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COMBINATION OF LICAP AND IMAP FLAP FOR TREATMENT OF LONG-LASTING CUTANEOUS FISTULAS OF THE CHEST WALL WITH OSTEOMYELITIS

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Summary

Patients presenting large chest wall defects often represent a challenge, the more when other conditions, like osteomyelitis, may complicate the wound healing process.

We present a case of long-lasting cutaneous fistulas of the chest wall caused by ribs and sternum osteomyelitis, refractory to both conservative and surgical treatment. Both lateral intercostal perforator flap and internal mammary perforator flap were performed in the same surgery for chest wall coverage after accurate debridement. The procedure allowed for resolution of osteomyelitis and wound healing with no recurrence. The purpose of this report is to highlight how, in apparently untreatable cutaneous fistulas caused by ribs and sternum osteomyelitis, an accurate debridement and coverage with perforators propeller flaps may be successful.

Key words: reconstructive surgery, chest wall defects, osteomyelitis, LICAP flap, IMAP flap

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INTRODUCTION

Defects of the chest wall represent a challenge, especially when associated with osteomyelitis [1]. Before perforator flaps era, pedicled musculocutaneous flaps were the most common reconstructive choice, although these flaps are associated with high donor-site morbidity, sometimes long operative times and aesthetic impairment [2]. Another important reconstructive option is the use of free flaps, which should be considered when local pedicled flaps have failed or seem inadequate [3]. Growing experimental evidence shows that fasciocutaneous flaps are just as effective as muscle flaps in treating osteomyelitis and they also reduce donor-site morbidity [4]. Internal mammary artery perforator (IMAP) flap and lateral intercostal artery perforator flap (LICAP) are fasciocutaneous flaps supplied, respectively, by one muscle perforator arising from the internal mammary vessels and by one perforator arising from lateral intercostal artery [5-9]. We report the case of a patient affected by chronic cutaneous fistulas in sternum and ribs osteomyelitis, successfully treated with accurate debridement combined with reconstruction with IMAP flap and LICAP flap in the same procedure.

CASE REPORT

A 70-year-old woman (BMI 25 kg/m^2) presented at our unit with a history of chronic cutaneous fistulas located in sternal region and at inferior left chest wall, due to sternum and ribs osteomyelitis, as a result of rib and sternum fractures following a cardiopulmonary resuscitation. Her quality of life was severely affected, the patient firstly developed clinical signs of osteomyelitis approximately 18 months before presenting at our institution, after being treated with surgical debridement, vacuum therapy and pectoralis major muscle flap, but without improvement (Fig. 1). After first evaluation at our clinic, we performed angio-CT scan on the purpose to study the patency of vessels in thoracic and upper abdominal region. This exam confirmed the presence and the patency of the right internal mammary and the left lateral intercostal vessels, but absence of patency of superior epigastric arteries bilaterally. Therefore, we decided to use IMAP flap for reconstruction of sternum defect and LICAP flap for reconstruction of inferior left chest wall. We performed color doppler US using a 8 MHz probe, to study vessels position and flow velocity. During surgical procedure, the receiving sites were prepared with accurate and wide debridement, the resection was extended to include the ribs and a portion of sternum. Skin-paddle incisions were performed along the preoperative markings and dissection proceeded in a subfascial plane. Second intercostal perforator of internal mammary artery and sixth intercostal perforator of lateral intercostal artery were identified, further skeletonization, including a careful intramuscular dissection, was performed in order to achieve the highest degree of flap mobilities, decreasing the risk of kinking and tension. The flaps were then inset, with an arc of rotation of 90° for IMAP (flap dimensions: 20 cm x 8 cm) and 180° for LICAP (flap dimensions: 11 cm x 5 cm) to repair defects, obliterating any cavity (Fig. 2). Before final sutures, we performed ICG angiography in order to check perfusion of two flaps. Donor sites were closed by primary intention and three drains were inserted; the skin was then sutured (Fig. 3). Post-operative treatment included low-weight eparin, aspirin, flavonoid and antibiotics. No flaps failure was observed and no further complications or relapses were observed during follow up at 18 months. The procedure allowed osteomyelitis resolution and wound healing with no recurrence (Fig. 4).

