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Reconstruction of Post-Sternotomy Defects Using Pectoralis Major Flaps with or without Z-Plasty – A Case Series of Five Patients

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Abstract
Deep sternal wound infections (DSWI) following cardiac surgery are rare but severe complications, associated with significant morbidity and prolonged recovery. Early detection and appropriate reconstruction using vascularized soft tissue are key to preventing mediastinitis and reducing mortality.
This case series highlights five patients who developed sternal wound dehiscence with or without pericardial exposure following median sternotomy. All were successfully managed using bilateral pectoralis major muscle flaps, and in three cases, local fasciocutaneous Zplasty flaps were added for inferior defect coverage. None required omental or free flaps. All patients healed well without major complications.
Keywords: Sternotomy, DSWI, pectoralis flap, Z-plasty, sternal reconstruction

INTRODUCTION

After open heart surgery where surgeons cut through the sternum (median sternotomy), about 1%-3% of patients might develop deep infections (1,18,19). Some of these patients might eventually need reconstructive surgery.
Infections can often be managed with regular cleaning, negative pressure wound treatment on the wound, debridement, & rewiring the sternum. Sometimes even part of sternum also needs to be removed if get infected. But when these options don't work, a local muscle flap is used to fix the defect. This flap can also be applied immediately after properly cleaning the wound (1,2,3).
There are different types of flaps used for reconstructing sternal defects. The pectoralis major muscle flap is often called a workhorse flap. Other kinds include omental flaps and flaps from muscles like the rectus abdominis or latissimus dorsi (12). Sometimes free flaps like from the thigh (ALT free flap) might be used too (15); however, there are challenges since vessels at recipient site may be absent or injured due to earlier surgery (4,5).
The pectoralis major muscle is located at the front of the upper chest. It starts from both the sternum & clavicle and inserted to a bicipital groove of humerus bone in the upper arm. Different techniques using this muscle have been described—like bilateral advancement or creating a turnover flap on one side.
This series presents five patients with post-sternotomy wound complications managed surgically with pectoralis major flap ± fasciocutaneous Z-plasty, emphasizing flap selection, outcomes, and lessons learned.

MATERIALS AND METHODS

Between January 2024 to June 2025, five patients (3 females, 2 males; aged 28–62 years) presented with sternal wound dehiscence following open-heart surgery (mitral valve replacement or CABG). All underwent:

- Initial conservative management with debridement ± NPWT
- Reconstructive surgery using pectoralis major flaps
- Additional Z-plasty or fasciocutaneous flaps when lower-third defects were present

Surgical Protocol:

- Procedures performed in a cardiac OR with CTVS backup

- Flaps raised under general anesthesia
- Thorough debridement to healthy bleeding tissue
- Bilateral pectoralis major advancement flaps for mid and upper sternal coverage
- Z-plasty/fasciocutaneous flaps for lower defects if required
- Suction drains placed under all flaps
- Postoperative care in cardiac ICU with regular wound monitoring

CASE HIGHLIGHTS:

CASE-1:-We had a 30-year-old female who underwent Mitral Valve replacement for mitral valve regurgitation via median sternotomy in Cardiothoracic-Vascular Surgery Department in Smt. B.K. Shah Medical Institute and Research Centre on 12 January, 2024 which was uneventful.

Post operatively patient was kept cardiac ICU for 7 days and patient was discharged on request on POD 12 asked for follow up visit on POD 17 but she did not come at given follow up date. She directly came on POD 28 with infected surgical incision site and admitted in cardiac ICU for management. Gradually she developed large sternotomy wound with exposed pericardium. They had already done several cleanings and tried using a negative suction dressing (vac dressing). Condition of wound was improved by that and then she was referred to us (Plastic and Reconstructive Department) for closure of her infected sternotomy wound that was gaping open with exposed pericardium on 7th march,2024 and planned for surgery on 10th march, 2024.

Her wound measured about 25 x 7 x 4 cm and showed exposed pericardium in the lower third part while having healthy granulation tissue as shown in Figure 1-A. There was no any pus discharge and any signs of active infection which was determined clinically by absence of pus discharge, condition of surrounding skin (absence of redness & edema, no raised temperature). Her white blood cell count was also within normal limit (7600 cells/cumm). pre operative doppler for blood supply of muscle was not needed as it is most reliable flap.

