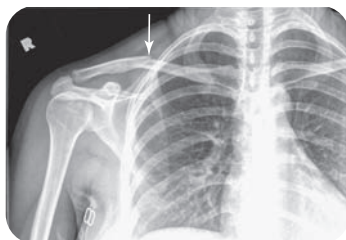


Clavicle Fractures

George M. Bridgeforth, Shane J. Nho, Rachel M. Frank, and Brian J. Cole



A 25-year-old woman who fell on her right arm complains of marked pain and soreness around her right collarbone.

Clinical Presentation

The clavicle is the only bony connection between the upper arm—shoulder and the thorax. It is the most frequently broken bone in the human body. The clavicle is divided into thirds. Fractures of the middle third are the most common, accounting for 80% of cases. Many of these fractures are caused by direct

blows or falls, including falls onto an outstretched hand. Fractures of the lateral third account for 15% of cases. Generally, these types of fractures are caused by a direct impact injury at the top of the shoulder (Fig. 31.1). Fractures of the medial third account for 5% of cases and are usually caused by direct chest trauma. Patients with clavicle fractures complain of marked pain, particularly with movement; swelling and bruising; and tenderness.

The clinician should evaluate clavicle fractures, especially those involving the medial and middle thirds, for any associated thoracic and cervical injuries. It is essential to treat any associated cervical injury as an unstable acute spinal cord injury until it is proven otherwise. Stabilization of the patient on a spine board and in a hard cervical collar is necessary until a cervical injury is excluded by radiographs and a computed tomography scan. Thorough examination of the patient's neurovascular status (associated compartment syndrome, cold cyanotic limb with decreased or absent pulses), with careful documentation, is necessary.

It is important to examine the acromioclavicular (AC) joint and the upper humerus for any evidence of associated swelling and ecchymosis. Lateral clavicular fractures may be associated with AC joint separations or upper humeral fractures. It is necessary to palpate the humeral head and neck (Fig. 31.2). In the AC joint, there may be a nondisplaced fracture, a grade 1 joint separation, or a step-off deformity with possible fracture displacement. In addition, the clinician should inspect the shoulder girdle for any acute dislocations. In addition, the clinician be on the alert for several associated conditions.

It is necessary to strongly consider a thorough chest examination with rib films if there is accompanying chest wall trauma. Radiographs show an effacement of the vascular tree. Sometimes with smaller pneumothoraces (<10%), the effacement may hide in the apical portions of the lungs. This is easy to miss (Fig. 31.3).

The examiner should also check for any focal chest wall tenderness associated with absent breath sounds (and hyperresonance to percussion), which is suspicious for an associated pneumothorax. Patients with an effusion have shortness of breath, dullness at the bases (if they are able to sit up), and absent

CLINICAL POINTS

- Most clavicle fractures affect the middle third of the bone.
- Fractures affecting the medial third of the bone may be associated with more serious thoracic injuries.
- Most of these fractures heal without serious sequelae; however, complications can occur.

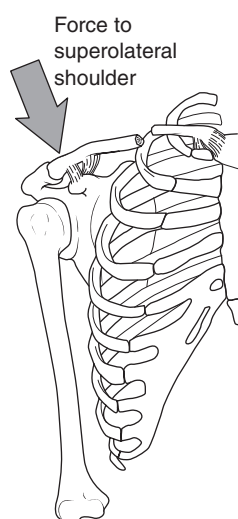


Figure 31.1 The most common mechanism of clavicle fracture is a fall on the superolateral shoulder. Since the sternoclavicular ligaments are extremely strong, the force exits the clavicle in the midshaft. (From Bucholz RW and Heckman JD. *Rockwood & Green's Fractures in Adults*. 5th ed. Philadelphia, PA: Lippincott, Williams & Wilkins, 2001.)

