

## Case Report

## Manubriosternal joint dislocation due to blunt force trauma

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## ARTICLE INFO

## Keywords:

Sternal fracture  
 Manubriosternal  
 Chest wall trauma  
 Sternomanubrial dislocation

## ABSTRACT

A 35-year-old woman was involved in a motor vehicle collision and suffered a manubriosternal joint dislocation with posterior subluxation of the manubrium. She underwent open reduction and internal fixation with sternal plate reconstruction. This report highlights the mechanism and management of these rare traumatic chest wall injuries.

## Introduction

Manubriosternal joint (MSJ) dislocation due to blunt force trauma is a rare injury that may result from rapid deceleration, chest trauma, cervical hyperextension, or hyperflexion of the head. Here we present the case of a 35-year-old woman who suffered a motor vehicle collision (MVC) related MSJ dislocation and review the mechanism and management of these injuries.

## Case Report

A 35-year-old woman presented to the emergency department following a MVC. The patient was a restrained front seat passenger in a head-on collision at 40 miles per hour with subsequent front and side airbag deployment. There was no loss of consciousness. Upon presentation she reported severe pain along the upper sternum and her examination was significant for a palpable bony step-off at the MSJ with no other abnormalities. She denied any prior medical or surgical history. Cardiac enzymes, 12-lead electrocardiogram, and transthoracic echocardiography were normal. Computed tomography (CT) of the chest revealed posterior subluxation of the manubrium at the MSJ and an anterior mediastinal hematoma (Fig. 1). Imaging was also significant for T6 and T7 vertebral fractures which were ultimately managed with external brace support alone. The patient suffered persistent, severe chest discomfort and surgical correction of the MSJ dislocation was offered.

General endotracheal anesthesia was utilized and she was positioned in supine fashion. A 5-cm longitudinal incision was made over the site of injury and the MSJ exposed. Penetrating towel clips were applied to the manubrium and elevated to manually reduce the dislocation. The costochondral attachments of the second rib at the MSJ were sharply resected as they were disrupted and non-viable. Two 8-hole Blu-SternaLock® (Biomet Microfixation, Jacksonville, Florida) straight fixation plates were applied longitudinally bridging the MSJ and secured with 14-mm screws. The procedure was tolerated well and the patient worked aggressively with physical and respiratory therapy during her recovery period. Post-operative pain on visual analogue scale was rated 2/10 which had improved from 9/10 pre-operatively. She was discharged on post-operative day 4 and continues to do well on 12-month follow-up.

