

**Sternum Fracture Fixation With Volar Radius Plate: A Case Report**Şener Yıldırım<sup>1</sup>, Murat Korkmaz<sup>2</sup>, Mustafa Fatih Erkoç<sup>3</sup><sup>1</sup>Bozok University, Faculty Of Medicine, Thoracic Surgery Department, Yozgat, Turkey<sup>2</sup>Bozok University, Faculty Of Medicine, Ortopedia and Traumatology Department, Yozgat, Turkey<sup>3</sup>Bozok University, Faculty Of Medicine, Radiology Department, Yozgat, Turkey**\*Corresponding author**

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**Abstract:** Sternum fractures which is a condition seen by 3-8% after blunt thoracic trauma is a situation faced frequently, especially depending on seatbelt usage in traffic accidents. Stabilization is recommended to prevent complications that have high mortality rate like flail chest and cardiovascular injury in sternum fractures. Various materials have been used as a sternal fixation method until now. It was stated that sternum stabilization is provided very easily with using of very fine plaques in 1.5-2 mm. We aimed to present a male patient with flail chested that is 63, operated to prevent risk of cardiac trauma that will be able to develop depending on sternum fracture displaced structure developing at the end of tractor accident because of difference of instrument used in operation.

**Keywords:** internal fixators; sternum; thorax; injuries

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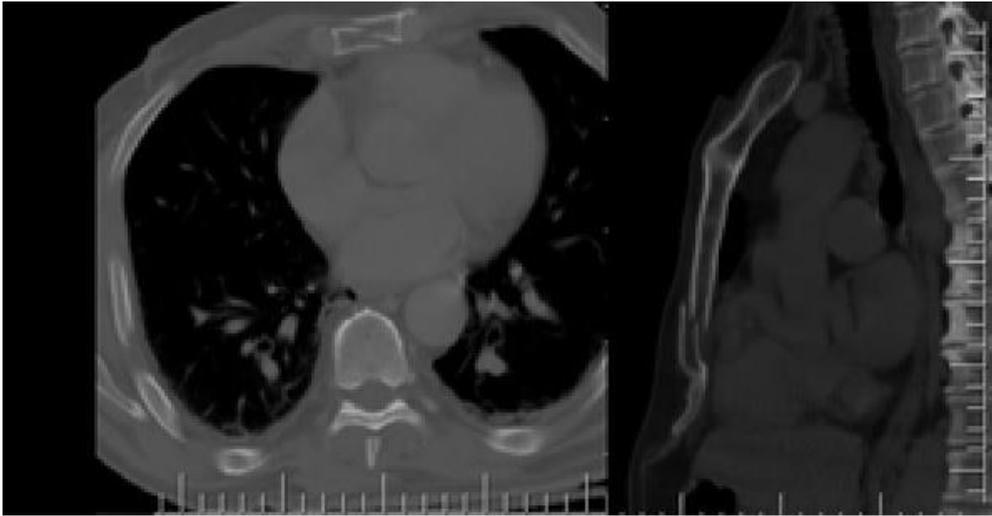
**INTRODUCTION:**

Sternum fracture has been monitored in 3-8% of the cases with blunt thoracic trauma. Traffic accidents are the most frequent trauma that causes thoracic trauma [1-2]. Especially depending on seatbelt usage, even if there was an increase in the incidence of sternum fracture, in case of putting no seatbelt it should not be forgotten that accident victim will get out of window and more serious injuries even death will develop. With sternum fracture, risk of injury varies between 18-62% [1-2]. Lateral thoracic graphy and Thorax CT (Computed Tomography) have the importance diagnostically. Especially thorax CT can show full localization of fracture line, sternum thickness, the relation with cardiovascular structures of fracture end in posterior completely and can also show pathologies like pericardial effusion and/or hematoma clearly [3]. Absolute stabilization is recommended to prevent possible complications after sternum fracture. We aimed to present a male patient with flail chested that is 63, operated to prevent risk of cardiac trauma that will be able to develop depending on sternum fracture displaced structure developing at the end of tractor accident because of difference of instrument used in operation.

