Coracoid Process Fracture in a High School Football Player

Edwin E. Ryan, Jenna Doherty, and Lindsey Eberman

Abstract : We presented a unique case of a high school athlete who suffered from a coracoid process fracture following a collision with an opposing player. This fracture is commonly misdiagnosed as a clavicular fracture or AC joint sprain. Initial radiographic examination may fail to identify the fracture site. Understanding the clinical features of this injury is an important prerequisite to its overall management. Any misdiagnosis or alteration from the appropriate course of treatment can inhibit return to play and may be avoided by using indicated diagnostic evaluation tools.

Scapular fractures occur infrequently, as they only account for 1% of all fractures and fewer than 5% of shoulder girdle injuries (Cottalorda, Allard, Dutour, & Chavrier, 1996). In addition, coracoid process fractures occur significantly less, accounting for only 3 to 13% of all scapular fractures with the most common mechanism of injury for coracoid process fractures being a direct blow or a forceful muscular contraction causing an avulsion fracture (Cottalorda et al., 1996; Protass, Stampfli, & Osmer, 1974). Coracoid process fractures are frequently missed due to inadequate radiographic screening and the occult nature of this injury. It is therefore important that clinicians be knowledgeable concerning the clinical manifestations of a coracoid process fracture. Recognition, advanced medical referral and appropriate follow-up of this enigmatic injury may augment the efficacy of treatment and result in an expeditious return to sport and functionality. The unique case presented in this report emphasizes the importance of appropriate overall health care for coracoid process fractures, and provides advanced clinical insight and education for certified athletic trainers, athletic therapists, physical therapists and other sports medicine professionals.

The scapula is a flat, triangular-shaped bone on the posterior aspect of the thorax. Bony landmarks include the spine, the acromion process and the coracoid process (Arnheim & Prentice, 2000). The coracoid process projects anteriorly from the supero-lateral apex of the scapula (Arnheim & Prentice, 2000). Muscular attachment of the biceps brachii, coracobrachialis, and pectoralis minor occur at the coracoid process. In addition, ligamentous support is created through the attachment of the coracoacromial, coracohumeral and coracoclavicular ligaments (Arnheim & Prentice, 2000; Mahaffey & Smith 1999). The scapula is attached to the clavicle by the acromioclavicular and coracoclavicular ligaments and articulates with the humerus at the glenoid fossa (Arnheim & Prentice, 2000). The primary function of the scapula is to attach the upper extremity to the thorax and provide a stabilized platform for upper extremity movement (Arnheim & Prentice, 2000; Mahaffey & Smith, 1999). Forced shoulder adduction or elbow flexion exacerbates the pain of a scapular fracture (Cottalorda et al., 1996). Plain radiographs that show anterior posterior views of the scapular may fail to reveal the complete structure and may need to be supplemented with oblique angle views (Goldberg & Vicks, 1985).

The scapula is ossified at several locations (Cottalorda et al., 1996). From the fifteenth to the eighteenth month after birth, ossification takes place in the middle of the coracoid process, joining with the rest of the bone during adolescence around the fifteenth year (Cottalorda et al., 1996). Between age fourteen and twenty, ossification continues at the root of the coracoid process, base of the acromion, inferior angle, vertebral border, extremity of the acromion, and finally at the vertebral border (Cottalorda et al., 1996). Even though coracoid process fractures are uncommon, the late ossification of this structure may predispose adolescents involved in contact sports to fractures (Cottalorda et al., 1996; Protass, Stampfli, & Osmer, 1974).

Background

Case Presentation. A fifteen year-old male American football player suffered a fracture of his left coracoid process. The injury occurred during a football practice session and was observed by the supervising Certified Athletic Trainer. Direct trauma to the shoulder occurred with helmet contact under the front of the athlete's left shoulder pad. The athlete presented with a depressed shoulder posture toward the left shoulder. The athlete complained of a stabbing pain at the anterior-lateral aspect of his left shoulder. No obvious deformity was observed; however, slight swelling was present inferior to the acromioclavicular (AC) joint. Active range of motion (AROM) and passive range of motion (PROM) were decreased. Upon palpation the athlete reported point tenderness over the lateral one-third of the left clavicle and AC joint. The athlete reported numbness and tingling surrounding the left-elbow; however, dermatomes, myotomes, and deep tendon reflexes were intact. Further evaluation by the Certified Athletic Trainer was unwarranted, therefore the left shoulder was immobilized, ice was applied, and the athlete was referred to a physician for further evaluation. The Certified Athletic Trainer suspected a clavicle fracture and an AC joint sprain as possible differential diagnoses.