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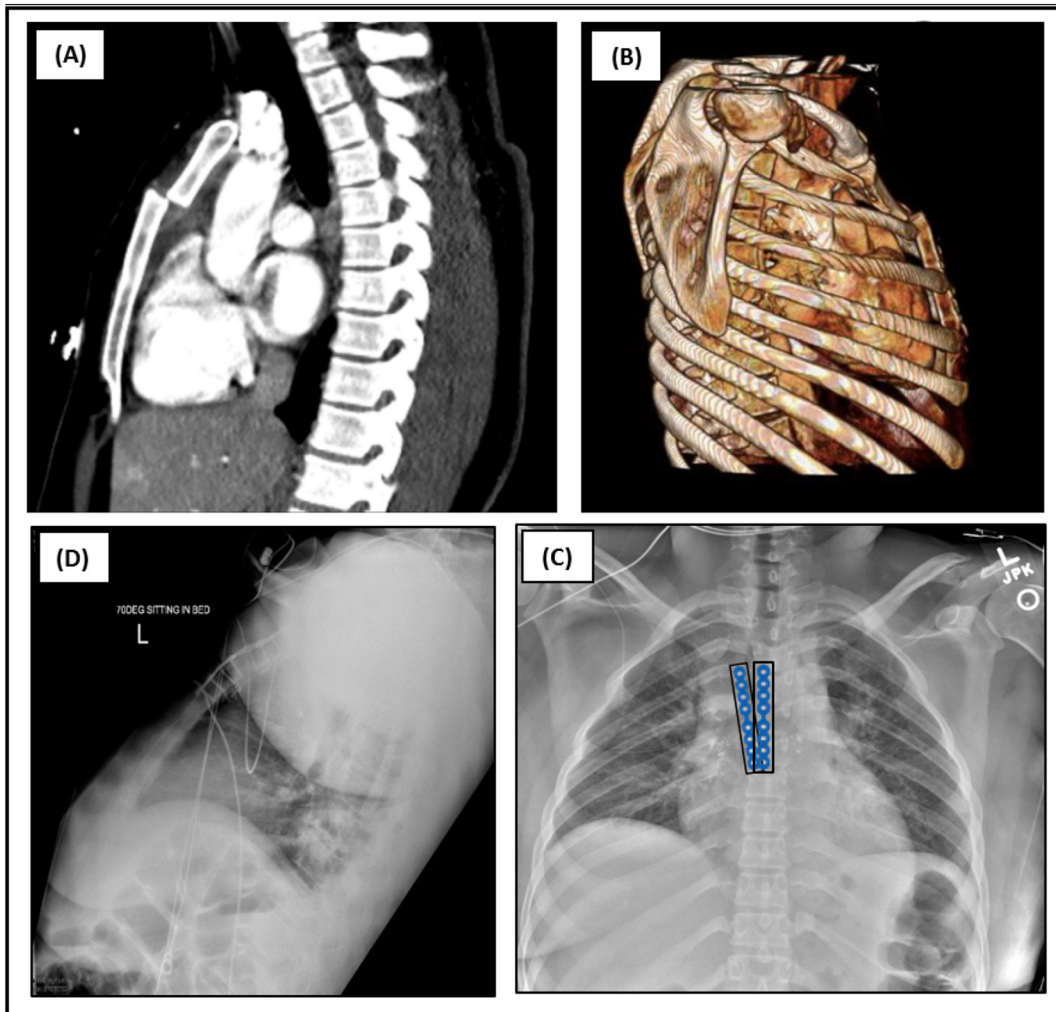
<https://doi.org/10.1016/j.tcr.2019.100187>

Accepted 25 March 2019

Available online 29 March 2019

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**Fig. 1.** (A) Pre-operative sagittal computed tomography of chest revealing posterior dislocation of the sternal body on the manubrium; (B) Pre-operative sagittal 3-D reconstruction of chest; (C) Post-operative chest roentgenogram with sternal fixation plates and screws (colored blue); (D) Post-operative lateral chest roentgenogram revealing stable sternum with fixation plate and screws. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

## Discussion

Dislocation of the MSJ is a rare entity and represents 1.3–3.0% of all traumatic injuries [1,2]. Associated risk-factors include female sex, advanced age, and seatbelt use. The low incidence of MSJ dislocation is attributed to the anatomical features of the sternal body in relation to the manubrium and second rib. The second ribs articulate at the MSJ forming a strong synchondrosis. The joint is further reinforced by sternocostal ligaments that provide a strong fibrous mesh conjoining the rib periosteum with the costal cartilages. Additionally, the elastic recoil of the thoracic cage augments blunt force compliance to further attenuate traumatic impact.

The pattern of MSJ dislocation is classified as either Type-I or Type-II (Fig. 2) based on the position of the sternum in relation to the manubrium on sagittal plane [3]. Type-I injuries include posterior dislocation of the sternum and often result from high-energy direct compression. Type-II injuries comprise posterior manubrial dislocation and are associated with indirect high-energy flexion-compression or rotational injury. An early report by de Tarnowsky explored the mechanism of Type-II injuries, postulating that ventral and upward pressure on the thoracic cage as well as a ‘wedging’ effect of the second costal cartilages resulted in separation of the manubrium from the sternal body [4]. A biomechanical study by Watkins et al. revealed thoracic spine stability to decrease by 42% in flexion-compression injuries, adding insight to the increased opportunity for MSJ subluxation in this circumstance [5]. It has also been observed that Type-II injuries are associated with other high blunt-force traumatic injuries such as first rib fracture and great vessel injury.

