

CASE REPORT

Reconstruction of a deep sternal wound with exposed pericardium using an IMAP propeller flap: A case report

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Abstract

The results of this case suggest that the IMAP propeller flap may be a viable and safe option for deep sternal wound reconstruction with minimal donor-site morbidity.

KEYWORDS

chest wall reconstruction, deep sternal wound infection, internal mammary artery perforator flap, propeller flap, sternal reconstruction

1 | INTRODUCTION

The reconstruction of defects following deep sternal wound infections (DSWIs) and sternal dehiscence is still a challenge for the reconstructive surgeon. Pectoralis major and rectus flaps have been the workhorse flaps in this field together with omental flaps.^{1,2} However, these flaps are associated with long operative time, aesthetic impairment, and a high donor-site morbidity.³ Moreover, each single flap is not able to cover the entire sternum so that more than one flap has to be used when the defect involves the sternum in all its length.⁴

In the last years, the internal mammary artery perforator (IMAP) flap has been used with satisfying results in the

resurfacing of sternal wounds with sternal dehiscence.^{5,6} We discuss the use of an IMAP flap as a propeller flap in association with an IMAP V-Y advancement flap for the treatment of a DSWI with full-thickness sternal defect in a pediatric patient. To our knowledge, this is the first case of this kind in literature.

2 | CASE REPORT

A 14-year-old boy presented to our A&E with an abscess in the presternal area and high temperature. No cause for the abscess could be recalled. The patient was active and a

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nonsmoker, and he had a BMI of 16 and no comorbidities. The blood tests showed raised inflammatory markers, and the CT chest showed involvement of the anterior mediastinum with sternal osteomyelitis.

The cardiothoracic team drained the abscess, debrided the affected skin, and proceeded with a midline sternotomy, excision of the infected bone, and irrigation of the mediastinum. Infected tissues, bone fragment, and thymus were sent for microbiology and histological examination.

The full-thickness sternal defect and the skin wound that resulted were temporized with negative pressure wound therapy (NPWT). *Staphylococcus aureus* was identified as the causative microorganism, and targeted antibiotic therapy with IV flucloxacillin and clindamycin was started. An acute interstitial nephritis caused by flucloxacillin was diagnosed following a drop in renal function confirmed on ultrasound and a renal biopsy. The therapy was then switched to IV cefturoxime. Two further washouts and NPWT dressings were done after four and eight days, respectively. This resulted in a 3 × 3 cm sternal bone defect and a 7 × 4 cm soft tissue defect. Microbiology and histology confirmed acute osteomyelitis. The case was discussed at our local multidisciplinary team meeting.

A 12 × 4 cm IMAP fasciocutaneous propeller flap based on the perforator of the right third intercostal space was planned. A second V-Y advancement IMAP flap, based on the perforator of the third intercostal space was planned on the contralateral side. Both the perforators were identified and marked preoperatively with a handheld Doppler (Figure 1).

The procedure was carried out under general anesthesia. The patient was positioned supine with arms adducted. The

senior author (LT) harvested the propeller flap starting from the medial edge of the flap, in a subfascial plane. No skin incisions were made before identification of an adequate perforator (Figure 2A). The dissection continued in a subfascial plane. No further dissection was performed around the perforator through the pectoralis muscle (Figure 2B). The flap was propelled clockwise through 180° to fill the bone defect (Figure 2C). The V-Y IMAP flap on the left side was harvested without skeletonizing the perforator and advanced medially.

The pectoralis muscle fascia of the propeller flap was firmly stitched to the pericardium and to the sternal periosteum. The tip of the propeller flap was de-epithelialized (Figure 2C). The pectoralis major muscle of the left side was slightly detached from the chest wall medially and minimally advanced to cover the bone in the left side. The superficial portion of the muscle was then sutured with the Scarpa's fascia of the propeller flap. Finally, the skin of the two flaps was sutured without tension, and the donor sites of both flaps were closed directly (Figure 2D). No surgical drains were used.

The only postoperative instruction was to avoid abduction of the upper limbs for the first 4 days. No surgical complications occurred in the postoperative period, and both flaps survived entirely. The patient was discharged from the hospital within 11 days of the reconstructive procedure once kidney function normalized. Antibiotic therapy was continued for a total of 6 weeks.

Photographs taken at 12 months post surgery showed completely healed wounds (Figure 3). The patient experienced no functional morbidity and no signs of infection. No unsightly deformities were present.

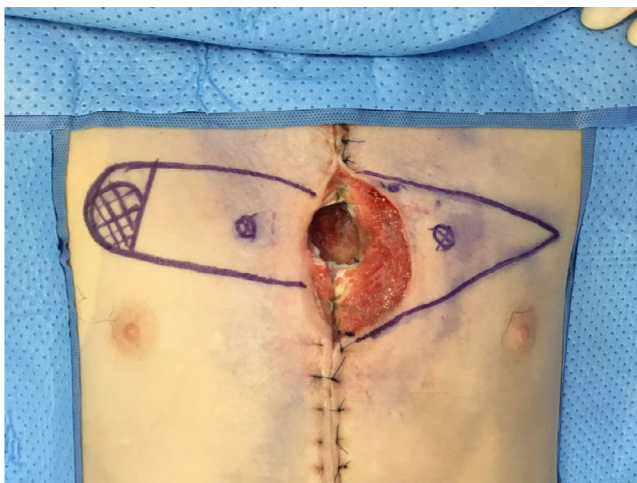


FIGURE 1 Image showing sternal skin defect of 7 × 4 cm and bone defect of 3 × 3 cm with exposed pericardium. The perforators identified on Doppler are marked. The 12 × 4 cm propeller flap was planned on the right side, based on the position of the perforator and the defect. The area to be de-epithelialized is marked on the distal aspect of the flap. The V-Y flap was planned on the left

3 | DISCUSSION

The initial treatment of the DSWIs with sternal dehiscence and mediastinitis requires aggressive surgical debridement (pseudo-tumoral excision) including any structure and hardware involved by the infective process.^{7,8} A culture-specific antibiotic therapy should start as soon as possible. NPWT has proven to be the best bridge between serial debridements until wound closure⁹.

