

# Multidisciplinary Surgery In Thoracic Wall Reconstruction For Sternal Osteomyelitis

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## Abstract

Sternal osteomyelitis and dehiscence are a common problem with an incidence rate of 0.5% to 5.0% after major cardiac surgery. However, the management of separation of the sternum in the patient's thorax remains a challenge for cardiac surgeons and thoracic surgeons using the incision. After cardiac surgery, postop sternal dehiscence and osteomyelitis was developed in the patient. The old steel wires were removed and the sternum was resected due to long-term infection and extensive deformation of the sternum. Pectoralis muscle flaps were partially mobilized and adducted. The large defect was closed using a large prolene patch. Proper sized transversal titanium plates were selected. Due to the sternum bone was severely destroyed by infection, longer transversal titanium plates were chosen to achieve thoracic stability. Healthy tissues were detected on the ribs. A total of 4 titanium plates were placed intermittently. The plates were fixed to the ribs with titanium locking screws. The pectoral muscle flaps adducted to the plates by the plastic surgery team. A total of 3 drains were placed, one in the mediastinum and two between the thoracic wall and muscle structures.

## INTRODUCTION

Sternal osteomyelitis and dehiscence are a common problem with an incidence rate of 0.5% to 5.0% after major cardiac surgery. [1] Recently, it has been reported that the mortality rate in deep sternum wound infection after major cardiac surgery is decreasing, but still high as 16% to 22%. [2]

Conventional treatment of sternal osteomyelitis and dehiscence includes partial or total sternal resection with intravenous antibiotic therapy, continuous irrigation with antimicrobial agents containing saline, and localized negative pressure therapy known as vacuum assisted closure. When severe inflammation cannot be controlled using these methods, debridement of the devitalized sternum is required. [3] However, the conventional treatments have some limitations, especially in severe cases. First, massive resection, which is essential to prevent recurrence, reveals a small disease-free border and does not provide enough space to hold the sternum in conventional treatment. [4] Second, when the defect is large, the remaining bony structure after resection of dead tissue is not sufficient to prevent paradoxical chest wall motion using conventional treatment.

Recently, the use of hard metal plate fixation to close the sternum was recommended and reported promising results in many centers. [5] Sternal wound dehiscence may be managed conservatively with regular wound dressings, application of negative pressure to the wound, debridement and reclosing of the sternum or a local muscle flap is recommended to close the defect. [6]

## CASE PRESENTATION

Because the study was a case report, approval from the International Review Board was not required. Since the study was a retrospective case report, informed consent was not required.

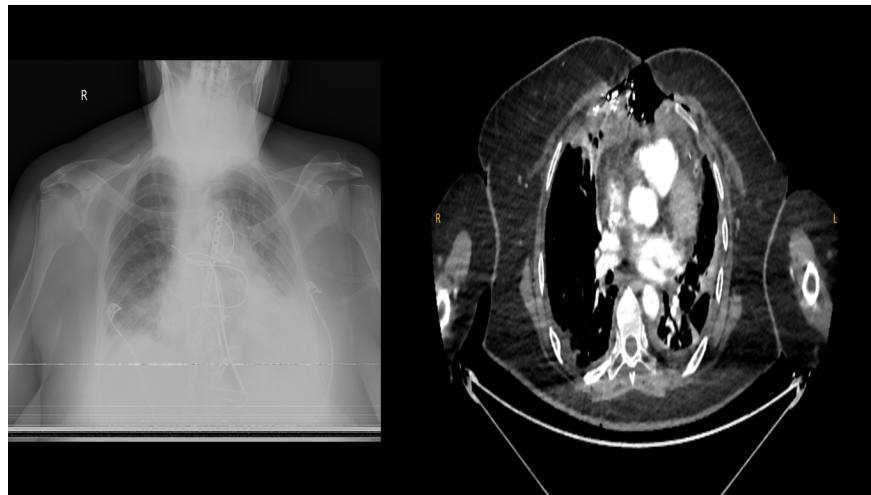
Our case was a 72-year-old female patient who underwent cardiac surgery 2 months before sternal reconstruction. Our patient has diabetes and uses oral antidiabetic. After cardiac surgery, postop sternal dehiscence and osteomyelitis was developed in the patient. Since the patient did not have benefit with the treatments during 2 months, the operation was planned after the controls.