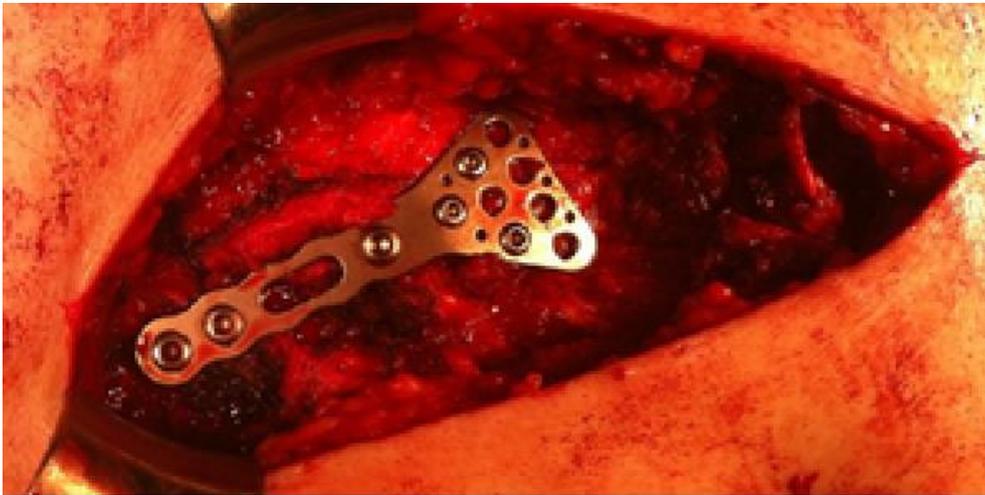
**CASE REPORT:**

The male patient who is 63 applied to emergency service of our faculty because of tractor

accident. In physical examination done in emergency service; the patient had common sensitivity on the front face of thorax and flail chest in right lateral of sternum. In bilateral chest radiography, multiple rib fractures on the right and fracture area that are displaced structure in the sternum corpus was monitored. Patient had no hemothorax and pneumothorax. In thorax CT, it was seen that posterior part of fracture in the posterior displaced toward mediastinum and risked cardiac and vascular structures. The patient was taken to the operation because of being flail chest and that sternum fracture in thorax CT creates cardiac complication risk (Figure 1). Distal radius plaque operation shaped like T was decided by making consultation with orthopedics because of having no appropriate plaque to detect fracture before operation. Sternum was separated from mediastinal structures with finger dissection from upper end of xiphoid by entering lower sternotomy incision that is approximately 8 cm. It was suspended with one number of vaginal ecarteur later on. The fracture was flipped from the front surface of sternum by using radius plaque with volar lock 5 numbers of screws with cortical lock (Figure 2). The patient whose flail chest disappeared also beginning from early post-op term and is mobile was discharged without any problem and no problem has been developed in clinical and radiological follow-ups (Figure 3).



**Fig-1:** The risk of perforation of heart in posterior of sternum fracture line was shown in post-operative CT imaging.



**Fig-2:** After sternum was elevated from posterior, fracture line was flipped by using radius plaque with volar lock and screw with unicortical lock.



**Fig- 3:** It was observed that the fracture in sternum was stable in control chest radiographies.

## DISCUSSION

Unseparated sternum fractures usually are treated with conservative therapy in isolated thorax traumas. In addition to this, cardiac and major vascular injuries and flail chest might occur in displaced types of fractures [4]. The complication seen in flail chest cases are deterioration of blood oxygenation, pneumonia, atelectasia and the need of mechanical ventilator treatment [5]. Early fracture fixations are recommended to these patients in terms of preventing complications. With the help of fixation, complications are prevented, the need of mechanical ventilation and recovery of fracture are provided and relieving pain completely is provided especially in severely painful cases. Thus, the patient has been achieved more relaxed respiratory physiology and duration of hospital stay has been shortened [6].

Various materials have been used as a sternal fixation method until now. It was stated that sternum stabilization is provided very easily with using of very fine plaques in 1.5-2 mm [7]. Later on, successful results were achieved by using plaques with fixed angle to develop for cervical bones and radius previously [8-9]. It was indicated that locked plaques were an important fixation method in terms of functional way by decreasing friction significantly between bone and plaque. It was stated that placing locked plaques like internal fixator on anterior sternal surface provided strong fixation of convex surface and prevented opening of fracture in case of traction with the help of this. It was stated that delay of recovery of bone depending on each respiratory movements was also prevented because inner cortex of sternum was fixed thanks to fixation [10].