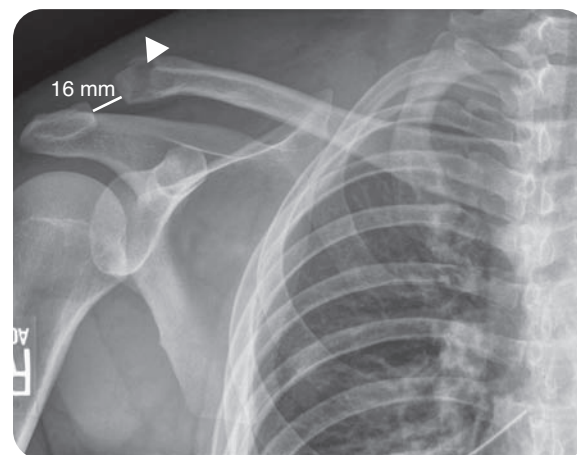


Figure 31.2 An anteroposterior radiograph of the right shoulder in a 30-year-old patient who was involved in a motorcycle collision, demonstrating an acute fracture through the distal third clavicle (arrow) and widening of the acromioclavicular joint by 16 mm.

breath sounds. Radiographs show blunting of the affected diaphragm(s). The normally sharp costophrenic angle is effaced with an effusion. A pneumothorax may occur with or without an associated chondral (rib) or clavicular fracture. A tension pneumothorax is rare, but it is characterized by an acute pneumothorax that is associated with tracheal deviation. The ruptured lung operates like a one-way valve. It allows air to accumulate in the pleural space (between the pleural lining and the collapsed lung) during inspiration. As the pressure in the pleural cavity increases, it can cause deviation of the trachea and move the cardiac structures to the opposite side. Decompression with chest tube placement must be performed immediately.

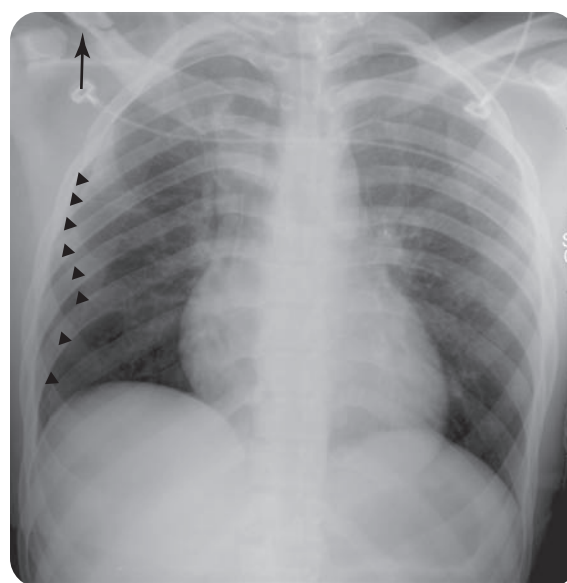


Figure 31.3 A portable chest radiograph in a trauma patient, demonstrating an acute right clavicle fracture (arrow) associated with a moderate-sized right pneumothorax (arrowheads). A computed tomography scan of the chest demonstrated nondisplaced fractures of the right ribs.

PATIENT ASSESSMENT

1. Pain, swelling, and tenderness at the fracture site (usually at the middle of the clavicle)
2. Possible clinical and radiological evidence of displacement
3. Limited range of motion



Although cardiac tamponade is a rare complication, the clinician should suspect it in any patient who presents with jugular venous distention, diminished heart sounds, and hypotension. An emergency pericardiocentesis is a life-saving procedure. Aortic injuries (transections) may cause a widening of the mediastinum on a posteroanterior (PA) or anteroposterior (AP) radiograph. Many of the radiographs taken in the emergency setting on unstable patients are portable AP projections that normally may show slight enlargement of the cardiac structures.

Radiographic Evaluation

The clinician should obtain standard radiographs of the shoulder and AP views of the clavicle in external and internal rotation. Clavicle fractures are usually evident on standard views. In addition, he or she may order optional radiographs, including

- “Y” view: recommended for suspected acute shoulder trauma. It substitutes for the lateral view and is very useful for detecting anterior (95% of cases) and posterior (<5% of cases) shoulder dislocations.
- Angled frontal view: not commonly used by primary care physicians. This projection is angled 15 degrees above the clavicle and is used to identify fractures of the middle third of the clavicle.