Evaluation. The athlete was transported to a walk-in clinic. Upon initial observation and further evaluations, the athlete was diagnosed with a shoulder dislocation or AC joint sprain. The physician administered a local anesthetic and performed passive shoulder range of motion tests in all planes, which demonstrated a significantly reduced range of motion. Radiographic examination (Figure 1) was ordered to allow for a skeletal view of the injured site. The physician finally diagnosed the athlete as having an AC joint sprain with a possible minor separation and concomitant contusion of the clavicle and acromion. The release orders prescribed ibuprofen for pain relief, immobilization via a sling at approximately 40 degrees abduction, and the application of ice 4 times per day.

The athlete's parent desired a second opinion and took the athlete to a local hospital, where the athlete was able to consult with an orthopedic physician. The athlete presented with slight erhythmia, edema, and point tenderness. The orthopedic physician diagnosed the athlete with a coracoid process fracture after evaluating the radiographic images (Figure 2). To further delineate the extent of the fracture, a computerized axial tomography (CAT) scan of the involved shoulder was ordered to confirm the findings. The physician reported a minimally displaced fracture of the left shoulder, with normal respiratory efforts, and good chest wall excursion. The neurological examination revealed intact motor and sensory distributions.

The CAT scan imaging was performed in the axial plane at 1-mm intervals with coronal and sagittal reformatted images. The CAT scan demonstrated a transverse fracture at the base of the coracoid process at the junction with the bony glenoid and scapula. The fracture was not comminuted but was displaced 7mm anteriorly and approximately 3mm medially. No other fractures were identified on the CAT scan, and there was no evidence of either AC joint or glenohumeral joint dislocations. A non-operative approach was suggested and passive range of motion exercises were prescribed once symptoms improved. The athlete was placed in a sling with the arm abducted at 40 degrees and was prescribed hydrocodone for pain control.

Clinical Course. The athlete returned to the physician five days following the coracoid process fracture diagnosis. Range of motion was limited to 90 degrees of abduction and flexion and 60 degrees of external rotation. The physician also prescribed pendulum exercises and stretching. Additional exercises consisting of passive and active-assisted range of motion were also prescribed. Isometric and isotonic stretching and strengthening techniques were demonstrated to the athlete and his parents as part of a home based preliminary rehabilitation program. In addition to a home exercise program, the athlete was also referred to a physical therapist.

Upon the sixteenth day following initial injury, the athlete was evaluated by the orthopedic physician and began physical therapy. The physician evaluation revealed no signs of erythema or edema, but continued point tenderness over the coracoid process. Manual muscle testing scored 4+/5 for shoulder flexion, abduction, external rotation, elbow flexion, and 5/5 for shoulder extension, adduction, internal rotation and elbow extension. Pain was experienced in external rotation. Radiographs at this time demonstrated maintained alignment of the minimally displaced coracoid fracture.

A conservative rehabilitation approach was implemented by the physical therapist. Exercises consisted of gentle stretching and range of motion exercises. In the early stages of physical therapy, the athlete exhibited hypomobility in inferior and posterior glenohumeral glides as well as decreased range of motion in shoulder flexion, abduction, and external rotation. Isotonic strengthening was employed in the side lying position with and without weights to improve strength and utilize the effects of gravity. These exercises consisted of mainly scapular stabilization exercises such as lower trapezius lift and external rotation exercises. T-Bar abduction and flexion was done to improve ROM along with wall walk exercises. Bicycle ergometer cycling was done to maintain a minimal level of aerobic fitness. Each visit concluded with a period of cryotherapy to assist with healing and swelling, and electrical stimulation also for healing and pain control.

One-month post-injury the patient had a marked decrease in pain and improved range of motion; however, he was still mildly point tender at the fracture site. X-rays displayed maintained alignment and a minimally displaced coracoid fracture. The athlete continued with physical therapy and progressed from gravity eliminated positions to gravity resistant shoulder exercises. Range of motion for shoulder flexion and abduction were still measured sub-normal, yet they were significantly improved. Inferior and posterior humeral glides were still hypomobile.

Approximately seven weeks after the fracture, the athlete demonstrated normal flexion and abduction in active and passive ranges of motion. Radiographic examination at this time showed a maintained alignment of minimally displaced coracoid fracture, but the fracture line was still visible. A fibrous union would eventually heal at the fracture site within one to two months.

