse etiologies, such as pressure sores, tumor resection, infection, or trauma, and represent a challenging procedure. Myocutaneous flaps, such as the latissimus dorsi flap or trapezius flap, have been widely used to cover these defects [1-3]. Although these flaps are preferred by some authors because of simple and reliable techniques [4], they are associated with greater donor-site morbidity than perforator flaps.

The introduction of perforator flaps [5] has revolutionized reconstructive surgery over the past two decades. The application of perforator flap technique enables long and reliable vascular pedicles, thinner flaps with minimal donor-site

morbidity and without including muscle tissue [6]. Intercostal artery perforator flaps have been used widely to cover the diverse trunk defects, based on an understanding of the anatomy of intercostal vessels [7-12]. Among them, dorsal intercostal artery perforator (DICAP) flaps have recently been described in posterior trunk reconstruction [13-17].

This paper describes a case of a large DICAP propeller flap for the reconstruction of extensive posterior trunk oncological defects.

CASE REPORT

The patient was a 70-year-old woman with neurofibromatosis I (von Recklinghausen's disease) with the chief complaints of a giant mass on her left upper back that had been increasing in size gradually for 10 years (Fig. 1). Preoperative computed tomography showed a lesion, measuring $20 \times 15 \times 10 \text{ cm}^3$, overlying the trapezius muscle and the infraspinous region of the scapula. Under general anesthesia, a wide local excision of the lesion was performed with a 2-cm margin. Frozen sections of the excision margins were free of tumor. The tumor was excised at a submuscular plane, including the trapezius, rhomboid major and minor, directly below the tumor. The soft tissue defect was approximately $25 \times 20 \text{ cm}^2$ in size and a $30 \times 18\text{-cm}^2$ DICAP propeller flap was designed to close the defect based on the 6th posterior intercostal artery (Fig. 2). An exploratory incision was made, and a large perforator was identified (Fig. 3). The perforator flap was elevated at the subfascial level and transposed 90° into the defect. The donor site was closed directly and the remaining wound was covered with a split-thickness skin graft (Fig. 4). The flap healed uneventfully. Histopa-

thology demonstrated a completely excised malignant peripheral nerve sheath tumor (MPNST). At 6 months postoperative-

Fig. 2. Wound defect after wide local excision of malignant peripheral nerve sheath tumor that measured $25 \times 20 \text{ cm}^2$. A $30 \times 18\text{-cm}^2$ propeller dorsal intercostal artery perforator flap was designed to close the defect based on the 6th posterior intercostal artery.

Fig. 1. A 70-year-old female with a malignant peripheral nerve sheath tumor measuring $20 \times 15 \times 10 \text{ cm}^3$ was present on the left upper back.

Fig. 3. The 6th posterior intercostal artery was identified using an exploratory incision adjacent to the defect. Red circles, preoperative localization of the posterior intercostal artery perforators using a hand-held Doppler; red dotted line, the course of the vessel loop around the 6th posterior intercostal artery under the flap; yellow line, the midline; orange shaded area, the elevated flap area.

ly, the patient did not have any limitation in the range of motion or pain (Fig. 5). Written informed consent was obtained for publication of this case report and accompanying images.

DISCUSSION

Posterior trunk reconstruction may be a challenging procedure. Many different operative options have been used to cover the posterior trunk defect; each has distinct advantages and disadvantages. Myocutaneous flaps, such as the latissimus dorsi flap and the trapezius muscle flap, have long been the main treatment for posterior trunk reconstruction [1,2,18,19]. These flaps provide well-vascularized tissue and simple and reliable techniques, but they imply major donor-site morbidity (sacri-

fice of a major muscle), increased blood loss, and longer operative time. As a consequence, posterior trunk reconstruction has been addressed with perforator flaps, such as the thoracodorsal artery perforator flap or the intercostal artery perforator flaps [9,19].

There are multiple perforating vessels in the dorsal area, and the anatomy of intercostal vessels has been studied extensively [7]. The DICAPs arise from the posterior intercostal artery at the vertebral segment. Consistent with the angiosome theory and recently published studies [20], the DICAP flap can be extended safely to capture adjacent perforasomes because of the extensive true anastomotic connections with the multiple surrounding perforators [10]. To date, the biggest DICAP flap elevated on a single perforator reported thus far was a $40 \times 15 \text{ cm}^2$ propeller flap by Prasad and Morris [17].

The size of the flap in the present case was slightly smaller ($30 \times 18 \text{ cm}^2$), but it extended from the posterior midline to approximately the midaxillary line based on a single perforator. The flap was elevated safely and healed uneventfully without tip necrosis or congestion. There were some technical points and originalities with satisfactory results. First, MPNST is biologically an aggressive tumor, and its excision is difficult because of the intractable hemorrhage. Maintaining a bloodless field is paramount to ensuring clear visualization of the perforating vessels and safe excision. To accomplish that, a wide local excision of the lesion was performed with a 2-cm margin three-dimensionally, not only for the tumor clearance but also for the inclusion of normal tissue for less bleeding. In addition, an MPNST excision is performed with the generous use of bipolar electrocautery. Second, an exploratory incision (4 cm) was made first, and a perforator adjacent to the defect was explored. After identifying the large perforator, the skin islands were redesigned according to the perforator location and the size of the defect. The isolated perforator is mobilized and dissected free with the overlying to prevent flap congestion and to

Fig. 4. Immediate postoperative appearance.

Fig. 5. Postoperative appearance at 6 months. (A) At rest. (B) Bilateral arms abduction.

gain sufficient pedicle length without tension. According to the anatomical study and clinical applications of DICAP flap [16], it could safely be extended as far as the midaxillary line or the anterior border of the latissimus dorsi with stable blood circulation and complete survival.

