Sternal Fixation with Nonspecific Plate

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Purpose: The aim of the present study was to fixate displaced sternum fractures with a nonspecific plate, without a sternotomy procedure.

Method: Between May 2010 and December 2011, 15 patients with sternal fractures were included in this study. We performed fixation for 8 of 15 sternal fracture patients. Posteroanterior and lateral chest x-rays and computed tomography were taken for diagnosis of sternal fractures. Our surgical indications were severe pain, dislocation-overlapping of sternal edges, and thoracic wall instability. Locked volar distal radius plates were used for the sternal fixation.

Results: After fixation of sternum with plate, the sternum was stable in all 8 patients. There were no complications intra- or postoperatively. Sternal union was observed for all. Pain relief was determined dramatically.

Conclusion: Locked volar distal radius plates can be used for displaced sternal fractures. It is an alternative and successful method for sternal fractures.

Keywords: sternal fracture, trauma, fixation of sternum

Introduction

Sternal fractures account for 0.45% to 4% of all the recorded admissions in emergency departments. 1,2) They are usually caused by car accident, fall or direct blunt chest trauma.

Diagnosis of sternal fractures is sometimes difficult for physicians in emergency conditions. Because a lateral, plain chest radiograph is not usually obtained during the initial trauma evaluation, chest computed tomography is an important diagnostic tool, and coexistence of other problems could be determined. 3) Myocardial and pulmonary contusion, cardiac rupture, pericardial tamponade, and pulmonary injury can be associated with sternal fractures. Also, unstable or compound fractures may cause disruption of chest wall stability or intractable pain.

The usual medical approach to sternal fractures is conservative treatment that includes analgesics, rest, and usage of a sternal corset. We think that surgical correction of sternal fractures should be made to prevent intractable and chronic pain, and instability and deformity of the thoracic wall. 4) There is no standard surgical technique to fix the sternum. We report fixation of sternum fractures with a different material, in eight patients.

Materials and Methods

Between May 2010 and December 2011, 15 patients with sternal fractures were included in this study who had severe traumas and admitted to our hospital. The mean age of patients was 38 years (range, 20–62 years). All of the patients were seen at the emergency room. 10 of them had additional systemic injuries, like brain contusion, intracranial hemorrhage, splenic rupture, liver and/or lung contusion, pneumothorax and/or hemothorax, flail chest, displaced extremity fractures. A plain chest radiograph and whole body computed tomography

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Table 1  Patients with sternal fixation

<table>
<thead>
<tr>
<th>Patients</th>
<th>Age</th>
<th>Location of fracture</th>
<th>Associated injuries</th>
<th>Hospitalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>Sternal corpus</td>
<td>None</td>
<td>3 days</td>
</tr>
<tr>
<td>2</td>
<td>41</td>
<td>Sternal corpus</td>
<td>None</td>
<td>3 days</td>
</tr>
<tr>
<td>3</td>
<td>31</td>
<td>Sternal corpus</td>
<td>None</td>
<td>3 days</td>
</tr>
<tr>
<td>4</td>
<td>62</td>
<td>Sternal corpus</td>
<td>Hemopneumothorax + rib fractures</td>
<td>9 days</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>Sternal corpus</td>
<td>Rib fractures</td>
<td>6 days</td>
</tr>
<tr>
<td>6</td>
<td>24</td>
<td>Sternal corpus</td>
<td>Pneumothorax + lung contusion</td>
<td>7 days</td>
</tr>
<tr>
<td>7</td>
<td>25</td>
<td>Sternal corpus</td>
<td>Lung contusion</td>
<td>4 days</td>
</tr>
<tr>
<td>8</td>
<td>47</td>
<td>Sternal corpus</td>
<td>Hemothorax</td>
<td>5 days</td>
</tr>
</tbody>
</table>

were taken for all patients. Only 5 of 15 patients had isolated sternal fractures. We performed fixation for 8 of 15 sternal fracture patients (Table 1). Three patients did not want to have a surgical procedure. Two patients died in the emergency room because of other severe, systemic injuries. Two patients were followed up with a non displaced sternal fracture. Our surgical indications were severe pain, dislocation-overlapping of sternal edges and thoracic wall instability (Fig. 1).

