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Superior epigastric artery perforator flap for sternal osteomyelitis defect reconstruction☆

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Summary Sternal osteomyelitis after median sternotomy is associated with considerable morbidity and mortality. Combined with radical debridement, muscle and less frequently omentum flaps are used to reconstruct the resulting defects. In this study, we present our experience with the fasciocutaneous superior epigastric artery perforator (SEAP) flap for defect closure. After resection of the entire sternum, including the costochondral arches and the sternoclavicular joints, the repair of the defect was performed with the perforator flap without any re-stabilisation of the thoracic wall. A consecutive series of nine patients with a mean age of 69 ± 6 years were reconstructed with the SEAP flap. The mortality rate was zero. One patient developed a mediastinal haematoma and required five re-interventions by the cardiothoracic surgeons and thereafter a revision to close a small-wound dehiscence at the tip of the flap. Another two patients developed partial necrosis of the flap that could be managed conservatively. One patient had a revision for a seroma on the donor site, resulting in a 100% closure rate of the defect; there were revisions in two out of nine patients. The underlying infection was controlled by debridement, antibiotic therapy and flap closure in all cases. The overall success of the procedure was satisfactory; however, the local complication rate was relatively high with three out of nine patients on the flap side and one of nine on the donor site. Major advantages of the perforator flap in this highly morbid patient cohort are that the operation is relatively quick, muscle tissue is spared and re-education facilitated.

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Ideally, defect reconstruction after thorough debridement of sternal osteomyelitis is a safe procedure with minimal donor-site morbidity permitting rapid recovery in this patient group presenting frequently in a poor general condition. Traditionally, muscle flaps, mainly pectoralis major turnover or advancement flaps,[1] which may be sufficient in cases of sternal osteotomy wound dehiscence, have been used. In cases of recalcitrant osteomyelitis necessitating radical debridement that creates large defects after debridement, latissimus dorsi and vertical rectus abdominis muscle flaps or omental flaps have been used.[2] Associated weakening of the abdominal wall by muscle harvest or opening of the abdominal cavity for harvest of the omentum or relatively long operation time with free flaps may be potential drawbacks of these procedures. Perforator flaps represent the most advanced method of tissue transfer in terms of applied anatomic and physiological principles. Basically, the use of a perforator flap maximally decreases donor-site morbidity and spares muscle tissue that is currently probably most frequently used for sternal defect closure.

Theoretically, perforators such as superior epigastric artery perforator (SEAP) present an ideal source for fasciocutaneous flaps for sternal reconstruction. Previously, the use of this flap has been described for autologous breast volume augmentation after massive weight loss,[3] tumour resection and radionecrosis,[4–8] or after trauma.[9] Of the total of 19 flaps described in the literature, only three were used for sternal osteomyelitis.[10] The aim of the present study is to present the results obtained with a consecutive series of SEAP flaps for defect closure after radical sternectomy for recalcitrant osteomyelitis with an emphasis on infection control, local complications of the flap and the donor site and duration of post-flap hospital stay.

Patients and methods

General patient data

Between May 2010 and July 2012, nine patients presenting with osteomyelitis after sternotomy were operated on. Informed consent was taken from all patients including approval for publication of fotodocumentation. All patients underwent at least one debridement (range 1—4) and wound conditioning before defect closure, but did not undergo any flap procedure to close the defect before the SEAP flap procedure. American Society of Anaesthesiologists (ASA) score, presence of diabetes mellitus, arterial hypertension and active smoking were assessed.

Surgical technique

All procedures were performed under general anaesthesia. After debridement, multiple biopsies were harvested for microbiological and histological workup. Perforator vessels were identified with a handheld Doppler probe with the possibility of previous internal mammary artery harvest in mind. No other imaging techniques were used for operative planning. After perforator mapping, the skin paddle was designed with the most suitable perforator serving as the pivot point. None of the flaps crossed the midline or, in other words, the perforators were on the ipsilateral side in relation to the flap. The inframammary fold, that is, the lower border of the pectoralis muscle, served as the upper border of the flaps that were horizontally orientated in all cases resulting in a final flap rotation of 90°.

Flap dissection started in the distal, lateral part of the flap in the plane above the muscle fascia, which was left intact, towards the previously identified pedicle. If there was more than one potential pedicle identified with the Doppler probe, flap preparation continued until the first (pivot point) perforator was identified. Fine perforator preparation was limited to the amount necessary to transpose the flap into the defect (Figure 1). The flaps could be easily rotated 90° into the defect and all donor sites could be primarily closed by a reverse abdominoplasty-type procedure. All patients received antibiotic treatment according to previous biopsy results or on an empirical basis with later adaptation as recommended by the infectious disease team. Drains were removed if output was <20 ml/24 h. The typical presentation after 1-year follow-up is presented in Figure 2.

Post-operative evaluation

All patients were prospectively monitored for post-operative complications, especially for signs of infection, wound dehiscence and flap necrosis-related and donor-site-related complications. Complications were classified as major or minor depending on whether a reoperation was necessary or not. The duration of hospital stay and the 30-day mortality were also obtained.

Results

General patient data

Mean age was 69 ± 7 years; there were five male and four female patients; ASA score was for all patients III or IV. Body mass index (BMI) ranged between 30 and 39 kg m^{-2} (mean 34 ± 3 kg m^{-2}) (Table 1). Four of the patients had either three or four coronary artery bypasses and one patient had five bypasses as the initial intervention.

Surgical data and complications

After debridement, the defect size in surface ranged between 120 and 280 cm^2 (mean 190 ± 50 cm^2). The mean operation time was 128 ± 25 min including the debridement.

There was no recurrent or persistent infection after the flap procedures combined with antibiotic therapy. One patient developed a mediastinal haematoma not related to the flap procedure and required five re-interventions by the cardiothoracic surgeons and a last revision for a tip necrosis of the flap. Two more partial flap necroses, that is, wound dehiscences, could be managed conservatively, resulting in an overall ischaemic complication rate of 3/9 (Table 2). At the donor site, one patient was taken back to the operation room for a seroma, whereas haematoma and seroma in one patient were managed conservatively. One patient