

Fly Fishing–related Lesser Tuberosity Avulsion in an Adolescent

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abstract

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Stress lesions of the shoulder in athletic and active adolescents are most commonly associated with overhead sports. One of the most uncommon stress lesions of the shoulder in adolescents is an avulsion of the lesser tuberosity of the proximal humerus. To our knowledge, only 2 other cases of lesser tuberosity avulsions from repetitive motion have been reported, both of which were secondary to baseball pitching.

This article describes a case of an isolated partial avulsion of the lesser tuberosity of the humerus in an adolescent as a result of repetitive stress from fly fishing. The patient had no symptoms in his shoulder until after casting for approximately 10 hours a day for 3 days. He presented with anterior shoulder pain that worsened with abduction and external rotation. On examination, he had tenderness over the lesser tuberosity and pain with subscapularis muscle testing, such as the lift-off test. He had a negative apprehension sign but no signs of a superior labrum tear. Conventional radiography with an axillary view confirmed the diagnosis. He recovered with rest and gradual return to activities. Two years after injury, the patient had no limitations functionally, and his shoulder examination was normal.

This case highlights the importance of being aware that (1) this lesion can occur in activities other than baseball, (2) characteristic physical findings exist with this lesion, (3) obtaining an axillary radiograph can confirm diagnosis, and (4) these avulsions can be treated successfully with nonoperative interventions.

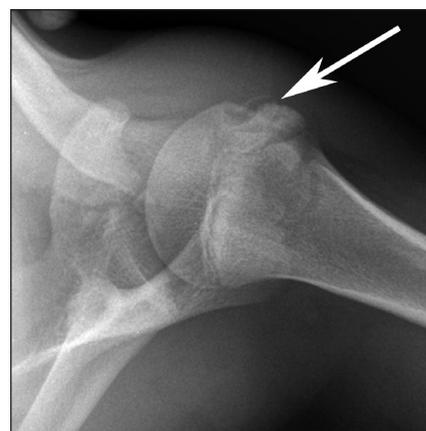


Figure: Axillary shoulder radiograph showing a lesser tuberosity apophysis irregularity with a minimally displaced osseous avulsion fragment (arrow).

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Although proximal humeral fractures occur fairly frequently in adolescents (incidence, 26.5 per 100,000 adolescent years), isolated fractures of the lesser tuberosity are rare.¹ Two acknowledged mechanisms exist for fractures of the lesser tuberosity in children. The most common cause of this injury is trauma involving external rotation and abduction force to the shoulder, such as from wrestling, falls, or being checked in ice hockey.¹⁻⁹ The second mechanism for lesser tuberosity fractures or avulsions in adolescents is repetitive stress to the tuberosity. In a review of the English literature, only 2 cases were found of avulsion fractures of the lesser tuberosity as a result of the repetitive trauma of the throwing motion; both cases were in baseball players.^{10,11} This article describes a case of an isolated partial avulsion of the lesser tuberosity of the humerus that occurred in an adolescent boy as a result of repetitive stress from fly fishing.

CASE REPORT

Informed consent is not required by our Institutional Review Board for case reports. However, because our patient was a minor, consent was obtained from the parents and the patient for this case to be reported.

A previously healthy 14-year-old boy presented for a second opinion concerning pain in his right, dominant shoulder. He reported no previous shoulder problems or injuries until 4 months previously when he had gone fly fishing and used a standard fly fishing rod and tackle. The method he used for launching the line included positioning his arm abducted approximately 60° with the arm extended and externally rotated behind his body. This position is similar to reaching into the backseat of a car because the arm is extended and externally rotated, or to throwing a ball with the arm less abducted. He reported that he fished 10 hours a day for 3 consecutive days. He did not feel a single cast or other event that

caused his shoulder to hurt, but he began to feel soreness the day after cessation of fishing. He reported no previous problems with his shoulder, and he was not involved in baseball or other overhead sports before symptom onset.

The pain had gradually worsened, and he sought treatment with an orthopedic surgeon. The orthopedic surgeon had obtained radiographs and magnetic resonance imaging but had not arrived at a diagnosis. Because the patient had continued pain without resolution or an identifiable cause, he was referred to our clinic.

