

## CLINICAL IMAGE

## RIGHT SHOULDER DEFORMITY: CLAVICLE FRACTURE

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A 16-year-old male presented to the emergency department for a chief complaint of right shoulder pain. He was riding a dirt bike prior to his arrival, when he hit a bump that caused the front wheel of his bike to go upward, resulting in the patient falling off his bike and landing on his upper back and right shoulder. He was wearing a helmet and denies head trauma, neck pain, back pain, abdominal discomfort, or other injury. His only complaint was pain in his right shoulder with associated decreased range of motion. On exam, deformity was noted to the right clavicular region with diffuse tenderness to palpation. There were no open wounds or skin tenting. He did have abrasions to the right upper, posterior shoulder. He denied paresthesias or weakness to his right upper extremity. He did not have any past medical problems or surgeries. Upper extremity pulses were 3+ bilaterally. An x-ray was obtained of the right shoulder, which showed the following (Figure 1).

## FIGURE 1:

Midshaft clavicle fracture.



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## QUESTIONS

**1. Which of the following physical exam findings signify need of emergent referral for a clavicular fracture?**

- Tenderness to palpation over the fracture site
- Numbness over the area of the arm supplied by the ulnar nerve
- Bruising over the fracture site
- Decreased range of motion

**Correct answer:**

*B. Numbness over the area of the arm supplied by the ulnar nerve*

Clavicle fractures typically present with tenderness to palpation, but this finding alone is not emergent.<sup>1,2,3</sup> The clavicle is in close proximity to neurovasculature, most prominently the brachial plexus.<sup>3,4</sup> Numbness or loss of motor function over the area supplied by the nerves of the brachial plexus, including musculocutaneous, axillary, median, radial, and ulnar nerves, suggests injury to these nerves and requires emergent referral.<sup>2,3,5</sup> Bruising and edema are typical physical exam findings and are not necessarily emergent; however, tenting of the skin should be observed for, as this would be an emergent finding.<sup>2,3,6</sup> Range of motion will likely be decreased secondary to pain, but this also does not signify an emergency.<sup>3</sup>

**2. Which of the following fracture characteristics would necessitate surgical treatment as opposed to conservative management?**

- Nondisplaced midshaft clavicle fracture
- Distal third clavicle fracture with intact acromioclavicular joint
- Proximal third clavicle fracture with no intrathoracic complications
- Midshaft clavicle fracture in a patient with decreased distal pulses

**Correct answer:**

*D. Midshaft clavicle fracture in a patient with decreased distal pulses*

Several characteristics make clavicle fractures surgical, including open fractures, high risk of nonunion, symptomatic nonunion and malunion, skin tenting, neuromuscular injury, floating shoulder, and multiple traumas.<sup>1,2,3,6</sup> Nondisplaced clavicle fractures, particularly those in the midshaft, are most commonly treated conservatively as long as the aforementioned findings are not present.<sup>1,2,3,6,8</sup> Distal third fractures are also managed conservatively if there is no joint involvement, displacement, or any of the aforementioned findings.<sup>2,6,7</sup> Proximal third fractures are managed conservatively.<sup>2,6,10</sup> Although midshaft clavicle fractures are most commonly treated

conservatively, neurovascular compromise, such as decreased distal pulses, makes them emergent.<sup>1,2,3,6</sup>

## DISCUSSION

Clavicular fractures are the most common fractures in children, making up 10% to 15% of childhood fractures and 2% to 5% of adult fractures.<sup>1,2,3</sup> These fractures demonstrate a bimodal age distribution, with the first peak being young adult males and the second peak being older adults.<sup>2,3</sup> The most common cause of a clavicle fracture is a fall directly onto the shoulder.<sup>1,2,3</sup> These fractures commonly occur in cyclists and in those who experience motor vehicle accidents.<sup>2</sup> The middle portion of the shaft of the clavicle is affected in 90% to 95% of pediatric fractures.<sup>2,3</sup>