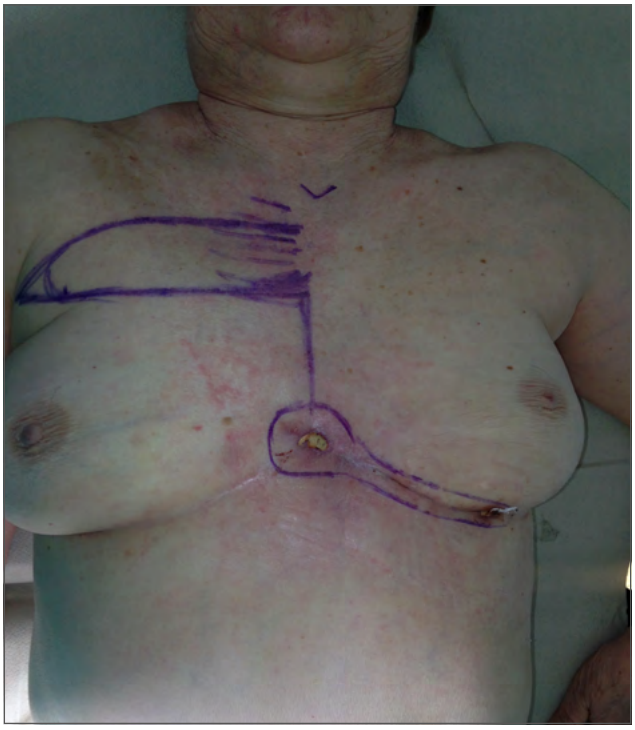

Figure 1. Pre-operative picture: long-lasting cutaneous fistulas of the chest wall for ribs and sternum osteomyelitis, refractory to both conservative and surgical treatment. Planning of IMAP and LICAP flap for reconstruction after accurate debridement.

Figure 2. IMAP and LICAP harvesting and their inset for repair defect after accurate and wide debridement.

DISCUSSION

The case presented reports the successful treatment of chronic cutaneous fistulas of chest wall due to osteomyelitis by combining accurate debridement and double fasciocutaneous perforator flaps: IMAP flap and LICAP flap in the same surgical procedure. The advantages of using perforator flaps compared to muscle flaps include less donor site morbidity, superior versatility in flap design, muscle sparing and an improved

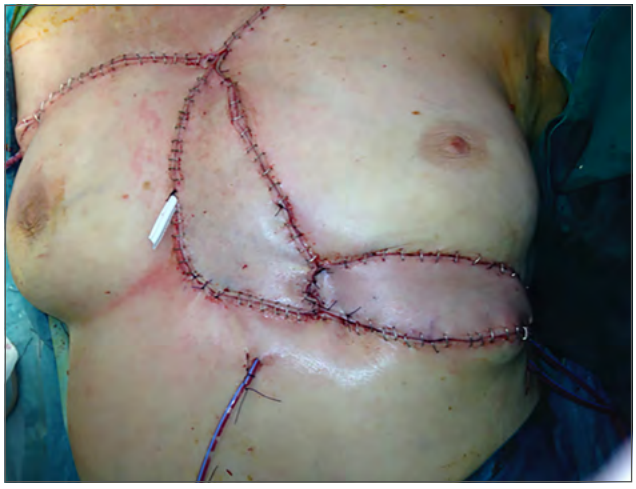

Figure 3. Final result after skin closure.

Figure 4. 18 months follow-up: no recurrence, minimal donor site morbidity and symmetry between breasts and lack of nipple areolar complex distortion.

post-operative recovery [10]. If a good preoperative study is performed, perforator flaps have a predictable and consistent blood supply with one perforating vessel of sufficient pedicle length and the possibility to close the donor defect primarily [11].

According to the mentioned results we came to reach the conclusion that IMAP and LICAP were the only pedicled flap options to reconstruction sternal region and left inferior chest wall, due to absence of patency of superior epigastric arteries for previous cardiopulmonary resuscitation and then for osteomyelitis development.

Moreover, free flaps could have been another reconstructive option, but the patient had already undergone many other surgical procedures previously and refused microsurgical reconstruction that required a major operative surgical time and a longer hospitalization.

To the best of our knowledge there are no previous reports on the combined use of the IMAP flap and LICAP flap in the same surgical procedure in chest wall reconstruction for sternum and ribs osteomyelitis. Internal mammary artery perforator-based flaps have been described fairly extensively for head and neck reconstruction and in few small case series to cover sternal, chest wall and the upper abdominal wall defects [12,13]. IMAP flap has a good arc of rotation and considerable dimensions of its related perforasome, and can repair most defects of the anterior chest wall because of the wide angiosome of the internal mammary artery which spans from the clavicle to the 9th rib and from the midsternal line to the anterior axillar line. LICAP flap has been described for defect coverage of different anatomical regions such as the back and sternal regions, or partial breast reconstruction or augmentation [8]. The aim of the reconstructive procedure is to provide a defect repair with no recurrence with minimal donor site morbidity and a good aesthetic outcome. IMAP and LICAP, performed in the same surgery, have demonstrated to be flexible reconstructive tools without an increase of postoperative complications, achieving a good aesthetic result: symmetry between breasts and lack of nipple areolar complex distortion. To be successful in the surgical procedure and to achieve a complete recovery, both demolition and reconstructive parts must be carefully planned. The purpose of this report is to highlight how, in apparently untreatable cutaneous fistulas related to ribs and sternum osteomyelitis, accurate debridement and coverage with perforators propeller flaps may be beneficial with capability of successfully repair large defects. In our experience IMAP and LICAP flaps are characterized by good arc of rotation and dimensions, versatility and reliability, and can be used in combination to restore large defects of chest wall, without the use of free flaps.

