

[Primary Care]

First-Rib Stress Fracture in a High-School Lacrosse Player: A Case Report and Short Clinical Review

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A 14-year-old right-hand dominant female lacrosse player presented with a complaint of right shoulder and upper posterior thorax pain of 8 days' duration. She had been playing lacrosse at the attack wing and midfielder positions and experienced insidious pain after a game. She had no history of trauma to that shoulder during that game and had not experienced an injury in the past. Six days after the pain developed, she woke up one night with a sudden increase in the pain, which brought her to tears and caused slight difficulty with breathing. The pain was located anteriorly just lateral to the right sternoclavicular joint and posteriorly in the paraspinal muscles in the upper thoracic region. Physical examination suggested a first-rib stress fracture, which was subsequently confirmed by chest and shoulder radiographs.

Keywords: rib; stress fracture; lacrosse; chest pain; shoulder

Stress fractures are a common injury in active and athletic individuals, accounting for 0.7% to 20% of injuries seen at sports medicine clinics.⁹ Most stress fractures occur in the lower extremity, with the tibia, metatarsals, and fibula being the most common sites.⁹ Stress fractures of the upper extremity and torso are relatively rare; isolated fracture of the ribs are even more uncommon.^{5,12,23}

Middle-rib stress fractures occur in competitive rowers,^{4,10,14,16,35} golfers,^{11,19,29} gymnasts,²⁸ and swimmers³² primarily because of the opposing muscular forces of the serratus anterior and external oblique muscles. Stress fractures in the floating ribs (XI and XII) occur in baseball players as a consequence of opposing latissimus dorsi and external oblique muscle forces.³⁴

Stress fractures of the first rib have occurred in baseball,^{8,13,18} basketball,²⁴ tennis,³³ weightlifting,²¹ gymnastics,³² and ballet.⁵ The current report is, to our knowledge, the first documentation of a stress fracture of the first rib in a lacrosse player.

CASE REPORT

Eight days before presentation, a 14-year-old right-hand-dominant female lacrosse attack wing and midfielder experienced insidious right shoulder pain. Six days after her pain began, she awoke with a sudden increase in pain that brought her to tears and caused slight difficulty with breathing. The pain was anterior in the right

sternoclavicular joint and posterior in the paraspinal muscles in the upper thoracic region. Two days later, she presented with resolution of her shortness of breath but with continuing pain, mainly in the right periscapular region. The pain level was 0 of 10 at rest and 8 of 10 with forward flexion or abduction of the right arm above 90°. The pain was relieved by 200 mg of ibuprofen, 2 to 3 times per day. She reported no trauma to the right shoulder and was otherwise healthy. There had been no changes in her lacrosse practice routine, and she had not been shooting any more than usual during lacrosse practice before the onset of pain. As a freshman, she was one of the youngest players on the varsity team, but her training schedule was identical to that of her teammates, with practices or games 5 to 6 days per week. She reported normal menstrual cycles and eating habits, rendering the female athlete triad unlikely.

On physical examination, no deformity, atrophy, or traumatic injury was apparent. She had full range of motion of her neck and was neurologically intact for sensation and motor testing of all upper extremity peripheral nerves. Results of her shoulder examination were normal. She was tender to palpation in the right anterior cervical triangle just above the clavicle but not at the sternoclavicular joint. She also had mild tenderness to palpation of the anterior chest wall just inferior to the midclavicle on the right side. Radiographs of the right shoulder showed an acute first-rib fracture (Figure 1).

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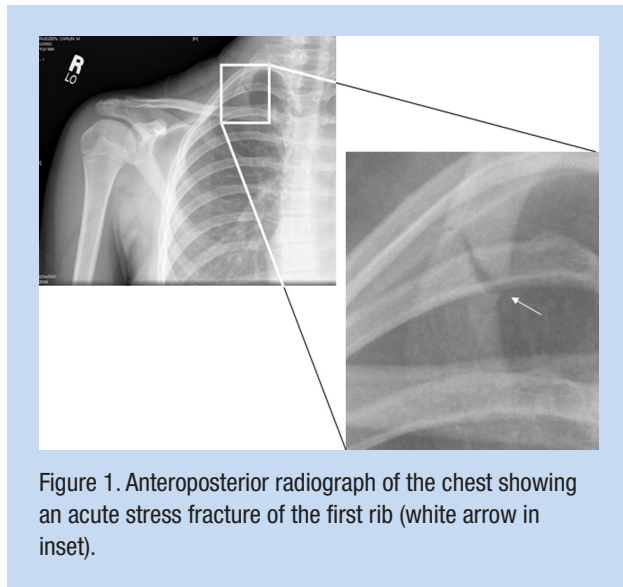


Figure 1. Anteroposterior radiograph of the chest showing an acute stress fracture of the first rib (white arrow in inset).

The patient was instructed to discontinue all athletic activity for at least 6 to 8 weeks. She was encouraged to move the extremity so that she would not become stiff, but she was instructed to avoid weighted activity with more than 2 lb (0.91 kg). Radiographs at 6 and 12 months showed incomplete healing of the fracture with a pseudarthrosis (Figure 2). Despite this pseudarthrosis, she was able to return to full participation in lacrosse after 3 months without any specific rehabilitation program aside from her activities of daily living.

