Isolated Traumatic Subscapularis Tear in a 12-Year-Old Male Gymnast: A Case Report

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Abstract

Isolated avulsion fractures of the lesser tuberosity are rarely encountered in younger and older populations. However, because the tendon of the subscapularis insertion is stronger in skeletally immature individuals, isolated tears to the tendon occur more commonly in adults than children and adolescents. Most studies have been limited to case reports that mainly describe traumatic subscapularis tears in adolescent athlete-patients. We present a 12-year-old male gymnast who reported to our clinic with pain and weakness in the right shoulder at 2 months after the initial injury. We performed open repair with suture anchor fixation for treatment of an isolated subscapularis tear. At 6 months postoperatively, the child felt no pain, regained full range of shoulder motion and strength, and returned to highly competitive physical activity. Isolation of the subscapularis insertion during physical examination can be essential to initial diagnosis, allowing for successful and early operative treatment.

Introduction

Isolated avulsion fractures of the lesser tuberosity of the proximal humerus are uncommon injuries, especially in children and adolescents. Although a study by Hartigan[1] in 1895 was the first to describe a lesser tuberosity avulsion fracture in an adolescent boy, both an isolated and pediatric occurrence of this fracture was not reported until nearly a century later.[2] These isolated avulsion fractures are unusual in skeletally immature patients because, at younger ages, the tendon of the subscapularis insertion is stronger than the tuberosity-humerus interface.[3,4] In contrast, older individuals (>40 years) have reduced mechanical properties of the rotator cuff, allowing injuries to the tendon to occur more frequently with avulsions.[4]

Because of its infrequency, isolated tears of the subscapularis tendon in younger patients have been examined mostly in case reports of adolescent athletes.[2-6] The subscapularis muscle relaxes when the arm is in 90° of abduction, but forceful external rotation of the arm will cause the muscle to eccentrically contract.[3,7,8] These injuries are typically related to rotator cuff tears resulting from traumatic events such as forced abduction and external rotation.[6,9] Associated injuries include biceps tendon tears, biceps tendon dislocation, and anterior dislocation of the glenohumeral joint.[7,10] However, only 2% to 7% of rotator cuff tears (found in <1% of patients aged <20 years) involve subscapularis tears.[4,5,7,10] The results from physical examinations are often limited owing to the rarity of this condition, which subsequently can delay accurate diagnosis.[3,7] We describe thorough examination and successful treatment of an isolated subscapularis tendon tear without bony avulsion in an adolescent gymnast.

Case Report

A 12-year-old male gymnast presented to our clinic with anterior pain and sensation of weakness in the right shoulder. The patient participated in highly competitive gymnastics and was jumping on a trampoline when the injury occurred. He had performed a front flip, missed his landing because of over rotation, and placed his arm in front to brace the fall and protect his face. On evaluation immediately after the injury, no glenohumeral dislocation was noted but the patient did express paresthesias (which resolved a few days later) and pain. He was referred to our clinic by an orthopaedist from another facility and arrived 2 months after the initial injury. No symptoms of glenohumeral instability were found, and the patient did not report previous injuries to the shoulder.

On physical examination, he appeared generally healthy and physically fit. Examination of his right upper extremity revealed tenderness to palpation at the anterior shoulder. Results of belly-press and lift-off tests were positive for damage to the subscapularis insertion. Additionally, the patient had increased external rotation of the right shoulder compared to the contralateral, uninjured side. About 80% of overall shoulder strength was present when testing the subscapularis muscle by means of resisted internal rotation, and the shoulder was neurovascularly intact distally. Findings of magnetic resonance imaging (MRI) revealed a full-thickness tear of the retracted subscapularis tendon, with mild damage to the anterior labrum but no evidence of a Hill-Sachs lesion (Figure 1).

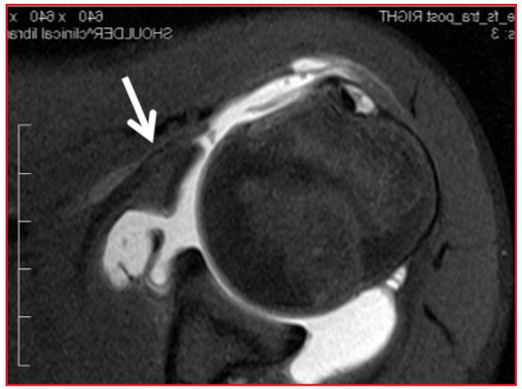

Figure 1. T1-weighted magnetic resonance arthrogram with contrast material, showing axal view of the right shoulder. The subscapularis tendon (arrow) is torn off its origin on the lesser tuberosity and retracts to the level of the glenohumeral joint. Notably, the biceps tendon maintains location in the bicipital groove.

After talking with the patient and his parents, we decided to perform open repair of the subscapularis tendon in the right shoulder by the deltopectoral approach. Results of initial intraoperative examination under anesthesia revealed a globally stable glenohumeral joint. The subscapularis tendon was found retracted to the level of the glenoid. A small amount of cartilage with the detached tendon was noted, but no bone was avulsed from the humerus. Three PEEK fully threaded, triple-loaded 5.5 mm suture anchors (Arthrex, Naples, FL) were fixated to the lesser tuberosity (Figure 2). The repair was done using a Mason-Allen stitch configuration, and sutures were tied down sequentially while the shoulder was in neutral rotation.

