Parallel Plating for a Sternomanubrial Dislocation

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abstract

Sternomanubrial dislocations are rare injuries. Although few cases of this injury have been reported in the literature, the etiology has varied widely: trampoline injury, seizures, falls from height, sporting injuries, gradual deformities from spine fractures, and motor vehicle collisions. This injury has been classified into 2 types: in type I, the sternal body is displaced posteriorly to the manubrium, and in the more common type II, the sternal body is displaced anteriorly. The sternomanubrial joint is an amphiarthroidal joint that bears hyaline cartilage on both surfaces connected by a fibrocartilage meniscus. It serves a protective role to vital thoracic structures and is an anterior stabilizing strut to the thorax, assisting the thoracic spine in upright stability. It is important to not ignore type I dislocations because posterior sternum displacement is a harbinger of injury to the pulmonary tree, heart, and esophagus. Chronic instability at this joint can lead to dyspnea and dysphasia due to sternum displacement. In the right scenario, type II injuries are occasionally treated conservatively with palliative treatment until the sternum heals with malformation.

This article describes the case of a 20-year-old man who was treated surgically for symptomatic type II sternomanubrial dislocation with dual anterior locked plating. Locked plating gives the benefit of unicortical fixation, with the screws and plate acting as a unit to resist motion. Screw pullout and failure is less common, and the construct is more resistant for this application. The patient returned to full participation in activities of daily living and military duty 4 months postoperatively.
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This injury has been classified into 2 types: in type I, the sternal body is displaced posteriorly to the manubrium; in the more common type II, the sternal body is displaced anteriorly. The various etiologies for this injury coalesce to 2 mechanisms: direct compression across the anterior chest wall or a flexion–compression injury transmitting forces across the sternomanubrial joint. The sternomanubrial joint is an amphiarthroidal joint that bears hyaline cartilage on both surfaces connected by a fibrocartilage meniscus. It serves a protective role to vital thoracic structures and is an anterior stabilizing strut to the thorax, assisting the thoracic spine in upright stability. It is important to not ignore type I dislocations because posterior sternum displacement is a harbinger of injury to the pulmonary tree, heart, and esophagus. Chronic instability at this joint can lead to dyspnea and dysphasia due to sternum displacement. In the right scenarios, type II injuries have been treated conservatively with palliative treatment until the sternum heals with malformation. This article describes the case of a 20-year-old man with a symptomatic type II sternomanubrial dislocation who was treated operatively with dual anterior locked plating.

CASE REPORT

A 20-year-old man presented 4 weeks after a motor vehicle collision. He was an unrestrained back seat passenger and was seen and released from a trauma center the day of injury. The patient presented to the authors’ clinic 4 weeks later reporting anterior chest wall pain, shortness of breath with ambulation, and pain with swallowing. A lateral chest radiograph demonstrated a bony injury to the anterior chest wall, and a computed tomography scan of the chest revealed a type II sternomanubrial dislocation (Figure 1). The patient refused surgical fixation, but he returned to the clinic 1 week later due to worsening symptoms and underwent operative intervention.

A midline surgical incision was performed from the suprasternal notch toward the xiphoid process. The pectoral fascia and perios- teum were reflected laterally to reach the borders of the sternomanubrial junction. The patient had a significant amount of callus anteriorly that was excised to affect reduction. Using pointed reduction forceps and elevators as levers, the manubrium was elevated to the level of the sternum anteriorly.

While holding the manubrium in place, two 3.5 locking plates (Synthes, West Chester, Pennsylvania) were placed longitudinally parallel across the sternomanubrial joint. Screws were first placed unicortically in the manubrium in both plates, which allowed the distal section of the plates to maintain reduction as they rested against the sternum. With 2 screws in each plate of the manubrial side of the fixation, the authors obtained lateral fluoroscopic imaging to gauge the sternomanubrial reduction. This was helpful because removal of the callus from the anterior chest wall made direct visualization of the reduction less reliable. Screws were then placed on the sternal side of the construct. Fluoroscopy was used to help gauge reduction and screw placement. A postoperative computed tomography scan was obtained to evaluate reduction and screw length (Figure 2).

