Clavicle Fracture With Thoracic Penetration and Hemopneumothorax but Without Neurovascular Compromise

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abstract

Clavicle fractures are rarely associated with more severe neurologic or vascular injuries. When these associated injuries are encountered, prompt recognition and treatment are paramount to optimize outcome. The majority of fractures that result in neurovascular compromise are from high-energy trauma; however, a high index of suspicion should be present in all cases as low-energy trauma can also result in more catastrophic injury.

This article describes a case of a low-energy clavicle fracture in a 28-year-old woman that resulted in intrathoracic penetration of the fracture fragment with hemopneumothorax. The patient underwent successful chest tube placement and open reduction and internal fixation of the fracture. A multidisciplinary team was used during surgery, including cardiothoracic, trauma, and orthopedic surgery. Two years postoperatively, the patient was back to normal activities with no neurologic, pulmonary, or vascular sequelae. This case highlights the importance of a comprehensive physical examination and inspection of all radiographs so that associated injuries are not missed.

Figure: Initial AP radiograph of the left shoulder demonstrating an apparently mildly displaced mid-shaft clavicle fracture (A). Initial AP chest radiograph demonstrating subcutaneous air inferior to the lateral clavicle fragment (B).
Clavicle fractures are common injuries that usually occur secondary to direct trauma. Although isolated clavicle fractures are rarely associated with serious complications, patients who sustain high-energy injuries are at increased risk of associated injuries, such as neurovascular compromise.

Pneumothorax as a complication of an isolated clavicle fracture has only been reported 7 times in the literature. In each of these cases, the pneumothorax was treated by a thoracostomy, and the clavicle fracture was treated conservatively. A clavicle fracture with thoracic penetration was recently described in a patient following a high-energy motor vehicle collision. This patient had a neurologic deficit consistent with an injury to the posterior cord of the brachial plexus and was subsequently treated with thoracic chest tube insertion and open reduction internal fixation (ORIF) of the clavicle using an AO reconstruction plate.

This article describes the second case of an isolated clavicle fracture with thoracic penetration. Our case is unique in that it occurred after a low-energy fall and the patient sustained no neurovascular injury; however, the patient injured the lung parenchyma, resulting in a hemopneumothorax.

Case Report

A 28-year-old woman presented to the emergency department reporting left shoulder pain after a fall. She described tripping while chasing her daughter, falling down approximately 3 steps, and landing with her left shoulder impacting a pole. She reported no loss of consciousness, weakness, numbness, paresthesias, or shortness of breath. On initial triage, her vital signs were normal, with an oxygen saturation of 97%. On examination, the patient had a 2-cm abrasion over her left clavicle with mild ecchymosis, and the area was tender to palpation. However, she was neurologically intact distally. Her lungs were clear to auscultation bilaterally with no wheezes or crackles. The rest of her physical examination was within normal limits.

Radiographs of the chest and left shoulder demonstrated a displaced left clavicle fracture (Figure 1). On the chest radiograph, subcutaneous air was present, but no obvious pneumothorax was identified. Chest computed tomography (CT) demonstrated a left midshaft clavicular fracture with intrathoracic displacement of the medial fracture fragment and a left upper lobe pulmonary laceration with hemopneumothorax and pneumomediastinum (Figure 2). Computed tomography angiogram ruled out injury to the nearby great vessels.

Trauma surgery, orthopedic surgery, and thoracic surgery were subsequently consulted. Trauma surgery immediately placed a left chest tube for decompression of the hemopneumothorax. Orthopedic surgery and thoracic surgery proceeded emergently to the operating room for ORIF of the clavicle fracture. A standard incision was made parallel to the long axis of the clavicle. The dissection was carried down to the platysma and deep fascia, which were subsequently incised to reach the clavicle. Once the clavicle was visualized, it was apparent that the first rib was displaced and that the medial clavicular fragment was lying under the first rib. Using a bone hook to elevate the lateral fragment of the first rib, the clavicle was extracted from the lung parenchyma and then placed in a reduced position. The thoracic surgeons confirmed that the subclavian artery and vein were intact. The clavicle was then repaired with an 8-hole, precontoured clavicular plate (Accumed, Hillsboro, Oregon) (Figure 3A). The chest tube was removed 6 days after insertion with no subsequent pneumothorax.