As described above, successful reconstruction of the back was possible using a DICAP propeller flap. Although there is a limitation that requires long-term follow-up, a DICAP propeller flap offered a satisfactory result in the present patient. Overall, this technique offers early recovery with minimal donor-site morbidity.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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REFERENCES

1. Bostwick J 3rd, Schefflan M, Nahai F, Jurkiewicz MJ. The "reverse" latissimus dorsi muscle and musculocutaneous flap: anatomical and clinical considerations. *Plast Reconstr Surg.* 1980;65:395-9.
2. Miyamoto S, Kayano S, Umezawa H, Fujiki M, Nakao J, Sakuraba M. Efficient design of a latissimus dorsi musculocutaneous flap to repair large skin defects of the upper back. *Microsurgery.* 2014;34:20-2.
3. Casas LA, Lewis VL Jr. A reliable approach to the closure of large acquired midline defects of the back. *Plast Reconstr Surg.* 1989;84:632-41.
4. Yoon SK, Song SH, Kang N, Yoon YH, Koo BS, Oh SH. Reconstruction of the head and neck region using lower trapezius musculocutaneous flaps. *Arch Plast Surg.* 2012;39:626-30.
5. Koshima I, Moriguchi T, Soeda S, Kawata S, Ohta S, Ikeda A. The gluteal perforator-based flap for repair of sacral pressure sores. *Plast Reconstr Surg.* 1993;91:678-83.
6. Kim JT, Kim SW. Perforator flap versus conventional flap. *J Korean Med Sci.* 2015;30:514-22.
7. Kerrigan CL, Daniel RK. The intercostal flap: an anatomical and hemodynamic approach. *Ann Plast Surg.* 1979;2:411-21.
8. Oki K, Murakami M, Tanuma K, Ogawa R, Ozawa H, Hyakusoku H. Anatomical study of pectoral intercostal perforators and clinical study of the pectoral intercostal perforator flap for hand reconstruction. *Plast Reconstr Surg.* 2009;123:1789-800.
9. Hamdi M, Van Landuyt K, Monstrey S, Blondeel P. Pedicled perforator flaps in breast reconstruction: a new concept. *Br J Plast Surg.* 2004;57:531-9.
10. Hamdi M, Van Landuyt K, de Frene B, Roche N, Blondeel P, Monstrey S. The versatility of the inter-costal artery perforator (ICAP) flaps. *J Plast Reconstr Aesthet Surg.* 2006;59:644-52.
11. Zang M, Yu S, Xu L, et al. Intercostal artery perforator propeller flap for reconstruction of trunk defects following sarcoma resection. *J Plast Reconstr Aesthet Surg.* 2015;68:822-9.
12. Baghaki S, Diyarbakirlioglu M, Sahin U, et al. Extended locoregional use of intercostal artery perforator propeller flaps. *Microsurgery.* 2017;37:293-9.
13. Durgun M, Baş S, Aslan C, Canbaz Y, Işık D. Use of dorsal intercostal artery perforator flap in the repair of back defects. *J Plast Surg Hand Surg.* 2016;50:80-4.
14. Brunetti B, Tenna S, Aveta A, et al. Posterior trunk reconstruction with the dorsal intercostal artery perforator based flap: clinical experience on 20 consecutive oncological cases. *Microsurgery.* 2016;36:546-51.
15. Lupon E, Lellouch AG, Deilhaes F, Chaput B, Berthier C. Reconstruction of a dorsal thoracic wall defect with a dorsal intercostal artery perforator flap after removal of a bulky cutaneous squamous cell carcinoma: a case report. *J Med Case Rep.* 2019;13:294.
16. Minabe T, Harii K. Dorsal intercostal artery perforator flap: anatomical study and clinical applications. *Plast Reconstr Surg.* 2007;120:681-9.
17. Prasad V, Morris SF. Propeller DICAP flap for a large defect on the back-case report and review of the literature. *Microsurgery.* 2012;32:617-21.
18. Netscher DT, Baumholtz MA, Bullocks J. Chest reconstruction: II. Regional reconstruction of chest wall wounds that do not affect respiratory function (axilla, posterolateral chest, and posterior trunk). *Plast Reconstr Surg.* 2009;124:427e-435e.
19. Angrigiani C, Grilli D, Siebert J. Latissimus dorsi musculocutaneous flap without muscle. *Plast Reconstr Surg.* 1995;96:1608-14.
20. Taylor GI, Chubb DP, Ashton MW. True and 'choke' anastomoses between perforator angiosomes: part I. anatomical location. *Plast Reconstr Surg.* 2013;132:1447-56.

악성말초신경피복종 절제 후 발생한 광범위 등 결손의 등늑간동맥 천공지 프로펠러 피판술을 이용한 재건: 증례보고

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등의 광범위한 결손은 재건수술 영역에 있어서 항상 큰 도전이다. 주변의 근육피판을 이용한 재건방법이 문헌에 많이 보고되었지만, 이들은 근육 기능의 손실과 같은 공여부 손실을 피할 수 없다. 반면 천공지 피판은 공여부 손실을 최소화하며 주변 조직을 이용해 재건할 수 있어 최근 각광받고 있는데, 그중 등늑간동맥 천공지 프로펠러 피판술을 이용한 보고는 많지 않다. 본 증례보고에서는 악성말초신경피복종 절제 후 발생한 광범위 등 결손에서 등늑간동맥 천공지 프로펠러 피판술을 이용한 성공적인 재건을 보고하고자 한다.

색인단어: 천공지 피판, 종양, 재건 수술

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