The patient reported that the pain had worsened to the point of waking him at night. Raising his hand over shoulder height, reaching across his body, and abducting his arm with external rotation caused pain. He had taken 600 mg of ibuprofen periodically, with no diminution of pain. The pain was localized to his anterior shoulder, with radiation into his proximal arm in the area of the biceps tendon. He reported no neck pain or paresthesias and had no shoulder instability. He was in good health with no history of systemic illness, previous joint problems, or connective tissue disorders. He was unable to try out for hockey because he could not skate without pain.

On examination, he was in no distress and had no shoulder or upper-extremity atrophy, swelling, or deformity. He had full range of motion, except for internal rotation up the back, in which he reached the T10 vertebrae with the affected arm and the T6 with the normal arm. He had symmetric external rotation of both arms to 90°, with the arm abducted 90° and also with the arms at his sides. He reported pain during an anterior apprehension maneuver but no sense of instability. He also reported pain with resisted internal rotation with his arm at his side when tested with his elbow bent 90°. Lift-off test was negative,¹² but he reported anterior shoulder pain with the resisted lift-off test. He reported no pain or weakness with manual muscle



Figure 1: Axillary shoulder radiograph showing a lesser tuberosity apophysis irregularity with a minimally displaced osseous avulsion fragment (arrow).

shoulder abduction or external rotation testing. The Neer impingement sign,¹³ Kennedy-Hawkins impingement sign,¹⁴ active compression sign,¹⁵ and Whipple test¹⁶⁻¹⁸ (a test that suggests a rotator cuff tear) produced pain in his anterior shoulder. He also had a positive crossed-arm adduction stress test and a positive shrug sign that measured 5°. ^{19,20} He was tender to palpation anteriorly in his shoulder just lateral to the coracoid and on the proximal humerus. He was not tender along the biceps tendon when palpated 4 to 5 cm distal to the glenohumeral joint.²¹ However, studies have suggested that the biceps palpation test is not sensitive or specific for biceps pathology.^{21,22}

Conventional shoulder radiographs, including an anteroposterior view in internal rotation and external rotation, were normal. An axillary radiograph showed a small avulsion fracture of the lesser tuberosity, which was displaced 2 to 3 mm (Figure 1). Magnetic resonance imaging revealed bone marrow edema in the lesser tuberosity and fluid-like signal in the fracture line subjacent to the minimally displaced avulsion fragment (Figure 2), consistent with partial avulsion of his subscapularis tendon attachment to the lesser tuberosity.

Because the patient's symptoms were largely controlled with symptomatic

treatment, such as ice and low doses of ibuprofen, athletic activity that did not increase pain was allowed. However, the patient was instructed to avoid bench pressing and baseball throwing because these activities result in stress on subscapularis muscle. He had not been involved in these activities before injury.

At 3-month follow-up (7 months after symptom onset), the patient reported no shoulder pain, and the physical examination, including the tests reported above, was repeated. Shoulder physical examination was normal, with no tenderness, loss of range of motion, or pain with the provocative maneuvers. Radiographs showed no change in the position of the bony fragment (Figure 3). He was allowed to return to sports with no subsequent limitations. At last follow-up, 2 years after injury, he had no limitations with sports activities, including fly fishing. Because he reported no symptoms, repeat radiographs were not obtained.

DISCUSSION

This patient presented with an uncommon lesion of the subscapularis tendon and lesser tuberosity that occurred from fly fishing, a mechanism that, to our knowledge, has not previously been described as a cause of this injury. This patient had no other possible explanation for his injury because he was not involved in other sports before symptom onset. With careful attention to the patient's history, a thorough physical examination, and appropriate imaging studies, this rare lesser tuberosity injury in an adolescent athlete can be accurately diagnosed and treated.