The clavicle is a long bone connecting medially to the sternum and laterally to the acromion, thus making it the only bone with a connection to the trunk and the upper extremity.<sup>4,6</sup> The clavicle also has attachment sites for several muscles and ligaments, allowing it to play a critical role in range of motion of the upper extremity.<sup>4</sup> Because of the clavicle's muscular, bony, and ligamentous attachments, in addition to its close proximity to subclavian vessels and the brachial plexus, many possible complications can accompany clavicle fractures.<sup>2,4</sup> Because of this, it is important to recognize clavicle fractures and the presenting signs and symptoms that could make treatment emergent.<sup>2,3</sup>

Clavicle fractures can occur in the proximal, midshaft, or distal portion of the bone with the most common location being the midshaft.<sup>1,2,3</sup> This occurs due to the bone being thin in this area and not having muscular or ligamentous support.<sup>1,11</sup> Young patients will typically present with a history of a fall on the affected shoulder, with pain in the area of the fracture that worsens with movement of the affected arm.<sup>2,3,6</sup> On physical examination, a deformity may be appreciated, and in midshaft fractures such as this can manifest as the shoulder being depressed and uneven with the other side.<sup>2</sup> Range of motion of the affected shoulder will be decreased or unable to be assessed because of pain.<sup>3</sup> Other typical associated findings can include bruising, tenderness, and swelling over the fracture site.<sup>2</sup> Physical examination is critical in suspected clavicle fractures to assess for more emergent signs such as skin tenting and neurovascular compromise.<sup>1,2,3,12</sup> Skin tenting can be observed when a bone fragment tugs on the skin and stretches it.<sup>12</sup> This finding suggests angulation or displacement of the clavicle, which is a risk for an open fracture and may necessitate emergent surgery.<sup>2,3</sup> Another important component of the physical exam is assessing the neurovasculature.<sup>2,3</sup> The brachial plexus runs behind the clavicle, and function of these nerves should be assessed.<sup>2,3</sup> The subclavian vessels also run adjacent to the clavicle; therefore, pulses should be assessed as well.<sup>2,3</sup> Compromise of neurovasculature would necessitate an emergent referral.<sup>1,2,6,8</sup> Because the clavicle connects the upper extremity to the trunk, it is also necessary to assess nearby organs and bony attachments.<sup>2,4</sup> Concomitant scapular or rib fractures may be present, and due to the proximity of the lungs, it is important to assess for pneumothorax or hemothorax.<sup>2,4</sup>

Imaging can provide a definitive diagnosis of clavicular fracture.<sup>2,3</sup> First-line imaging consists of a plain film x-ray with two views: anteroposterior (AP) and 45-degree cephalic tilt.<sup>1,2,3,6</sup> The AP view

allows visualization of the whole clavicle, including its connections to the sternum and acromion.<sup>13</sup> The cephalic tilt view allows visualization of possible occult fracture.<sup>13</sup> In the case of shortening or suspected scapular fractures, AP views should be used.<sup>6</sup> To further assess joint involvement, particularly with proximal and distal fractures, a CT scan may be indicated.<sup>2</sup> A CT scan is also helpful in assessing displacement in midshaft clavicle fractures as well as shortening, nonunion, malunion, intra-articular involvement, and vascular injury.<sup>1,2,3</sup> MRI is not a commonly used imaging method for clavicle fractures; however, it can be used to further assess the brachial plexus, soft tissue, joints, and vasculature.<sup>14</sup> Once it has been determined that a fracture is present, it can be classified further based on location, displacement, and articular involvement in order to guide treatment.<sup>3</sup> The Allman classification considers middle third fractures to be Group I, distal third fractures to be Group II, and proximal third fractures to be Group III.<sup>6,7</sup>