In order to make plaque screw, the screws used are also required to have a feature of safe lock system. The number of screws that used can be increased or decreased depending on expanse of segments that is broken. Sometimes fixation-shaped bridge can also be done into the fractured in accordance with expanse of the fractured segment by using plaques that can cross over each of them. For that purpose it was stated that plaques designed as T or H can be used. Plaque with volar radius lock we used is completely anatomical locked plaque designed for treatment of distal radius fractures. The screw locations of plaque were designed to make maximum adhesion in distal radius area. While cortical locked proximal screws provide stabilization, it was designed to prevent soft tissue influence on dorsal surface. With the help of flexible anatomical structure of plaque, original anatomical geometry of patient bone can be done [11].

In surgical procedure thing to take into consideration not to injure mediastinal organs is that paying attention the screws used not to pass posterior of

sternum. For this purpose, both definite localization of adjacent bone and extra fractures structured bone can be revealed completely and thickness of sternum bone structure can be revealed clearly with tomographic examination in the pre-operative term. With the help of this, it was informed that, the screw that will be used was also determined before surgical operation [3]. We also determined the size of screws that we will use by adjusting tomographic examination, fracture line of localization and sternum thickness before surgery. In addition, we elevated sternum with a number of deep ecarteur by making dissection from lower xiphoid in terms of being more reliable method in our case.

As a result; although there have been various fixator models developed recent years in terms of sternal fixation, we wanted to emphasize that plaque with volar radius lock we used, can also be easily fixed in order to protect anterior mediastinal case by suspending sternum with an ecarteur in selected sternum fracture cases.

## REFERENCES:

1. Solak İ, Sözbilen M, Erhan Y, Solak A; Sternum Fraktürü Oluşumunda Emniyet Kemerinin Rolü [The role of the seatbelt in formation of the sternum fracture]. *Turkish journal of trauma emergency surgery* 1998; 4(2):108-10.
2. Metin B, Yıldırım Ş, Arıbaş OK; Trakeobronşial Yaralanmalar [Tracheobronchial Injuries]. *Türkiye Klinikleri. J Thor Surg-Special Topics*, 2015; 6(2): 10-5.
3. Restrepo CS, Martinez S, Lemos DF, Washington L, McAdams HP, Vargas D, *et al.*; Imaging Appearances of the Sternum and Sternoclavicular Joints. *RadioGraphics* 2009; 29(3):839-859.
4. Metin B, Kaya S, Tözüm H, Selvi F, Sarıçam M, Yılmaz YK; Bilateral Torakotomi ve İntratorasik Resüsitasyon uygulanan travma olgusu. [Bilateral Thoracotomy and Intrathoracic Resuscitation Performed in a Trauma Patient]. *Bozok Tıp Derg* 2012; 3: 51-54.
5. Engel C, Krieg JC, Madey SM, Long WB, Bottlang M; Operative chest wall fixation with osteosynthesis plates. *J Trauma* 2005; 58(1):181-86.
6. Granetzny A, Abd El-Aal M, Emam E, Shalaby A, Boseila A; Surgical versus conservative treatment of flail chest. Evaluation of the pulmonary status. *Interact Cardiovasc Thorac Surg* 2005; 4(6):583-7.
7. Schulz-Drost S, Mauerer A, Grupp S, Hennig FF, Blanke M; Surgical fixation of sternal fractures: locked plate fixation by low-profile

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- titanium plates-surgical safety through depth limited drilling. *Int Orthop* 2014; 38(1):133-9.
8. Ciriaco P, Casiraghi M, Negri G, Gioia G, Carretta A, Melloni G, *et al.*; Early surgical repair of isolated traumatic sternal fractures using a cervical plate system. *J Trauma* 2009; 66(2):462-4.
  9. Ergene G, Tulay CM, Anasız H; Sternal fixation with nonspecific plate. *Ann Thorac Cardiovasc Surg* 2012; 19(5):364-7.
  10. Schulz-Drost S, Opperl P, Grupp S, Grupp S, Schmitt S, Carbon RT, *et al.*; Surgical Fixation of Sternal Fractures: Preoperative Planning and a Safe Surgical Technique Using Locked Titanium Plates and Depth Limited Drilling. *J Vis Exp* 2015 ;( 95):e52124, doi: 10.3791/52124 (2015).
  11. Campbell DA; Open reduction and internal fixation of intra articular and unstable fractures of the distal radius using the AO distal radius plate. *J Hand Surg* 2000; 25(6):528-34.