At the conclusion to this evaluation, the athlete was two months into the course of rehabilitation and showed marked improvements. Both inferior and posterior humeral glides were within normal limits. Manual muscle testing revealed strength as 4/5 with slight pain for shoulder flexion, abduction and external rotation. Isotonic exercises included diagonal external rotation patterns and increased resistance for all exercises. Range of motion had increased and was now comparable to the opposite side with slight pain in both passive and active movements.

Methods

The investigators searched MEDLINE, SPORT Discus and Cambridge Scientific Abstracts (CSA) for scientific papers related to coracoid fractures. Key words used were fracture of the coracoid process, coracoid process fractures, and coracoid fractures in adolescents. The investigators used nine articles from the various databases. Information concerning the rehabilitation and evaluation was obtained from the attending physical therapist, physicians, and Certified Athletic Trainer.

Clinical Implications

In the best interest of the athlete, physicians, physical therapists, and Certified Athletic Trainers should be aware of coracoid process fractures. Indicating a coracoid process fracture as a possible differential diagnosis can initiate the appropriate course of care including the use of a CAT scan to make a definitive diagnosis. Any misdiagnosis or alteration from the appropriate course of treatment can inhibit return to play and may be avoided by using indicated diagnostic evaluation tools. When clinicians are cognizant of the most appropriate method of evaluation he/she can also raise important, respectful questions to the attending physician concerning appropriate evaluation procedures when a coracoid process fracture is a possible differential diagnosis.

Discussion

Coracoid process fractures are the most uncommon types of fractures that occur to the scapula and its occult nature may result in a missed diagnosis, which would delay the healing process and possibly result in further complications. (Blue, 1997; Cottalorda et al., 1996; Golberg, 1983; Haapamaki, 2004; Protass, 1975; Wilber, 1997). This type of fracture usually occurs from direct trauma such as in a vehicle accident or from violent contraction of the muscles attached to the bone, and may occur in isolation or in conjunction with other injuries (Cottalorda et al., 1996; Mahaffey & Smith, 1999; Protass, 1975). The researchers found only one other incident in which a coracoid process fracture was due to direct trauma during involvement in sporting activities. This occurred in a 15-year-old judo athlete who sustained the injury after a direct fall on the right shoulder (Cottalorda et al., 1996). Before closure of the epiphyseal plate of the coracoid process, the coracoclavicular ligaments are stronger than the epiphyseal plate. As a result, an injury that may result in ligament disruption in an adult may only injure the epiphyseal plate in a younger person (Cottalorda et al., 1996).

The uniqueness and infrequency of a coracoid fracture may indicate a lack of knowledge regarding the differential diagnosis of this injury. Standard anterior-posterior X-rays of the shoulder complex can sometimes give good views of the coracoid process and allow for proper diagnosis, as in our case. However, this is not always true due to the conspicuous anterior projection of the coracoid process over the acromion (Cottalorda et al., 1996). Some authors contend that the axillay view is essential for the fracture of a coracoid process to be visible (Blue, 1997; Cottalorda et al., 1996; Golberg, 1983; Haapamaki, 2004; Wilber, 1997). However, the patient’s pain usually prohibits abduction at the time of the initial evaluation (Cottalorda et al., 1996; Golberg, 1983; Harris, 1998). Researchers have argued (Goldberg & Vicks, 1983) that the coracoid process may be difficult to visualize even with axillary views due to its shortened projection and have suggested a 20-degree posterior oblique film 20 degrees toward the coracoid’s anterior section when other views are inconclusive.

The researchers found that scapular fractures in general are usually occult with 98% of all scapular fractures (Harris & Harris, 1988) resulting in associated injuries with hemopneumothorax and ipsilateral rib fracture being the most common (Harris & Harris, 1988). In a review of 100 consecutive scapular fractures, only fifty-seven were identified on the initial radiographs (Harris & Harris, 1988). Clinicians are encouraged to be both familiar with the symptoms of all scapular fractures in order to make the appropriate differential diagnosis and appropriate referral. This knowledge will also be of benefit in selecting the most effective rehabilitation plan to increase the likelihood of the individual's return to full function.

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Figure 1. Anterior-posterior radiograph showing the coracoid fracture site taken at initial evaluation.

Figure 2. Anterior-posterior radiograph showing the coracoid fracture site taken during the follow-up evaluation.