### Operative Technique

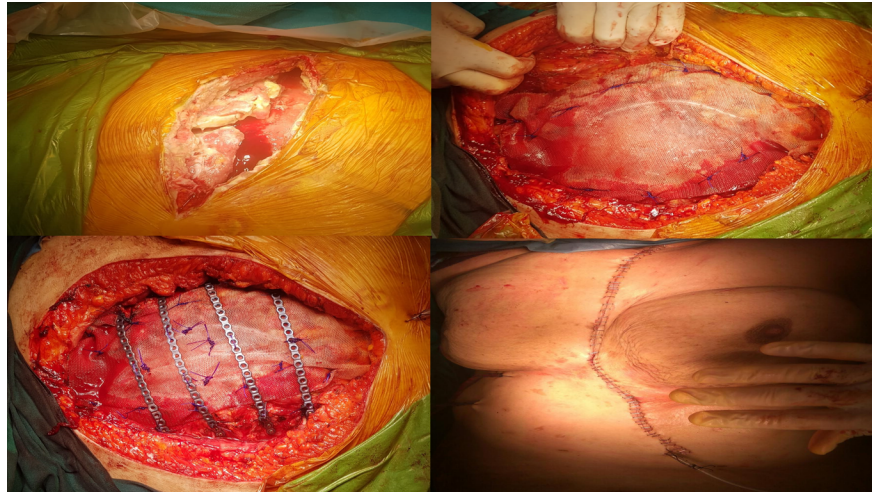
The patient who underwent cardiac surgery 2 months ago were applied many treatment methods for sternal dehiscence and osteomyelitis, but no success was achieved. The operation was started with general anesthesia. The sternum was exposed through the previous midline incision. The old steel wires were removed and the sternum was resected due to long-term infection and extensive deformation of the sternum. Pectoralis muscle flaps were partially mobilized and adducted. The large defect was closed using a large prolene patch. Proper sized transversal titanium plates were selected. Due to the sternum bone was severely destroyed by infection, longer transversal titanium plates were chosen to achieve thoracic stability. Healthy tissues were detected on the ribs. A total of 4 titanium plates were placed intermittently. The plates were fixed to the ribs with titanium locking screws. The pectoral muscle flaps adducted to the plates by the plastic surgery team. A total of 3 drains were placed, one in the mediastinum and two between the thoracic wall and muscle structures. Deformed skin tissue due to long-term infection was resected, and the remaining healthy tissues were closed according to the anatomical plan.

### Postoperative Protocol

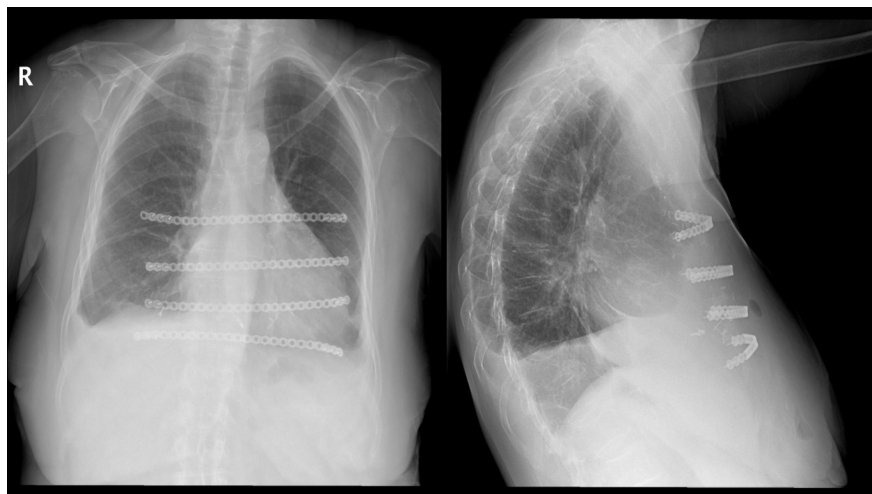
Drains that were placed to reduce the possibility of postoperative seroma and hematoma in the patient were used until drainage finished. All drains were terminated on the 6th postoperative day. The patient was discharged on the 7th postoperative day without complications.



**Figure 1:** Preoperative Radiological Imaging



**Figure 2:** Intraoperative Images



**Figure 3:** Postoperative Radiological Imaging at 6 Months

## DISCUSSION

Sternal dehiscence and infection problems of bone structure are complications after cardiac surgery and thoracic surgery, and incidence rate is between 0.5% and 5%. [7] In many cases where sternum revision is required, a simple wire circling, which is the most common method for sternal wound treatment, may not be sufficient to provide sternal stability, especially when a significant part of the sternum is resected. [8,9] In these cases, simple wire circling may cause sternum injury. Because tension may be applied to these areas even using the Robicsek technique. Unstable sternal fixation may cause non-healing of wound. Considering orthopedic principles, limiting movement between broken bone parts is extremely important for bone healing. [10] Supporting thoracic wall with metal plates may provide stabilization and immobilization of thoracic wall, and therefore it have been reported that promising for the treatment of a complicated sternum after major cardiac surgery. [11]

Conventional methods have failed to solve the chest wound problem. Most parts of sternum must be healthy to close sternum using traditional methods (simple wiring or Robicsek technique). Various disadvantages

have been reported that such as use of titanium plates is more expensive than conventional methods to close sternum and dislocation of screws. [12] Although these disadvantages, we consider that using titanium plates and supporting plates with prolene patches are very effective to provide sternal stability even wide resection of sternum, as in our case.

