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Neglected lesser tuberosity avulsion in an adolescent elite gymnast

Odysseas Paxinos^{1,2}, Alexandra Karavasili²,
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Athanasios Papavasiliou⁴

Abstract

We report the case of a 16-year-old elite gymnast who presented with recurring pain in the left shoulder after training. The athlete recalled an injury to the shoulder 2 years ago. Clinically a localized tenderness to the anterior shoulder and loss of strength and range of motion was noted. Imaging investigation suggested a neglected lesser tuberosity avulsion. The athlete was treated with open excision of the deformed tuberosity and direct repair of the subscapularis to the humeral head. Following a careful postoperative rehabilitation protocol the athlete was able to return to unrestricted gymnastics after 6 months. After surgery the athlete followed an intense rehabilitation program that allowed him to return to sports at 6 months. At 5-years follow-up, the athlete was asymptomatic and competing at an international level. Avulsion fractures of the lesser tuberosity are extremely rare injuries with significant shoulder disability if left untreated. Anatomic repair can yield excellent results, even in neglected cases.

Keywords

Adolescent, fracture, gymnast, lesser tuberosity

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Introduction

Participation in gymnastics has undergone rapid growth in recent decades, with children entering the sport at a very young age (5 years to 6 years old). Gymnastics is a demanding sport, with the immature skeleton being subjected to high repetitive loads. The high intensity and volume of training required to achieve high competitive levels puts the athlete at risk for a number of injuries. The physicians should have a high index of suspicion in these athletes for injuries located in the epiphysis and apophysis.¹ Avulsion fractures of the lesser humeral tuberosity are extremely rare and the diagnosis is frequently missed.^{2,7,11} A review of literature shows that this is the first case to involve a high level gymnast.^{2–11}

Case report

A 16-year-old healthy Tanner stage 4 male elite gymnast presented for chronic left shoulder pain. Symptoms were localized on the anterior part of the shoulder and aggravated after apparatus training (high bar, pommel horse, parallel bars and rings).

The athlete recalled being injured falling from parallel bars 2 years prior to his presentation and not being able to train for 6 weeks after that. No medical advice was sought for the initial injury.

On clinical examination, no asymmetry was obvious. Active forward elevation and abduction was normal. External rotation in adduction was slightly increased and internal rotation in abduction was decreased in the affected shoulder. There was a noticeable loss of internal rotation strength compared to the unaffected side. Apprehension–relocation, belly press and O'Brien tests were positive, whereas cross-body adduction

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Figure 1 Pre-operative anteroposterior (a) and axillary (b) X-rays. An exostosis pointed towards the epiphysis is clearly visible. The pseudarthrosis marks the lower border of the lesser tuberosity.

produced pain. The anterior shoulder was tender in palpation and a hard lump fixed to the humerus was palpable in the axilla.

The athlete was referred for imaging studies with the working diagnosis of an inflamed exostotic bursa. Radiographs of the shoulder revealed a bony lesion similar to an exostosis but pointed towards the epiphysis (Figure 1). The magnetic resonance imaging (MRI) scan established a diagnosis of an avulsion at the level of lesser tuberosity (Figure 2).

Because conservative treatment failed and the patient could not maintain his level of activity, informed consent was obtained from the athlete and his parents to proceed with open reduction and internal fixation. Under general anaesthesia, the patient was placed in the supine position. The exostosis was approached through a deltopectoral approach and was located in close proximity to the brachial plexus. It was only during surgery that the suspected avulsion of the lesser tuberosity was confirmed because the subscapularis was attached to the exostosis. The avulsion of lesser tuberosity along with periosteal stripping at the lower part of the subscapularis insertion caused significant post-traumatic heterotopic ossification contributing to the size of the exostosis seen. After careful mobilization of the surrounding bursa and neurovascular bundle, the avulsed lesser tuberosity and subscapularis were mobilized (Figure 3a). Direct repair was not considered as a result of the deformation of the bone fragment and the possibility of subcoracoid impingement. The bone fragment was excised (Figure

3b) and subscapularis was fixed in the anatomical position with suture anchors after appropriate decortication.