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Conflict of interest statement

The Authors declare no conflict of interest.

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Authors' contributions

Diletta Maria Pierazzi: DT, W
Sergio Arleo: D
Gianpaolo Faini: DT

Abbreviations

A: conceived and designed the analysis
D: collected the data
DT: contributed data or analysis tool
S: performed the analysis
W: wrote the paper
O: other contribution (specify contribution in more detail)

Ethical consideration

The research was conducted ethically, with all study procedures being performed in accordance with the requirements of the World Medical Association's Declaration of Helsinki.
Written informed consent was obtained from each participant/patient for study participation and data publication.

References

1 Nahai F, Rand RP, Hester TR, et al. Primary treatment of the infected sternotomy wound with muscle flaps: a review of 211 consecutive cases. Plast Reconstr Surg 1989;84:434-441. https://doi.org/10.1097/00006534-198909000-00009

2 Ringelman PR, Vander Kolk CA, Cameron D, et al. Long-term results of flap reconstruction in median sternotomy wound infections. Plast Reconstr Surg 1994;93:1208-1214. PMID: 8171140

3 Losken A, Thourani VH, Carlson GW, et al. A reconstructive algorithm for plastic surgery following extensive chest wall resection. Br J Plast Surg 2004;57:295-302. https://doi.org/10.1016/j.bjps.2004.02.004

4 Salgado CJ, Mardini S, Jamali AA, et al. Muscle versus nonmuscle flaps in the reconstruction of chronic osteomyelitis defects. Plast Reconstr Surg 2006;118:1401-1411. https://doi.org/10.1097/01.prs.0000239579.37760.92

5 Blondeel PN, Van Landuyt KH, Monstrey S, et al. The "Gent" consensus on perforator flap terminology: preliminary definitions. Plast Reconstr Surg 2003;112:1378-1383. https://doi.org/10.1097/01.PRS.0000081071.83805.B6

6 Vesely MJ, Murray DJ, Novak CB, et al. The internal mammary artery perforator flap: an anatomical study and a case report. Ann Plast Surg 2007;58:156-161. https://doi.org/10.1097/01.sap.0000232859.33035.d5

7 Schmidt M, Aszmann OC, Beck H, et al. The anatomic basis of the internal mammary artery perforator flap: a cadaver study. J Plast Reconstr Aesthet Surg 2010;63:191-196. https://doi.org/10.1016/j.bjps.2008.09.019

8 Hamdi M, Landuyt KV, de Frene B, et al. The versatility of the inter-costal artery perforator (ICAP) flaps. J Plast Reconstr Aesthet Surg 2006;59:644-665. https://doi.org/10.1016/j.bjps.2006.01.006

9 Hamdi M, Spano A, Landuyt KV, et al. The lateral intercostal artery perforators: anatomical study and clinical application in breast surgery. Plast Reconstr Surg 2008;121:389-396. https://doi.org/10.1097/01.prs.0000298317.65296.cf

10 Hallock GG. In an era of perforator flaps, are muscle flaps passé? Plast Reconstr Surg 2009;123:1357-1363. https://doi.org/10.1097/PRS.0b013e3181a0a111

11 Saint-Cyr M, Wong C, Schaverien M, et al. The perforasome theory: vascular anatomy and clinical implications. Plast Reconstr Surg 2009;124:1529-1544. https://doi.org/10.1097/PRS.0b013e3181b98a6c

12 Almadori G, De Corso E, Visconti G, et al. Impact of internal mammary artery perforator propeller flap in neck resurfacing and fistula closure after salvage larynx cancer surgery: our experience. Head Neck 2019;41:3788-3797. https://doi.org/10.1002/hed.25903

13 Karabulut AB, Kalender V. Internal mammary artery pedicled island flap for the treatment of chest wall radionecrosis. Plast Reconstr Surg 2001;108:583-584. https://doi.org/10.1097/00006534-200108000-00067