Figure 1: Initial AP radiograph of the left shoulder demonstrating an apparently mildly displaced midshaft clavicle fracture (A). Initial AP chest radiograph demonstrating subcutaneous air inferior to the lateral clavicle fragment (B).

Figure 2: Axial CT scans of the chest demonstrating the medial clavicle fragment entering the lung parenchyma and lodged below the first rib (A-C).
At 8-month follow-up, the clavicle had healed completely, and the patient was relatively pain free. Approximately 2 years postoperatively, the patient returned reporting hardware prominence. The plate was removed without difficulty, and the clavicle demonstrated complete union (Figure 3B). At no time did the patient have any neurovascular symptoms.

**DISCUSSION**

Clavicle fractures are common, accounting for 2.6% to 4.0% of adult fractures.\(^6\) Nonunion and malunion with clinical deformity are the most common problems that can arise from this injury, but more significant complications have been reported. Neurovascular compromise with injury to the brachial plexus and/or major vessels has been seen with high-energy injuries, and clavicle fractures with an associated pneumothorax have also been reported. Nerve injury can result from a variety of mechanisms in this entity. Injury may occur from initial fracture displacement, from a hypertrophic malunion or nonunion (in nonoperative treatment), or from open reduction techniques.\(^10\)\(^-\)\(^13\) Brachial plexus palsy with entrapment of the medial cord has been reported and is secondary to compression by the first rib inferiorly and callus formation superiorly, and is likely to produce ulnar nerve symptoms. Rowe\(^14\) initially described neurologic sequelae in 0.3% of >600 fractures; however, recent studies report an incidence ranging from 20% to 47%.\(^11\)\(^,\)\(^15\)\(^,\)\(^16\)

Vascular injury, when encountered, typically involves the subclavian artery or vein. Injuries may range from laceration of the vessel to pseudoaneurysm or thrombus formation.\(^17\) One study has shown a 24% incidence of associated vascular injury when a first rib fracture is seen as a result of chest trauma.\(^18\) Pulse deficits, a widened mediastinum, expanding hematoma, brachial plexus injury, a posteriorly displaced first rib fracture, and subclavian groove fracture anteriorly may help to detect this complication. When clinical suspicion is present, angiography is paramount to prevent ischemic injury to the limb.

Few data exist regarding the association of clavicle fractures with pulmonary injuries. In a recent study, a 75% incidence of associated pulmonary injuries was found with open clavicle fractures.\(^19\) In closed fractures (as in this case), these associated injuries are less common (Rowe\(^14\) found a 3% incidence in his series); however, these injury patterns require a high index of suspicion to ensure timely detection. Therefore, after assessing the patient’s vital signs, a thorough physical examination must be performed. Special care must be used in evaluating lung sounds and distal neurovascular status. Chest radiographs are variably ordered when patients present with clavicle fractures. In trauma, routine chest radiographs are part of the initial imaging series; however, patients presenting with isolated injuries may not receive a standard chest film. Making a chest radiograph part of the standard imaging series in these patients may be necessary and warrants further investigation.

Even with careful attention to detail, these injuries can be missed. Our patient had a benign presentation. Specifically, she presented with a mildly displaced mid-shaft clavicle fracture after a low-energy fall. Her vital signs were stable, her breath sounds were equal bilaterally, and her distal neurological examination was intact. The only evidence that she had sustained a more significant injury was a few air bubbles surrounding the soft tissue around her fracture site. This was not seen on her original shoulder radiograph but was seen on subsequent chest radiographs, which otherwise did not demonstrate a pneumothorax. Finally, chest CT scan detailed the full spectrum of her injury, which included a first rib fracture, a clavicle fracture with intrathoracic displacement of the medial fracture fragment, and an upper lobe pulmonary laceration with hemopneumothorax and pneumomediastinum.

**CONCLUSION**

This case demonstrates the hypervigilance necessary in treating clavicle fractures. Although most clavicle fractures are relatively innocuous injuries, careful physical examination and meticulous inspection of radiographs is mandatory in all clavicle fractures. As evidence mounts recommending operative fixation of displaced clavicle fractures, it is imperative that the operating surgeon understand the spectrum of injury that can occur so that adequate planning is undertaken.\(^15\) Based on reports of serious consequences with resulting pulmonary and neurovascular injury with severely displaced fractures, routine chest radiographs should be taken and incorporated into the algorithm for patients presenting with this injury.
REFERENCES