Postoperatively, the shoulder was immobilized in a sling and the athlete was prescribed a supervised rehabilitation programme. Aerobic capacity for the first 4 weeks was maintained with static bicycle training. Passive shoulder exercises and posterior capsular stretching were initiated immediately postoperatively, whereas resisted external rotation in adduction was allowed after the fourth week. At 8 weeks postoperatively, he was allowed a full set of shoulder exercises with elastic bands, excluding resisted internal rotation. Healing of the tuberosity was confirmed by radiographs and ultrasound at 4 months postoperatively and resisted internal rotation exercises were allowed. By that time, the athlete had a normal symptom-free range of motion and was allowed to continue conditioning with swimming. At 5 months, he started non-impact floor and vault gymnastics exercises and, at 6 months, he was allowed a gradual return to full competitive training. The athlete made a successful return to gymnastics and, at 5 years following the operation, is still competing at an international level (Figure 4).

Discussion

Avulsion fractures of the lesser humeral tuberosity are extremely rare injuries that are initially missed and often are diagnosed after patients seek medical advice because of chronic shoulder pain.^{2,7} Children and

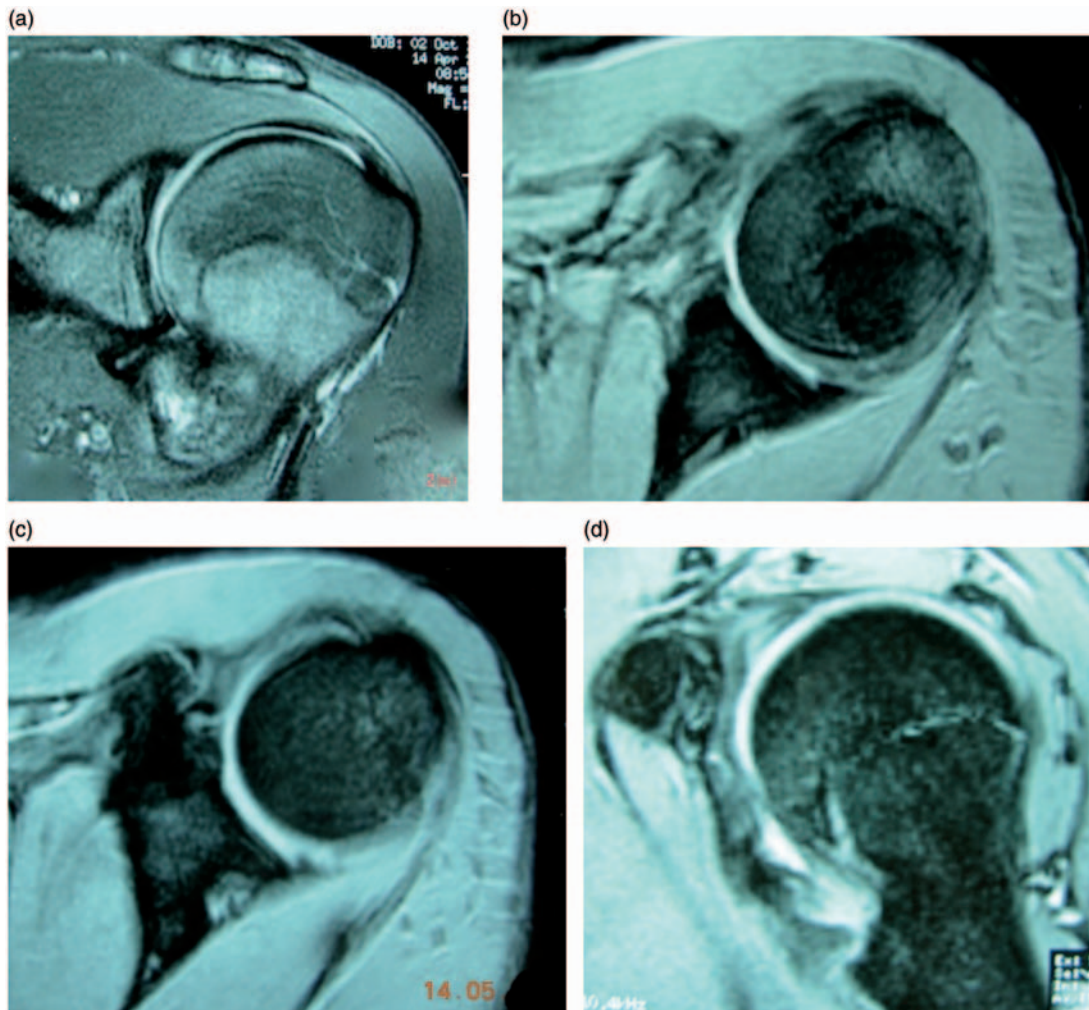


Figure 2. Pre-operative sagittal (a–c) and frontal (d) magnetic resonance imaging scans. The subscapularis is visualized attached to the proximal fragment of the exostosis (lesser tuberosity).