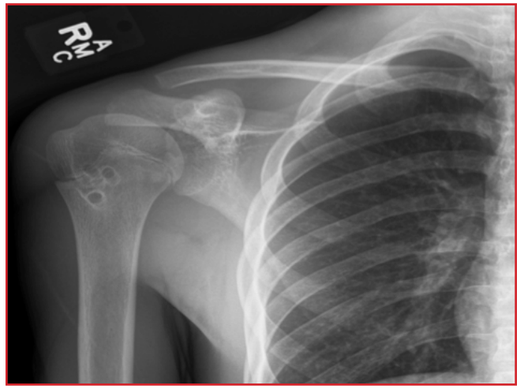

Figure 2. Postoperative radiograph of anteroposterior view of the right shoulder, showing suture anchor drill holes in the anatomical location of the lesser tuberosity. No change or arrest to the physis of the proximal humerus is evident.

Postoperatively, the shoulder was placed in a sling for 6 weeks. At 2-week follow-up after surgery, the strength of the shoulder was tested by pendulum exercises, rotation from external to neutral position, and wall-crawl activities. At 6 weeks postoperatively, results of a belly-press test were negative for tears to the subscapularis tendon, and the right shoulder had full range of motion equal to the contralateral side. The patient enrolled in physical therapy and used resistance bands to strengthen the rotator cuff.

At 12 weeks postoperatively, the patient noted baseline shoulder strength, finished formal physical therapy, and began home-based exercises with a resistance band. The range of motion of both shoulders was equal and the subscapularis insertion had 100% of strength. Additionally, results of belly-press and lift-off tests were negative for subscapularis tendon tears. Although limited to about 70% of full exertional capacity without impact activity, the patient returned to gymnastics. At 6 months postoperatively, he fully returned to competitive gymnastics (Figure 3).

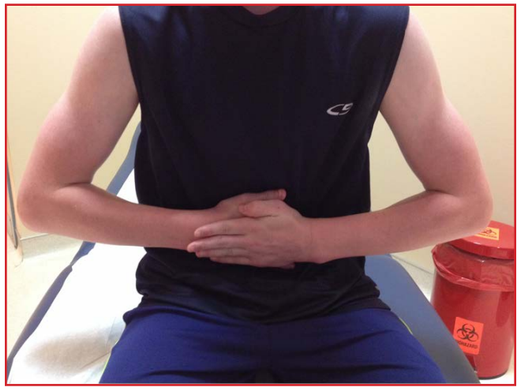

Figure 3. At 6 months postoperatively, the patient performs a belly-press test, with negative results for a subscapularis tear. Complete internal rotation of the shoulder is maintained (equal to the contralateral, uninjured side) with hands pressed into the belly.

Discussion

Although uncommon in older populations, subscapularis tendon tears in avulsion fractures of the lesser tuberosity are rarer injuries in children and adolescents.[2-6] The findings of the current case reinforce the importance of a detailed physical examination and advanced imaging techniques to help with initial diagnosis of subscapularis tears. As other studies have reported, the inspection of the rotator cuff can be essential in assessing the strength of the subscapularis muscle, including comparing external rotation of the proximal humerus with the contralateral side as well as lift-off,

belly-press, and bear-hug tests.[3,7,11] In our case, an increase in passive external rotation of the right shoulder compared to the contralateral side was frequently noted.

These results from physical examination should encourage preoperative imaging such as radiography and MRI to confirm diagnosis.[12] Although not always described with success, axillary views of radiographs may show avulsions of the lesser tuberosity.[8,11] Radiographs of subscapularis tears obtained shortly after initial diagnosis can reveal calcification at the level of the retracted tendon as a result of the robust healing response in children.[4]

Open procedures with the deltopectoral approach using transosseous sutures or suture anchors are the standard treatment for full-thickness tears.[13,14] Coates and Breidahl[12] advocated arthroscopy as a diagnostic adjunct to address intraarticular results of pathological studies, including labral tears of the shoulder. A study by Bartl et al[15] described significant improvement in postoperative constant scores and follow-up examinations for 30 patients with traumatic isolated subscapularis tears treated with open repair by the deltopectoral approach using suture anchors. Caniggia et al[16] recommended close monitoring of the patient postoperatively for malunion, impingement, instability, weakness, chronic pain, fracture displacement, and biceps tendon dislocation from the bicipital groove. However, no standard recommendation exists on how to treat partial-thickness tears of the rotator cuff in children.[4]

Other studies have noted poor outcomes with nonoperative treatment in adolescents and children.[8,16] Our case reinforces these findings and describes successful operative treatment of an isolated subscapularis tear with suture anchor fixation in a child. Thorough physical examinations and preoperative imaging may be crucial in properly diagnosing a tear of the subscapularis tendon, allowing for successful treatment.

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