We planned surgery in Cardiac operation room to avoid any cardiac related complications in presence of CTVS surgeon. Patient kept in supine position. General anaesthesia was given by cardiac anaesthetist keeping cardio-protectivity in mind. We cleaned up her wound again with debridement as shown in Figure 1-B and removed all unhealthy necrotic tissue using scooping till healthy fresh bleeding appeared. Haemostasis achieved with monopolar and bipolar cauterisation. Thorough wash with betadine then normal saline given. Then upper two third of defect closed using pectoralis major muscle advancement flaps based on pectoral branch of thoraco- acromial artery. But this alone wasn't enough for the bigger lower part which also had exposed pericardium which required good soft tissue coverage as it can't cover lower one third of defect. So we created a fasciocutaneous flap with Z-plasty technique to address that area instead as shown in Figure 1-C. As the remaining defect was of 5 cm, single Z-plasty planned with 5 cm of each limb and with angle of 60 degree as standard bio-geometry of Z plasty shown in figure 2. This is how need of omental flap avoided for coverage of lower part of defect. We placed three suction drains-two below Z-plasty and one below both advanced pectoralis major flaps as shown in Figure 1-D. Closure done after confirming haemostasis.

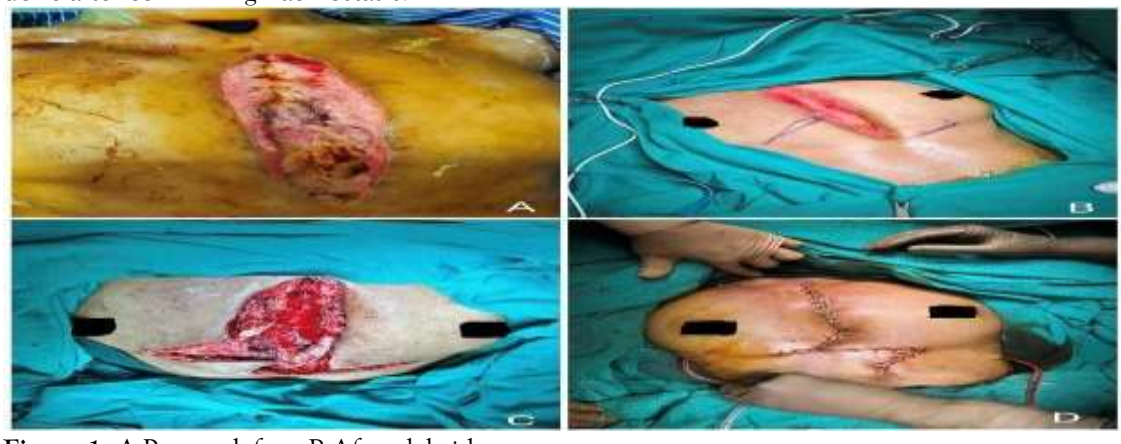

Figure 1: A-Pre op defect; B-After debridement;

C-after dissection of flaps; D-Post op image

Case	Age/Sex	Surgery	Defect Size	Exposure
1	30/F	MVR	25×7×4 cm	Pericardium (lower third)
2	54/M	CABG	18×5×3 cm	Sternal bone
3	40/F	MVR	22×6×3.5 cm	Pericardium (lower third)
4	62/M	CABG	20×8×4 cm	None
5	28/F	MVR	23×7×4 cm	Pericardium + sternal edge

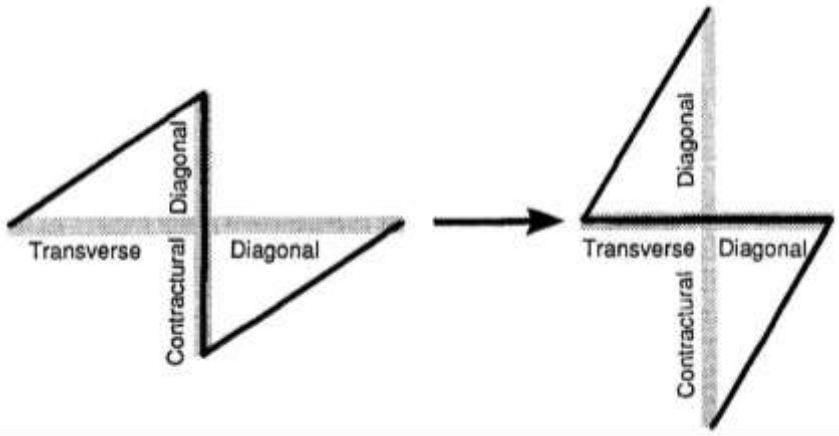

Figure 2: Bio-geometry of Z-plasty - Diagonals of Z-plasty showing how, with transposition of the Zplasty flaps, the contractural diagonal lengthened and transverse diagonal shortened (13)