Displaced fractures of the middle third of the clavicle are usually characterized by a cephalic (“upward”) displacement of the proximal fragment. The distal fragment is pulled inferiorly by the unopposed pectoralis major and the weight of the arm. The pectoralis major attaches to the coracoid process.

The Neer classification is used to evaluate fractures of the distal third of the clavicle.

- Type I: nondisplaced fracture of the distal clavicle. The coracoacromial ligament and the coracoclavicular ligaments are attached. The coracoclavicular ligament is made up of the conoid ligament and the trapezoid ligament; both these ligaments prevent displacement of the clavicle (Fig. 31.4).
- Type II fracture: displaced fracture. The medially placed conoid ligament is torn, and there is an associated cephalic (upward) displacement of the proximal fractured segment. However, the distal segment (which includes an intact AC joint) remains anchored by the intact trapezoid ligament and intact coracoacromial ligament (Fig. 31.5).
- Type III: displaced fracture that extends to the AC joint. However, the supporting coracoacromial and coracoclavicular ligaments remain attached. In patients with serious impact injuries to the upper thoracic region, chest radiographs and rib films (of the affected area) should be obtained as well (Fig. 31.6).

NOT TO BE MISSED

- Associated shoulder fractures
- Shoulder contusions
- AC joint strains/separations
- Rotator cuff strains/tears
- Subacromial bursitis
- Associated cardiac and pulmonary injuries
- Associated cervical injuries, including C5 radiculopathies
- Brachial plexus injuries (uncommon)



Figure 31.4 Neer type I. Anteroposterior radiograph of the left clavicle, demonstrating an acute nondisplaced fracture of the distal third left clavicle.

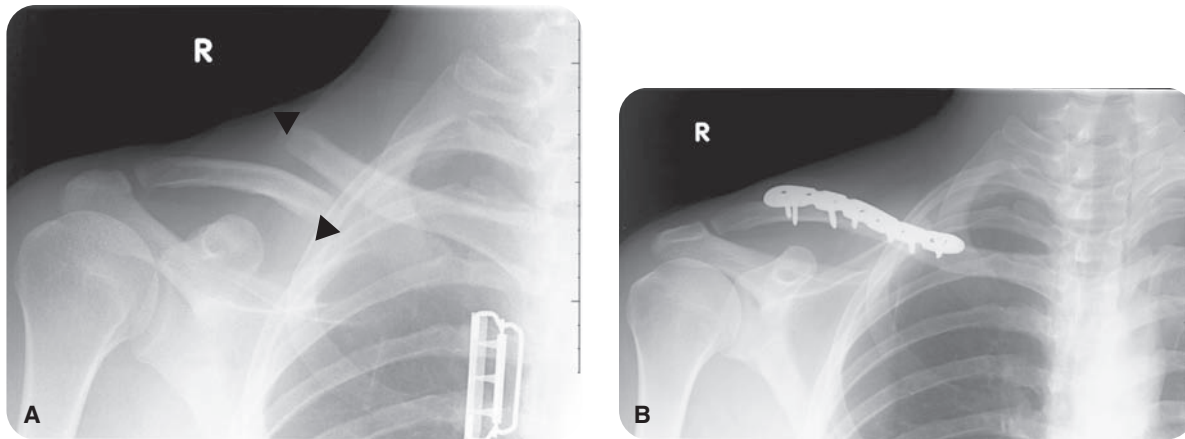


Figure 31.5 Neer type II. (A) Anteroposterior radiograph of the right clavicle, demonstrating an acute fracture of the middle of the clavicle with cephalad displacement of the proximal fracture fragment that overrides the distal fragment (arrows). However, the right acromioclavicular joint is intact. (B) A follow-up radiograph, demonstrating multiple fixation plates and screws from open reduction and internal fixation in the same patient.