In addition to using titanium plates in the treatment of sternal dehiscence and osteomyelitis, a muscle flap may be required to provide thoracic wall stability in large defects. Pectoralis major muscle flap, omental flaps, rectus abdominis flaps and latissimus dorsi flaps may be used in reconstruction of sternum defects. [13] Prolene patch, titanium plate and pectoral flaps were used to treat in large defect of our patient. We consider that this flap is effective to provide the stability of the thoracic wall and to control the infection of tissues. In the literature, it was reported that using the flap is successful in the treatment of sternal dehiscence and osteomyelitis. [14]

## CONCLUSION

After sternotomy method, which is often used in cardiac and thoracic surgery, severe complications such as sternal dehiscence and sternal osteomyelitis may occur. Patients, including our case, who need complete resection of sternum and underwent extensive soft tissue debridement, may be encountered. We consider that using stability factors such as prolene patch and muscle flaps with titanium plates in large sternal resections is effective to provide the integrity of the thoracic wall and to control the infection.

## REFERENCES:

1. Losanoff JE, Richman BW, Jones JW. Disruption and infection of median sternotomy: a comprehensive review. *Eur J Cardiothorac Surg.* 2002;21(5):831-9.
2. Matros E, Aranki SF, Bayer LR, McGurk S, Neuwalder J, Orgill DP. Reduction in incidence of deep sternal wound infections: random or real? *J Thorac Cardiovasc Surg.* 2010;139(3):680-5.
3. Sarr MG, Gott VL, Townsend TR. Mediastinal infection after cardiac surgery. *Ann Thorac Surg.* 1984;38(4):415-23.
4. Schimmer C, Reents W, Berneder S, Eigel P, Sezer O, Scheld H, et al. Prevention of sternal dehiscence and infection in high-risk patients: a prospective randomized multicenter trial. *Ann Thorac Surg.* 2008;86(6):1897-904.
5. Vos RJ, Jongbloed L, Sonker U, Kloppenburg GTL. Titanium plate fixation versus conventional closure for sternal dehiscence after cardiac surgery. *Thorac Cardiovasc Surg.* 2017;65(4):338-42.
6. Bakri K, Mardini S, Evans KK, Carlsen BT, Arnold PG. Workhorse flaps in chest wall reconstruction: the pectoralis major, latissimus dorsi, and rectus abdominis flaps. *Semin Plast Surg.* 2011;25(1):43-54.
7. Losanoff JE, Richman BW, Jones JW. Disruption and infection of median sternotomy: a comprehensive review. *Eur J Cardiothorac Surg.* 2002;21(5):831-9.
8. Losanoff JE, Jones JW, Richman BW. Primary closure of median sternotomy: techniques and principles. *Cardiovasc Surg.* 2002; 10(2):102-10.
9. Song DH, Lohman RF, Renucci JD, Jeevanandam V, Raman J. Primary sternal plating in high-risk patients prevents mediastinitis. *Eur J Cardiothorac Surg.* 2004;26(2):367-72.
10. Claes L, Eckert-Hubner K, Augat P. The effect of mechanical stability on local vascularization and tissue differentiation in callus healing. *J Orthop Res.* 2002;20(5):1099-105.
11. Snyder CW, Graham LA, Byers RE, Holman WL. Primary sternal plating to prevent sternal wound complications after cardiac surgery: early experience and patterns of failure. *Interact Cardiovasc Thorac Surg.* 2009;9(5):763-6.
12. Voss B, Bauernschmitt R, Will A, Krane M, Kross R, Brockmann G, et al. Sternal reconstruction with titanium plates in complicated sternal dehiscence. *Eur J Cardiothorac Surg.* 2008;34(1):139-45.
13. Piwnica-Worms W, Azoury SC, Kozak G, Nathan S, Stranix JT, Colen D, et al. Flap reconstruction for deep sternal wound infections: factors influencing morbidity and mortality. *Ann Thorac Surg.* 2020;109(5):1584-90.
14. Knackstedt R, Raymond DP, Soltesz E, Gastman B. Experience with sternal plating and local flap reconstruction in patients with sternal dehiscence. *J Plast Reconstr Aesthet Surg.* 2019;72(8):1436-47.