An appropriate history and physical exam will often reveal MSJ subluxation. Diagnosis is confirmed with lateral chest roentgenogram. If positive, computed tomography of the chest is indicated to evaluate for concomitant thoracic injury.

The optimal management of MSJ dislocation remains unresolved due to the small number of reported cases and lack of controlled

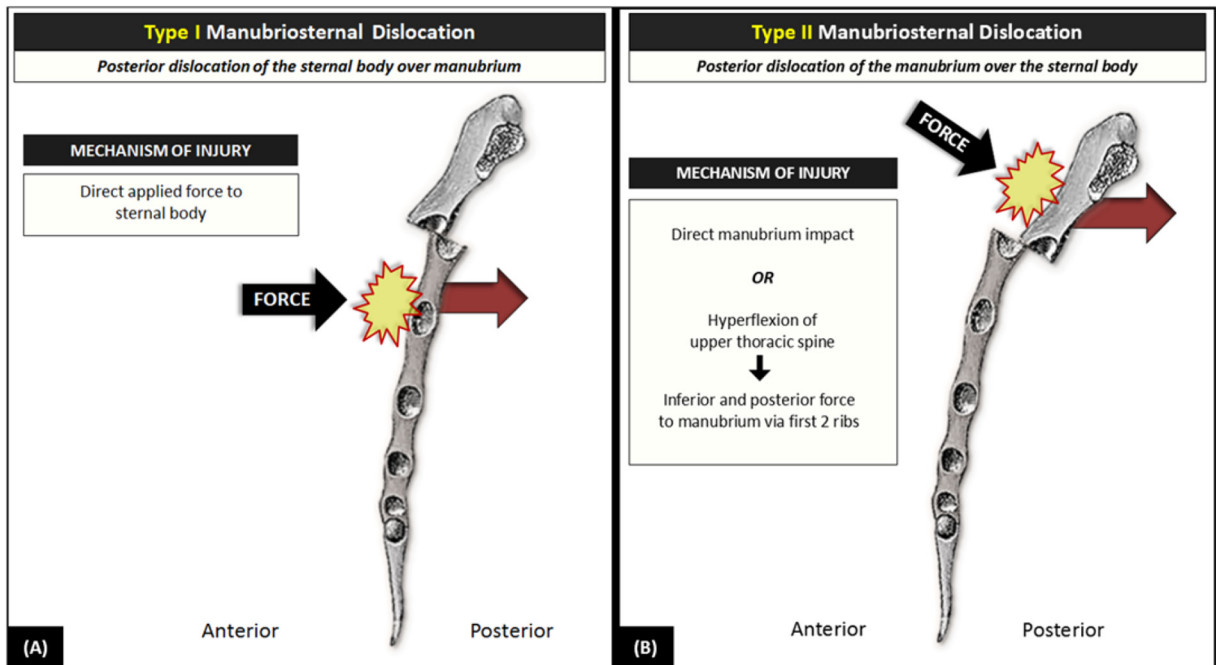


Fig. 2. Depiction of Type-I and Type-II MSJ dislocation injuries.

studies. Indications for operative intervention include intractable pain and impaired chest wall mechanical function. If untreated, these injuries may lead to periarticular calcification, ankylosis, chronic pain and structural deformity. Stabilization of the MSJ is readily accomplished with open reduction and internal fixation. This may be achieved by various fixation methods including wire cerclage, suture repair, plating, or alternative rigid fixation devices. Plating may provide enhanced SMJ rigidity while requiring less tissue dissection in comparison to wire fixation. In the presented case, dual plating provided excellent subluxation reduction and achieved early pain relief and durable repair.

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