Fracture of the First Rib in a Collegiate Soccer Player

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This paper discusses the case of an 18-year-old collegiate soccer player who developed right shoulder and scapular pain following a preseason practice session. Initial evaluation revealed tenderness of the right trapezius muscle but no swelling, deformity, loss of range of motion, or neurological signs. Subsequent radiographic examination revealed a fracture of the first rib. Although uncommon in sports, a nontraumatic fracture of the first rib may result from a sudden violent contraction of the scalenus anterior muscle. Symptoms of a first rib fracture include an acute, knifelike pain in the anterior neck, a dull ache in the shoulder or scapular region, a "snapping" sensation in the shoulder, and possible neurological symptoms due to involvement of the brachial plexus. Proper care includes application of ice, use of a sling for immobilization, and careful attention to the possibility of complications. Rehabilitation consists of a gradual range of motion and strengthening program.

An 18-year-old collegiate soccer player with no prior history of shoulder or thoracic injury sought treatment in the training room following a late afternoon preseason practice session. The player reported that during the practice session he had experienced an increasing level of pain in his right shoulder and upper back area. He denied being struck in this area, falling on his shoulder, colliding with a teammate, or falling on an outstretched hand during the practice session, which included intense conditioning drills and a small-sided scrimmage. Physical examination revealed no apparent swelling or deformity in the upper portion of the right shoulder and back. No contusions or evidence of trauma to the right shoulder area was seen. The athlete's right trapezius muscle, near the medial scapular border, was tender to palpation. Pain in the upper back area increased with movement of the right arm.

Full range of motion of the upper extremities was present and normal levels of strength were found upon manual examination. The athlete noted some discomfort upon elevation, abduction, and horizontal flexion of the right arm. No neurological signs or symptoms were found. The athlete did not complain.

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of anterior chest pain and was not tender to palpation of the humeral head, acromion or coracoid processes, clavicle, sternum, or scapula. Palpation of the cervical spine area did not reveal any point tenderness, and neck motion was full and pain-free. The examining athletic trainer initially suspected a strain of the right trapezius muscle. The athlete was treated with ice and ibuprofen and instructed to return for reexamination the following morning.

The athlete returned the next morning complaining of increased pain during the night and an inability to lie on his right side while sleeping. He also stated that he was now experiencing transient numbness and a tingling feeling down his right arm, which he vaguely recalled feeling briefly during the previous afternoon’s training session. The athlete’s grip strength was noticeably decreased and his arm motion remained full but painful. His reflexes and sensation level tested normal. The athlete was referred to the health center for examination by the team physician. Subsequent radiographic examination revealed a fracture of the right first rib (Figure 1). The athlete was placed in a sling for 4 weeks. Ice and ibuprofen were advised for pain relief.

At 2 weeks postinjury the athlete was pain-free and began limited range of motion exercises consisting of humeral abduction/adduction, flexion/extension, and pendular movements. Exercise sessions were preceded by application of a hydrocollator (moist heat) pack for 20 min and gentle active stretching of the upper extremities and back. The athlete was instructed to end each session with

Figure 1 — Radiograph showing fracture of first rib.
a 15-min ice application, to keep his arm in the sling when moving about and attending class, and to avoid lifting.

By the 3rd week the athlete had gradually progressed into full, pain-free range of motion and light resistive exercises. He was encouraged to use the Stairmaster and Fitron to maintain cardiovascular conditioning until he could jog or run without pain in the right shoulder area. The athlete was withheld from practice until each of the criteria for return had been met, including full pain-free range of motion, no neurological signs or symptoms, normal bilateral upper extremity strength, and the ability to complete functional drills without pain or hesitation. The soccer player had a successful return to practice following the 4th week and experienced only occasional right shoulder pain and symptoms of brachial plexus irritation during the remainder of the season.