DISCUSSION

Stress fractures of the first rib have been reported in many sports and activities that involve overhead motion of the arm.[†] Mamane et al²⁰ reported a first-rib stress fracture in a team basketball and lacrosse player, for whom symptoms began after an acute pop while playing tennis.

The cause of first-rib stress fractures is likely a combination of muscle forces acting on an inherently weak first rib.⁶ Movement of the arm overhead results in opposing forces in the serratus anterior and intercostals, which pull the rib inferiorly, and by the anterior and middle scalene muscles, which produce superiorly directed forces.^{2,7} The groove for the subclavian artery, located between the anterior and middle scalene, also provides a point of weakness in the first rib where the stress may concentrate and predispose to fracture.²⁷

The presentation of first-rib stress fractures typically includes pain beneath the shoulder and scapula, behind or just inferior to the clavicle, and at the base of the neck.³⁰ In most patients, the pain is subacute and often described as a dull ache.⁶ Exacerbating factors include coughing, deep inspiration, and overhead activity.^{3,6} Less common, there is sudden onset of sharp pain in the shoulder or neck region with transition

[†]References 5, 8, 13, 18, 21, 24, 32, 33.

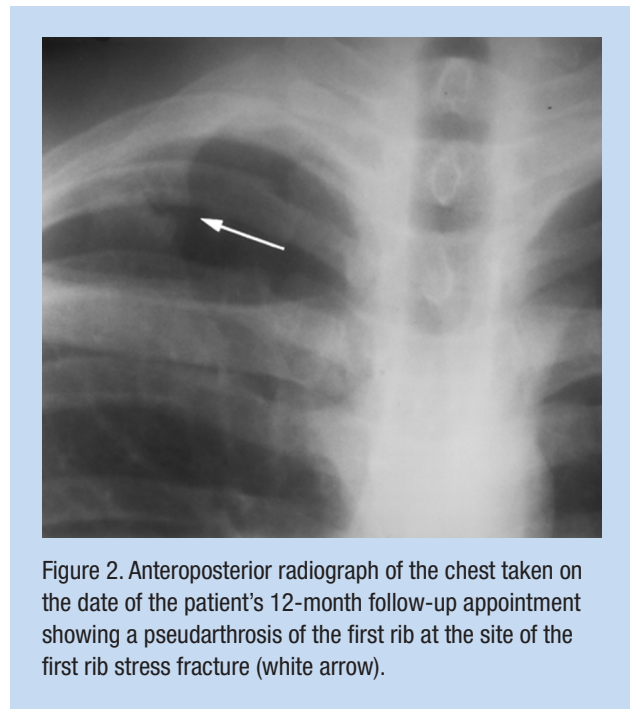


Figure 2. Anteroposterior radiograph of the chest taken on the date of the patient's 12-month follow-up appointment showing a pseudarthrosis of the first rib at the site of the first rib stress fracture (white arrow).

from stress fracture to complete fracture.^{13,18,24} In most cases of first-rib stress fractures, the onset of pain occurs over several months before becoming unbearable.²⁶ In some cases, there is a prodromal period of soreness followed by a sudden increase of the pain associated with a discrete event (eg, swinging a bat⁶ or serving a tennis ball²⁰). An unusual symptom for first-rib stress fractures in the current patient was her acute onset of dyspnea, chest pain, and shortness of breath. The differential diagnosis could include pneumothorax, atypical cardiac pain, pulmonary embolus, and tumor.¹⁷ Pneumothorax after traumatic first-rib fractures has been reported.¹

The sensitivity of radiography for all early-stage stress fractures may be as low as 10% and only 30% to 70% at follow-up.⁹ Early stress fractures can be identified by regions of focal periosteal bone formation and graying of the cortex, indicative of hyperemia, edema, and decreasing bone density.^{9,25}

When first-rib stress fracture is suspected but initial radiographic findings are negative, several additional imaging options are available. Radionuclide triple-phase bone scanning with technetium is exceedingly sensitive for stress fractures.¹⁵ With a stress fracture, all 3 phases of the bone scan are positive.¹⁵ Computed tomography, especially 3-dimensional reconstructive computed tomography, can confirm the diagnosis of stress fracture.^{5,9} Magnetic resonance imaging with fat suppression has certain advantages in detecting stress fracture: high sensitivity, localization, multiplanar capability, no radiation, and shorter imaging time compared with triple-phase bone scanning.⁹

The treatment for an isolated fracture of the first rib principally involves activity modification and pain control.³¹ Most patients can gradually return to the inciting overhead

activity after 4 to 6 weeks.³¹ Prolonged periods of rest may be necessary for delayed or nonunion.^{6,8} Several athletes have returned to their previous levels of sport without symptoms despite delayed or nonunion.^{7,13,22}

Potential late complications of first-rib stress fracture are rare, but include brachial plexus palsy, thoracic outlet syndrome, and Horner syndrome; all of which can result from extensive callus formation.⁶

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