Treatment

The course of treatment typically depends on the type of fracture, because some fractures have a much better chance of healing without surgery than others. Most minor nondisplaced fractures are treated conservatively. The large majority of fractures of the middle third of the clavicle can usually be treated with immobilization, either with a sling or with a figure-of-eight bandage. There has, however, been no determination that immobilization for pain relief only using anything other than a sling is necessary. However, nonsteroidal anti-inflammatory drugs (NSAIDs) and ice applications may be used to relieve pain and reduce swelling. Fractures of the proximal third of the clavicle can also be treated nonoperatively with a sling, especially if the fracture is nondisplaced. It should be noted that neonatal and pediatric clavicle fractures typically respond to conservative treatment within a few weeks.

However, recent studies have suggested improved clinical outcomes with open reduction internal fixation (ORIF) of clavicle fractures. Operative treatment indications had traditionally been reserved for cases of open fractures, tenting of the skin, neurovascular injury, floating shoulder, and polytrauma. In addition, despite the propensity to heal, many fractures unite in a significantly shortened position (i.e., more than 2 cm of shortening), which can lead to significant biomechanical abnormalities about the shoulder and scapula with associated pain and dysfunction. Thus, a decision to use ORIF may still be made for clavicle fractures that have a propensity to heal in an overlapping position. The current recommendations for displaced clavicle fractures with greater than 2 cm of shortening is operative management with ORIF; recent studies have reported improved functional outcomes and lower rates of malunion and nonunion with operative management. Treatment of fractures of the distal third depends on the specific nature of the fracture. Distal type I and type III (articular facing) fractures may need only nonoperative treatment with a sling and immobilization. Distal type II fractures, which are inherently unstable, typically require surgery.

Surgical options involve use of an intramedullary cannulated threaded screw or open reduction of the fracture followed by plate fixation with a compression or locking plate. Anatomically precontoured



Figure 31.6 Neer type III. Anteroposterior radiograph of the left shoulder, demonstrating a comminuted fracture of the distal left clavicle with extension to the acromioclavicular joint without significant displacement of the joint.

WHEN TO REFER

- Immediate referral is warranted for:
 - Patients with open fractures, displaced fractures, and complicated fractures
 - Cases involving serious chest injuries or neurovascular impairment

clavicle plates are available, and surgical use has have been successful. During surgery, the surgeon must pay special attention to important nerves (brachial plexus) and vessels (subclavian artery). In the postoperative setting, NSAIDs and ice may also be useful.

Suggested Readings

- Altamimi SA, McKee MD. Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. Surgical technique. *J Bone Joint Surg Am.* 2008;90(Suppl 2 Pt 1):1-8.
- Grassi FA, Tajana MS, D'Angelo F. Management of midclavicular fractures: comparison between nonoperative treatment and open intramedullary fixation in 80 patients. *J Trauma.* 2001;50(6):1096-1100.
- Jeray KJ. Acute midshaft clavicular fracture. *J Am Acad Orthop Surg.* 2007;15(4):239-248.
- Khan LA, Bradnock TJ, Scott C, Robinson CM. Fractures of the clavicle. *J Bone Joint Surg Am.* 2009;91(2):447-460.
- Low AK, Duckworth DG, Bokor DJ. Operative outcome of displaced medial-end clavicle fractures in adults. *J Shoulder Elbow Surg.* 2008;17(5):751-754.
- Pecci M, Kreher JB. Clavicle fractures. *Am Fam Physician.* 77(1):65-70.
- Postacchini F, Gumina S, DeSantis P, Albo F. Epidemiology of clavicle fractures. *J Shoulder Elbow Surg.* 2002;11(5):452-456.
- Pujalte G, Housner JA. Management of clavicle fractures. *Curr Sports Med Rep.* 20087(5):275-280.
- Robinson CM. Fractures of the clavicle in the adult: epidemiology and classification. *J Bone Joint Surg JBJS (Br).* 1998;80-B:476-484.

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