## TREATMENT

Treatment of clavicle fractures is based on location, presence of displacement, fracture characteristics, and patient needs.<sup>2,6</sup> All fractures require orthopedic referrals, but knowing the fracture type will help determine the urgency of referral.<sup>2,6</sup> Midshaft clavicle fractures (Allman Group 1) are the most common type and are typically treated conservatively with a sling or Figure-of-8 splint.<sup>1,2,3,6,7,8</sup> Conservative treatment of midshaft clavicle fractures seems to have better outcomes if the fracture is nondisplaced.<sup>2,6,8</sup> Conservative treatment is still used in displaced midshaft clavicle fractures, particularly if shortening and displacement are less than 2 cm; however, the risk of nonunion and malunion is higher.<sup>2,3,6,8</sup> The risk of nonunion is also increased in smokers, females, patients of increased age, and in fractures with comminution and displacement.<sup>1,2</sup> Immobilization continues until union occurs, which can typically take up to 6 weeks in children and up to 12 weeks in adults.<sup>2,6</sup> Range of motion activities for the elbow are encouraged while the sling is in place.<sup>6</sup> Following union and removal of the sling, shoulder range of motion activities should be completed.<sup>6</sup> Operative management for midshaft clavicle fractures is indicated with open fractures, those with a higher risk of nonunion, symptomatic nonunion and malunion, skin tenting, neurovascular injury, floating shoulder, or multiple traumas.<sup>2,3,6</sup>

Distal third clavicle fractures (Allman Group 2) are typically treated with sling immobilization, especially if ligaments are intact and there is no displacement.<sup>2,6,7,9</sup> Figure-of-8 braces are not used, as they can further displace the fracture.<sup>2</sup> Conservative versus operative management is complicated by intra-articular fractures, coracoclavicular ligament involvement, AC joint involvement, and displacement.<sup>6</sup> Operative management is nearly always indicated for open and unstable fractures.<sup>9</sup>

Proximal third fractures (Allman Group 3) are not as common, thus limiting the ability for a treatment consensus, but they are typically managed conservatively.<sup>7,10</sup> Immobilization with a sling is ideal, and range of motion as tolerated is encouraged.<sup>6</sup> The worst complications of proximal fractures are most often due to associated injuries, including thoracic injuries, as proximal fractures typically involve significant trauma.<sup>2,6,10</sup>

The patient in this case presented with right shoulder discomfort and decreased range of motion without any neurovascular compromise, open wounds, or skin tenting. His initial imaging demonstrated a comminuted fracture at the middle third of the clavicle with elevation of the medial component and relation to the distal component by up to 2 cm with an interposed fracture fragment. The acromioclavicular joint was intact and there were no associated rib fractures. The patient underwent open reduction and with internal with internal fixation of the right clavicle with a plate and screws (Figure 2). He was placed in a sling and advised to follow up in 2 weeks. At his follow-up visit, his wound had healed and the sling was discontinued. He was allowed to initiate activity shoulder height and below and advised to return 2 weeks later.

#### FIGURE 2:

Post-surgical image.



Clavicle fractures are common findings in adults and children.<sup>1,2,3</sup> These are managed based on multiple characteristics, and it is important to discern emergent signs that necessitate the need for immediate surgical referral versus those that can be managed conservatively.<sup>2,3,6</sup> Conservatively managed clavicle fractures typically heal in up to 6 weeks in children and up to 12 weeks in adults.<sup>2,6</sup> Fractures managed conservatively are usually followed up shortly after the event and then every couple of weeks to assess progress and symptoms.<sup>6</sup> Once symptoms have resolved, range of motion and strengthening exercises are encouraged, with the option to do this under the care of a physical therapist.<sup>2,3,6</sup> Common complications to be aware of with conservative management are nonunion, malunion, and posttraumatic arthritis.<sup>2,6</sup> Patients should avoid contact sports until they can demonstrate full range of motion, strength, and lack of tenderness of the injured shoulder.<sup>6</sup>

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