RESULTS:

PMM = Pectoralis Major Muscle flap

Z-Plasty	Flap Used	Outcome
Yes	Bilateral PMM flap + fasciocutaneous Z-plasty	Healed; no complications

Bilateral PMM flap only	No	Healed; minor seroma, resolved
Bilateral PMM + Z-plasty	Yes	Healed; hypertrophic scar managed
Bilateral PMM flap	No	Healed; prolonged drain output
Bilateral PMM + Z-plasty	Yes	Healed; no complications

- All five patients recovered without flap necrosis, wound dehiscence, or mediastinitis.
- Three patients with lower sternal defects had additional fasciocutaneous Z-plasty, which avoided the need for omental or rectus flaps.
- Mean hospital stay post-op: 10.4 days
- Drain removal: POD 5–8 depending on output
- Scar condition: Satisfactory in all; one patient required topical scar management.

In Figure 3, there is condition of suture line on POD-7 and after 3 months of surgery which is primarily healed and healthy without any complication IN CASE-1.

Figure-3: A-after drain removal-POD-7
B-after 3 months

DISCUSSION:

Muscle flaps remain the gold standard for sternal wound reconstruction, particularly for deep or infected defects. The pectoralis major flap offers:

- Reliable vascularity
- Minimal donor site morbidity
- Excellent coverage for mid and upper third defects

However, lower third defects often require additional strategies. Traditionally, omental or rectus flaps were used, but these:

- Require laparotomy or additional incisions
- Carry risks of herniation, donor site complications

In this series, fasciocutaneous Z-plasty proved effective for covering lower third defects without the morbidity associated with abdominal flaps. All three patients treated with Zplasty had favorable outcomes.
Infected sternotomy wounds were treated with debridement until 1963 when Shumaker &
Mandelbaum introduced primary closure over catheter irrigation with antibiotics (6,7,16). This method helped cut down death rates significantly from 50% down to 20%. However, Grossi et al. (8) showed that this method only saved patients if doctors identified infections within 3 weeks post-surgery (9). If diagnosed after three weeks then they left wounds open & packed them with antibiotic gauze so they could heal naturally (8).
Jurkiewicz and his team in 1980 were among those who started using muscle flaps effectively, leading to a clear reduction in mortality rates (10,14). Studies have shown that these muscle flaps boost blood supply and reduce dead space while fighting infections (11,17). This method has since been standard treatment for infected sternotomy wounds. Some popular flaps include: pectoral (including turnover ones), rectus abdominis, latissimus dorsi(20), serratus anterior, and some combined options like pectoralis major/rectus abdominis flap (3,6,12).
A drawback of these techniques can be that they aren't enough alone usually to cover larger defects at lower parts of the sternal area. That's why working with fasciocutaneous flaps makes sense here to cover lower part of defects for which usually omentum used for it. In our cases, we have preserved omentum for future use as we have just use z plasty and fasciocutanous flap for lower part of defect which has given wonderful covering and result.

CONCLUSION:

To treat an infected sternotomy wound ideally means catching it early while providing thorough cleaning along with well-perfused tissue such as omentum or muscle tissue! Using topical negative pressure wound therapy recently described can simplify reconstructive needs too! But it should be start in early period of time and surgical intervention for reconstruction should done at appropriate time.
We managed successfully by combining bilateral pectoral myocutaneous flaps with a fasciocutaneous flap covering her large sternal defect smoothly without complications whatsoever! This is a simple procedure that works well for big sternal defects!
The pectoralis major muscle flap can be called a gold standard in sternotomy defect reconstruction specially with mediastinitis and sternal dehiscence as because of its reliable blood supply, ease to harvest and low to no donor site morbidity. But it is not enough to cover lower third of sternal defect even when use in turn over manner in large sternotomy defects. For that we require other options like rectus abdominis flap or omental flap which has their own disadvantages like need of laparotomy in omental flap. In our cases to avoid it we have use local fasciocutaneous flap with single z plasty which is better than other options and has given great results.
This 5-patient case series concludes that:

- Bilateral pectoralis major advancement flaps are reliable and safe for most poststernotomy defects
- Z-plasty fasciocutaneous flaps effectively extend coverage to lower sternal wounds
- Avoiding omental flaps preserves intra-abdominal tissues for potential future use
- Early surgical intervention combined with adequate debridement and vascularized coverage ensures optimal healing

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