The authors allowed a rehabilitation protocol starting 2 weeks postoperatively, including shoulder range of motion exercises and shoulder girdles and trunk strengthening. The authors did not allow the patient to forcefully pull or push with his upper extremities beyond the plane of the thorax for the first 8 weeks postoperatively. The patient is now more than 18 months postoperative. He returned to full active military duty 4 months after fixation, at which point he was released to perform any activities, including weight training. His symptoms of pain with swallowing had resolved in postoperative week 1. Postoperative pain around the

Figure 1: Preoperative 3-dimensional and sagittal computed tomography images of the sternomanubrial type II dislocation.

Figure 2: Postoperative 3-dimensional and sagittal images of the sternomanubrial fixation.
pectoralis major origin along the sternum had resolved by 6-week follow-up.

**DISCUSSION**

Sternomanubrial joint dislocation is rare, with limited numbers of patients per series, and the majority are case reports.1-4 Type I dislocations have been described as dislocations of the manubrium anterior to the sternum, and the more common type II dislocations have been described as dislocations of the manubrium posterior to the sternum. The joint is amphiarthroidal and lined with hyaline cartilage and offers structural stability to the thorax.5-6 Watkins et al6 used cadaveric specimens to determine the contribution of the anterior sternomanubrial strut in the stability of the thorax. They reported that a disruption in the sternum decreased the stability of the thoracic spine by 42% in flexion and extension and 15% in axial translation. The stability provided by the anterior sternal strut should not be ignored and provides impetus for surgical stabilization in conjunction with potential impingement to the pulmonary tree and esophagus.

Few cases of nonoperative treatment for sternomanubrial dislocation injuries have been reported. In the physical therapy literature, Pidcoe and Burnet7 reported nonoperative rehabilitation with a return to sport in a gymnast with a type II sternomanubrial dislocation. The patient was a teenage girl who returned to pain-free, high-level athletics with monitored therapy. She underwent a regimented supervised rehabilitation and returned to competition 13 weeks after injury. She was in her early teenage years, with the capacity for healing and remodeling. The follow-up was short-term, and no long-term symptoms, examination, radiographs, or complications were mentioned. Cameron8 also reported a traumatic sternomanubrial dislocation in an adult who was followed without surgery. He reported callus formation on radiographs around the sternomanubrial joint and theorized that this added enough stability to the joint to allow a pain-free return to function. The callus formation added to the stabilization of the anterior sternomanubrial strut. However, the reporting period was short; therefore, the question of long-term sequelae in nonoperative treatment for a sternomanubrial dislocation remains.

In light of the cadaveric study by Watkins et al, re-concomitant injury to the sternum and thoracic spine offer an indication for operative treatment of the sternomanubrial joint. Stahlman et al9 reported a patient who went on to progressive kyphosis due to a thoracic burst fracture that eventually resulted in a symptomatic sternomanubrial dislocation. This underscores the importance of the sternum as an anterior support to the thoracic skeleton. Their recommendation was to surgically approach the spine and the sternomanubrial joint to stabilize both sides of the thoracic column.

In patients with associated symptoms from sternomanubrial joint dislocation due to impingement of the anterior chest organs or from the loss of anterior thoracic stability, surgical fixation is warranted. Several options exist for the operative treatment of the sternomanubrial joint. The first consideration is stabilization vs fusion. Fusion requires the preparation of both sides of the joint, reduction, bone grafting, and hardware. Stabilization requires reduction and hardware and is supported by eventual ligamentous and bony healing.

Hardware options range from wire fixation, standard plating, and locked plating.10 The use of wire fixation requires drill holes through the manubrium and sternum with cerclage of the wire. This fixation is at a disadvantage mechanically because it would not resist the most important component of motion—flexion and extension—for this injury. Standard plating would resist flexion and extension motion but also has disadvantages. The screws in standard plating require bicortical drilling, which can be risky in the anterior thorax. Each screw is susceptible to movement because standard hardware maintains its position by forces generated at the plate and screw–head junction. Movement can result in the screw loosening and hardware failure over time. Locked plating gives the benefit of unicortical fixation, with the screws and plate acting as a unit to resist movement. Screw pullout and failure is less common and the construct is more resistant for this application. In the current patient, dual plating helped control for potential rotation around a single line of fixation.

**CONCLUSION**

The current patient returned to all activities, including weightlifting without pain, by 4 months postoperatively. At last follow-up, radiographs showed callus formation along the left side of the sternomanubrial junction, with maintenance of reduction and no pain or dysphasia. Dual unicortical plating for symptomatic sternomanubrial dislocation appears to be an alternative treatment for sternomanubrial dislocation.

**REFERENCES**