All patients were evaluated for cardiac injury, and nobody had this type of injury. Informed consent was obtained from each patient. The fixation procedure was made in the operating room and under general anesthesia. Surgeries were generally performed at 2nd day of trauma because of stabilisation of vital signs. Approximately 6–8 cm long longitudinal incision was performed for all patients. Level of the sternal fracture was determined on thorax tomography before the operation. By the help of this knowledge and palpation of the fracture site, incision was made at fracture level. Sternal fracture edges were brought side to side by clamps. It is not necessary to expose the entire sternum or to enter the anterior mediastinum. Locked volar distal radius plate was flattened by bender (Fig. 2). Sternal thickness was measured on computed tomography and screw length was chosen, according to the sternal thickness to prevent mediastinal penetration. Four or six locked screws were used for plate stabilisation. Duration time of operation was about 20 to 30 minutes. Patients were extubated postoperatively in the operation room and followed up in thoracic surgery service with posteroanterior and lateral chest X-ray (Fig. 3).

Results

After fixation of sternum with plate, sternum was stable for all of 8 patients. There were no complications intra- or postoperatively. Sternal union was observed for all. We used non-steroidal anti-inflammatory drugs for postoperative period. Pain relief was determined dramatically. Two patients who were followed for a non-displaced sternal fracture needed a narcotic analgesic (Tramadol HCl) for severe pain. The mean length of hospital stay was 5 days.

Discussion

Sternal fractures are common as a result of direct trauma to the sternum. We believe that sternal fractures must be evaluated carefully in emergency conditions, and displaced sternal fractures should be fixated to prevent chronic pain, and deformity of the chest and sternum. Displaced sternal fractures may cause some complications like ventilatory difficulties, intractable and chronic pain, instability and deformity of the thoracic wall, if unrecognised in the early period of chest trauma.4,5

Movement of displaced sternal fractures leads to pain with respiration. Patients with displaced sternal
endings almost always avoid deep breathing to prevent more pain, and this causes some pulmonary complications. Therefore, to minimize pain and prevent the development of pulmonary complications, our advice was to fix the displaced sternal fractures with a plating system during the early period of chest trauma.

Among the techniques suggested for closure of displaced sternal fractures are hyperextension of the thoracic spine, figure-of-eight periosteal wiring or suturing, and internal fixation using plates.6–10

Our current technique with locked volar distal radius plate is safe and very effective for fixation. Sternal plating with locked volar distal radius plate provides stable sternum with faster healing period and less pain. In addition, the incision is cosmetically acceptable. Sternal plating system does not need to enter the mediastinum, by this way major vascular structures would not be injured.3,4 Intrapleural chest tubes or mediastinal tubes would not be used, because of extrapleural fixation of sternum in this technique.

Although wiring technique with median sternotomy is less expensive than plating system, secondary sternal fractures or sternal nonunion can be seen because of the nonrigid nature of the wires. Sternal fixation using a plate minimizes these risks and the potential advantages are more cosmetically acceptable incision, more secure reduction, faster healing, and lower risk of nonunion.11,12

The optimal timing of sternal fixation is not certain, but we think that fixation in the early period of trauma prevents some pulmonary complications because of intractable pain. When the thoracic surgeon prefers to follow the patient who has displaced sternal fracture with medical treatment, it will be very difficult to correct and fix the sternum in the late period because of difficult reduction and local inflammatory response to trauma.

The SternaLock plating system is a good way to fix the sternum, as explained by Chou and colleagues5 but it can not be found in every hospital and emergency conditions. It is specific equipment for the sternum, but our locked volar radius plate system can be generally obtained at most hospitals, where orthopedic surgeries are performed. Because of this, it is very easy for multidisciplinary hospitals to get these plates.

In conclusion, our advice was to fixate the displaced sternal fracture, as were done in earlier studies. Volar distal radius plate usage is an alternative and successful method for sternal fractures.

Disclosure Statement

We have no financial or other interest in the manufacture or distribution of the device.

References