Discussion

The first rib is well protected by the muscles and surrounding bones of the shoulder girdle and, hence, is more commonly fractured by indirect trauma (4). The mechanisms of indirect trauma can include falling on an outstretched arm, hyperabduction of the arm, anteroposterior compression (as when a player falls on another player), a blow to the shoulder, or a powerful twisting or hyperextension of the cervical region (2, 3). Generally the person feels a “snap” in the shoulder and a rapid onset of pain. The pain is commonly located diffusely behind the clavicle or shoulder region or under the scapula. Because of this, an injury to the shoulder may be mistakenly considered.

Several cases of first rib fractures of unknown or nontraumatic etiology have been reported in the literature. Lorentzen and Movin reported that between 1966 and 1970 at the Frederiksberg Hospital in Copenhagen, Denmark, 8 of 15 patients diagnosed as having a first rib fracture had no history of trauma, and their fractures were discovered by routine chest films (5). All 8 patients did have occupations that exposed them to daily stress on the shoulder girdle. Bailey reported the case of a surfer who was seen in the emergency room with the complaint of left shoulder pain that had begun while he was doing a “lay back” maneuver (reaching back into the water with the hand) while surfing (1). Apparently the mechanism was an extreme hyperabduction of the arm. Barrett reported that coughing, sneezing, tennis playing, and baseball pitching may also result in indirect fracture of the first rib (2).

An examination of the anatomical positioning of the first rib has led several authors to conclude that a nontraumatic first rib fracture may be due to a sudden violent contraction of the scalenus anterior muscle (1, 2, 4, 5). The first rib is relatively rigidly attached posteriorly to the first thoracic vertebra and anteriorly to the sternum. The scalenus anterior, which originates on the cervical vertebrae and inserts on the scalene tubercle of the cephalad surface of the first rib, exerts an upward pull, while the scalenus medius and first slip of the serratus anterior insert on the posterior third of the rib, with the serratus anterior exerting a downward pull on the rib (1). If the arm is pulled into traction, as with hyperabduction, or if the head is thrown backwards or sideways violently, the scalenus anterior and the serratus will exert opposite traction forces on the first rib on each side of the subclavian sulcus. The resulting fracture generally occurs at the
weakest area of the rib, the subclavian sulcus, a shallow depression near which lies the subclavian artery and vein (2).

Knowledge of the structures surrounding the first rib, the subclavian artery and vein, the brachial plexus, and the apex of the lung increases awareness of the potential for severe complications resulting from a fracture. Fortunately, serious complications such as neurovascular compromise are rare (2, 5). Complications of acute fracture of the first rib reported in the literature include rupture of the apex of the lung, emphysema, pleurisy, aortic arch aneurysm, tracheoesophageal fistula, brachial plexus injury, Horner’s syndrome, ruptured subclavian artery, and abscess formation above or below the clavicle (2). Because the potential for serious complications does exist, however, diagnosis and proper treatment are essential.

Summary
Thoracic pain in the athlete may be caused by a variety of sources, including injury to the spine, ribs, sternum, or shoulder or a cardiac or visceral problem. The initial examination should include a thorough inspection, including observation for deformity and swelling, and palpation of the bony structures. Posture should be observed and an accurate history recorded. Physical examination should include strength, range of motion, and neurological testing. The lungs should be listened to with a stethoscope. The cervical spine should be considered in the examination. Direct and indirect mechanisms should be considered. Fortunately, most rib injuries in sports are minor (3).

The typical signs and symptoms of a first rib fracture include an acute, knifelike pain sensation in the anterior neck region of the scalenus anterior muscle or a gradually increasing dull ache in the shoulder or scapular region, a ‘‘snapping’’ sensation in the shoulder, and possible neurological symptoms down the arm due to brachial plexus involvement (2, 5). Proper care includes application of a sling for immobilization of the arm, application of ice, and referral to a physician for radiographic examination and diagnosis. The rehabilitation process involves a gradual program of range of motion and strengthening exercises, with return to activity dependent upon resolution of all symptoms, the return of pain-free functional activity, and a follow-up X ray to confirm fracture healing.

References