Previous studies on lesser tuberosity fractures in adolescent athletes have reported that the mechanism of injury is a traumatic event or repetitive stress to the subscapularis tendon attachment with the arm abducted and externally rotated.¹⁻¹¹ Of the 16 reported cases of lesser tuberosity fractures in adolescents, 14 were traumatic and only 2 were secondary to repetitive

shoulder motion, both of which occurred from baseball pitching. Repetitive contraction of the subscapularis muscle is thought to result in fatigue failure of the lesser tuberosity with subsequent fracture and occasional displacement of all or a portion of the lesser tuberosity. Lesser tuberosity fractures from trauma are similarly believed to be a result of subscapularis contraction with the arm in an abducted and externally rotated position or posterior fracture shoulder dislocations.^{1,23,24}

The findings on physical examination were consistent with those previously reported in the literature for this injury.¹⁻¹¹ The common physical examination findings in previously reported cases of lesser tuberosity fractures are anterior shoulder tenderness, weakness or pain with resisted internal rotation of the shoulder, and anterior shoulder pain with an anterior apprehension maneuver. Physical examination tests specific for subscapularis tendon tears, such as the lift-off and resisted lift-off tests, may produce pain but may not produce weakness, as occurred in our patient. Other rotator cuff tests, such as the Neer impingement sign and the Whipple test, produced pain in our patient that may have obscured the diagnosis. Because tests used on physical examination of the shoulder for rotator cuff conditions, such as tendinitis, are not specific,^{13,14} it is possible that this patient had a rotator cuff irritation superimposed on the avulsion of his lesser tuberosity.

The best conventional radiographic study for evaluating a patient for an injury to the lesser tuberosity is the axillary view.^{5,24,25} Failure to obtain an axillary radiograph in this case delayed diagnosis by several months. In some cases, it may be necessary to confirm that the axillary view is performed with the arm in neutral rotation so that serial radiographs can be compared to evaluate the healing of the lesion. Typically, such lesions cannot be seen with anteroposterior radiographs or scapular "Y" shoulder

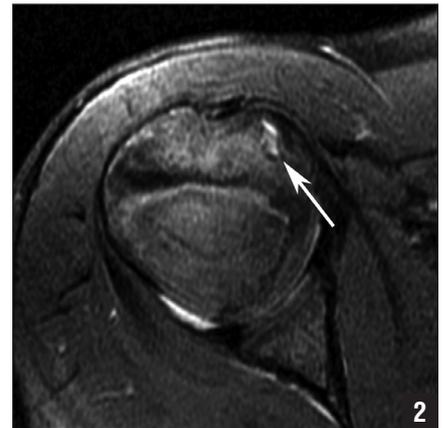


Figure 2: Axial fat-suppressed, proton-density-weighted, fast-spin-echo axial magnetic resonance image (repetition time=2800 msec; echo time=28 msec) showing bone marrow edema in the lesser tuberosity and fluid-like signal (arrow) subjacent to the minimally displaced avulsion fragment.



Figure 3: Follow-up axillary radiograph showing no change in the position of the lesser tuberosity fragment.

views. Magnetic resonance imaging and computed tomography may be beneficial if conventional radiographs are normal.²⁶ However, an index of suspicion for this lesion ensures that appropriate radiographs are obtained.

No consensus exists in the literature regarding whether nonoperative or operative treatment is best for lesser tuberosity avulsions in adolescents.²⁴ If our case is included in the analysis of the results of treatment in the literature, 6 of 8 patients treated nonoperatively had successful results, and 8 of 9 patients treated surgically had successful results. The 2 patients for whom nonoperative

treatment failed had subacute lesions (<6 months), and the patient with an unsuccessful surgical intervention had a chronic lesion (>6 months). Open reduction and internal fixation is the optimum surgical treatment, and the best result may be with early intervention.^{4,5,24} A case was reported of an arthroscopic repair of an isolated lesser tuberosity fracture in an adult, but this treatment should be reserved for surgeons with special expertise in this technique.²⁷

CONCLUSION

Although rare, lesser tuberosity lesions should be considered in the differential diagnosis of adolescents with anterior shoulder pain. Because the history and physical examination may not be specific for this injury, local tenderness to the anterior shoulder and pain with tests of subscapularis function may be helpful in the evaluation. Axillary radiographs and magnetic resonance imaging can assist in making the diagnosis. The decision for nonoperative or operative intervention should be made based on the degree and chronicity of the symptoms and the degree of displacement of the fragment. Smaller lesions can be successfully treated with nonoperative treatment, but additional studies of such lesions are needed. 

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