Once the wound is ready for closure, the reconstruction must be planned based on position and three-dimensional characteristics of the wound, such that one or more flaps might have to be used.^{4,10}

Although muscle flaps conventionally have been considered the best option in the context of osteomyelitis², recently, several authors have reported good results with the use of IMAP fasciocutaneous flaps^{5,6}. The IMAP flap has been reputable for its reliability and versatility^{11,12}. It can cover defects of the total sternal length, with the

FIGURE 2 Intraoperative image showing the IMAP propeller flap completely raised before it is inset (A), and the pedicle skeletonized (B). Flap propelled into position, with the area to be de-epithelialized marked in blue (C). Immediate postoperative result (D)

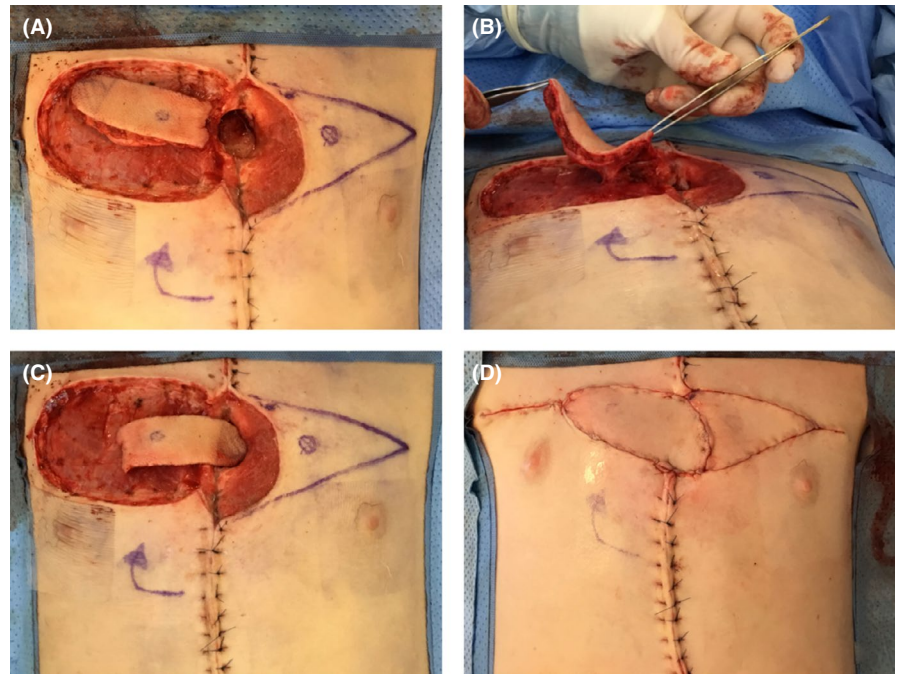


FIGURE 3 Follow-up at 12 mo after the procedure

advantage of replacing “like with like”. The donor site generally can be closed directly without necessitating an unsightly skin graft. It is significantly less invasive than the traditional rectus abdominis or pectoralis major muscle flaps, or the omental flap without additional functional disabilities, such as postoperative breathing difficulties and herniation³.

Nevertheless, until now, no one has described the use of IMAP fasciocutaneous flap as a propeller flap for deep sternal wound defects with full-thickness bone defects. An IMAP propeller flap according to the nomenclature

proposed during the “Tokyo” consensus on propeller flaps¹³, is an island flap based on an eccentric IMAP that reaches the recipient site only through an axial rotation from 90°-180°. The IMAP propeller flap may be considered the result of a multiple-step evolution of the deltopectoral flap described by Bakamjian et al, a pedicled flap based on the first four internal mammary perforators.¹⁴ Portnoy et al improved the mobility of the flap by detaching the medial portion with his deltopectoral island flap¹⁵, and subsequently, Yu et al described the IMAP flap.¹⁶

The major advantage of the use of the IMAP propeller flap without dissecting the perforator inside the muscle fibers as in this case is to reduce the operative time. At the same time, the bleeding risk is lower while the chance of pneumothorax is almost zero. All these aspects result in a lower degree of invasiveness for the patient, making this flap particularly useful in patients with several comorbidities such as the cardiothoracic patients.⁷ In addition, this flap does not preclude the future use of the internal mammary artery for heart revascularization as after a short amount of time, new vascular connections between the edges of the flap and the surrounding tissue form. The rotation up to 180° and a good preoperative planning should allow the flap to reach and cover every kind of sternal wound.

To our knowledge, this is the first described use of an IMAP propeller flap for the treatment of sternal wounds with cardiac exposure. Moreover, the use of an IMAP propeller flap has not been described in a pediatric setting.

We believe that these characteristics make this flap a valid alternative to the muscle flaps in treatment of DSWIs with sternal bone defect.

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

LT: served as the plastic surgery consultant who performed the surgery and conceived and designed the study. FZ: served as the clinical fellow who collected the data and wrote the paper. MB: served as the registrar who conducted the literature review and helped in writing the paper.

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