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An Alternative Technique for Sternal Closurein A Patient with Severe Sternal Destruction

Medical Science

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ABSTRACT

Postoperative sternal dehiscence is a potentially catastrophic sequel of median sternotomy that can cause not only chest wall discomfort and pulmonary dysfunction but infection, both superficial and mediastinal. In this case report, we presented a 69-year-old patient who had recurrent sternal dehiscence and destruction after cardiac surgery. An alternative technique was performed to close the destructive sternum. It consists of wrapping wires twice around each rib head and placing standard circumferential wire sutures for sternal closure, thus providing full stability by decreasing the load on the sternum using only steel wires. The procedure was uneventful on two months follow-up, the anterior chest wall was stable.
We think that the use of this stabilization technique is an economical, easy, and efficient method of complete sternal closure in the presence of lower sternal destruction.

Introduction:
Median sternotomy is the most commonly performed procedure in cardiac surgery. Postoperative sternal dehiscence is one of the most important complications of median sternotomy which may cause pulmonary dysfunction and mediastinitis [1]. Multiple sternal fractures are an infrequent sequel of median sternotomy after cardiac surgery; however, its occurrence significantly increases morbidity and mortality rates. Traditional treatment involves aggressive debridement with use of pectoral muscle flaps or transposed omentum. However, this approach can lead to thoracic instability that necessitates prolonged mechanical ventilator support, extended hospital stays, and increased costs [2,3].

In this case report, we presented that patient with sternal destruction because of multiple sternal fracture and osteoporosis, which underwent an alternative technique to close sternum.

Case Presentation:
In February 2013, 69-year-old men underwent coronary artery bypass grafting (CABG) at our institution. The patient's left ventricular ejection fraction was 50%. He had non-insulin-dependent diabetes mellitus and chronic obstructive pulmonary disease (COPD). COPD was defined as forced expiratory volume, during the first second, of less than 80% of predictive value. In postoperative one week period, sternal dehiscence was detected. There was no mediastinal infection symptom in patient. The diagnosis of sternal dehiscence was made on the bases of clinical criteria, chest radiography (anteroposterior and lateral views), and microbiological investigation. The patient underwent sternal debridement and combined application of Robicsek procedure and thermoreactive nitinol clips (Figure 1). One more week after the rewiring procedure, sternal re-dehiscence detected again. Re-exploration was performed. The major pectoral muscle was detachment and elevated bilaterally, from its insertion along the medial aspects of the ribs to the midclavicular line. After performed lower sternal debridement because of multiple sternal fracture and osteoporosis, there was a very large but inevitable defect with a few sternal fragments in the ½ lower sternal areas. These fragments were resected. Upper segment of sternum was preserved and an alternative technique was performed sternal closure. 5 no stainless steel wires twice around bilateral each rib head and rotated around itself (Figure 2). Subsequently, sternum was closed by these rotated wires turned on each other mutually (Figure 3).

No cardiac compression was observed in operative and postoperative period. After the sternal fixation with this technique, sternal stability observed and in postoperative 2 months follow-up period, there were no procedure related squeal. No instances of recurrent sternal instability and dehiscence.

Discussion:
When bone quality is poor or there are multiple fractures of the sternum, traditional rewiring can fail and rigid fixation systems can be required for sternal reconstruction. New approaches to sternal reconstruction, derived from experience with orthopedic, plastic, and maxillofacial fixation systems, have recently been introduced. Sternal closure systems that consist of titanium reconstruction plates, cables, and screws perform transverse rib-to-rib stabilization, thereby extending the zone of fixation laterally-beyond the fractured sternum to the ribs, where the bone quality should be better [4,5].

In many cases, sternal instability or infection requires debridement of the sternum and concomitant pectoral muscle-flap reconstruction necessary [2,3,5]. If resection of the sternum is required, reconstruction can become problematical, because muscle flaps might not prevent paradoxical chest-wall movement. In this event, atelectasia might develop due to malfunctions in full inhalation and expiration, which could result in hypoxia or a decreased discharge of carbon dioxide. In this event, patients with underlying lung disease, especially COPD, might have to be placed on prolonged mechanical ventilator support [8].

Vural and associates [9] presented a similar stabilization technique in 23 patients with sternal dehiscence and/or inappropriate sternotomy and they suggest that this technique seems to be successful in achieving full stabilization even in infected and fragile sternal bony tissue.

Last of all, we believe that the most important factor to prevent respiratory and mediastinal complications is full stabilization of the sternal tissue. In this technique we use minimal foreign stabilization material, and providing full sternal stabilization. We

think that the use of this stabilization technique is an economical, easy, and efficient method of complete sternal closure in the presence of lower sternal destruction. heads: a novel technique for prevention and treatment of sternal dehiscence.'' Heart Surg Forum, 10(5):E397-400.



Figure 1: Anteroposterior chest radiography of combined application of Robicsek procedure and thermoreactive nitinol clips.

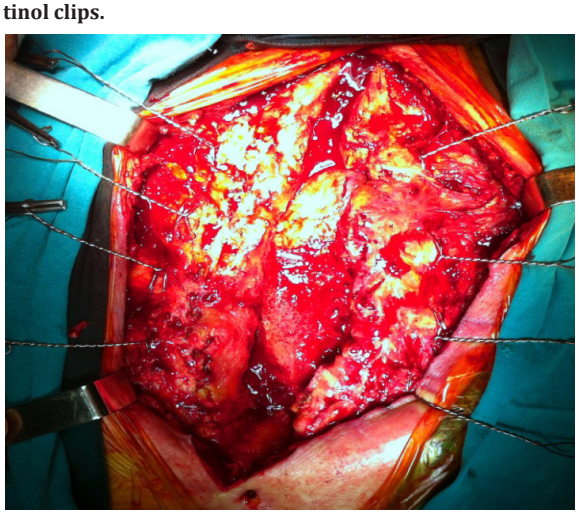


Figure 2: Intraoperative view of sternal destruction and stainless steel wires twice around bilateral each rib head and rotated around itself.

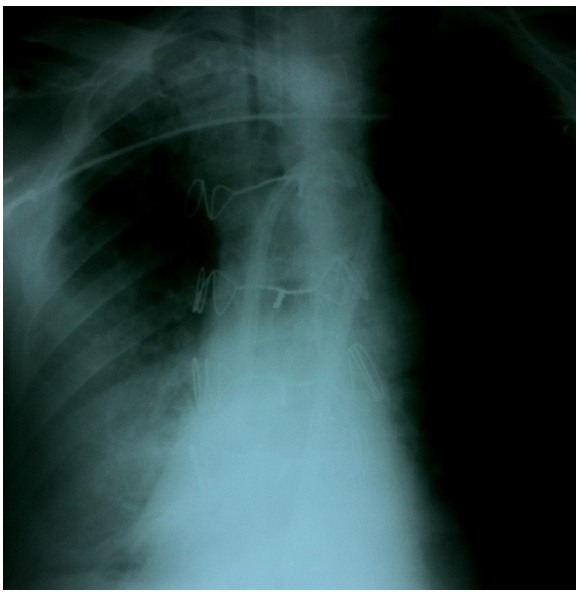


Figure 3: Anteroposterior chest radiography of closed sternum. Rotated wires turned on each other mutually.

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