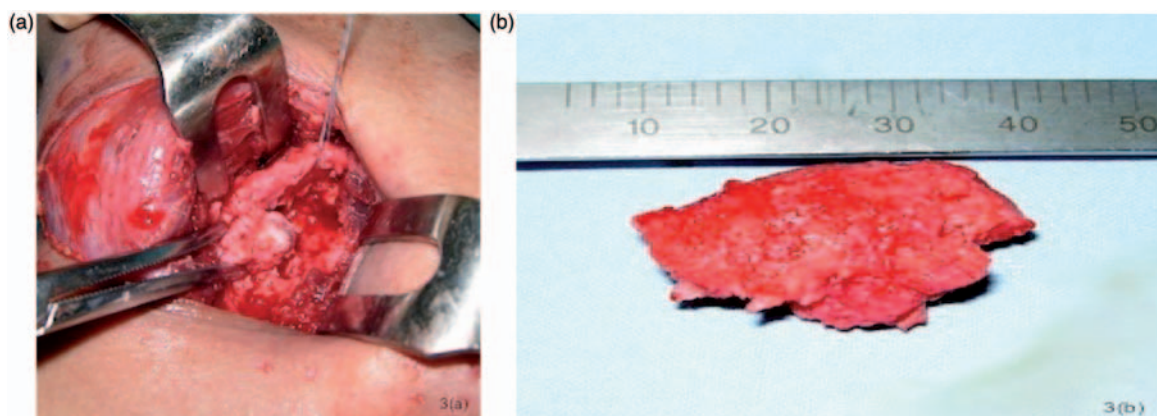


Figure 3. Intraoperative view. (a) The avulsed lesser tuberosity is held by a Kocher clamp after having been mobilized from the subscapularis and the distal part of the exostosis. The subscapularis is taged with a suture in preparation for fixation in the anatomical position at the humeral head. (b) The excised lesser tuberosity.



Figure 4. Five-year postoperative follow-up X-rays. The anchor fixation points and the distal part of the exostosis are visible in the anteroposterior view.

adolescent athletes with acute shoulder trauma or chronic shoulder pain should be carefully examined and, in the case of clinical findings, good radiographs including an axillary view should be ordered. A bone flake in the region of the lesser tuberosity needs further evaluation with computed tomography or MRI scans.³

Lesser tuberosity avulsion in adolescents can be either acute after a forceful subscapularis pull with the shoulder in abduction and external rotation,^{4,5,8,9,11} or chronic after repetitive traction in overhead activities^{7,10} Avulsion fractures of the lesser tuberosity have been reported after various sports and activities.^{4,6,11} Our patient is the first reported case of a neglected injury in an adolescent gymnast.

Both conservative and operative treatment have been proposed for this injury with good results. If the displacement and size of the fragment is small, then conservative treatment is a reasonable option.⁴ However, when the displacement is greater than 5 mm, or if there is block to the subacromial motion or significant muscle weakness and persisting pain, then operative treatment should be advised.^{6,11} Open reduction and fixation regardless of the displacement and the size of the fragment have been recommended to prevent subcoracoid impingement, subscapularis tears and biceps pathology.⁷ Surgical treatment is effective for restoring subscapularis function and a return to

sports, even in cases of a delayed treatment.¹¹ In our case, lesser tuberosity excision and subscapularis direct fixation to the humeral head 2 years after the initial injury resulted in an excellent result and a return to international elite level competition.

Lesser tuberosity avulsion is a rare injury that needs to be suspected after shoulder trauma in immature athletes.

References

1. Kerssemakers SP, Fotiadou AN, de Jonge MC, Karantanas AH and Maas M. Sport injuries in the paediatric and adolescent patient: a growing problem. *Pediatr Radiol* 2009; 39: 471–84.
2. Goeminne S and Debeer P. The natural evolution of neglected lesser tuberosity fractures in skeletally immature patients. *J Shoulder Elbow Surg* 2012; 21: e6–11.
3. Harper DK, Craig GJ and van Holsbeeck MT. Apophyseal injuries of the lesser tuberosity in adolescents: a series of five cases. *Emerg Radiol* 2013; 20: 33–7.
4. Hung LH, Chung KY, Tang N and Leung KS. Isolated avulsion fracture of the lesser tuberosity of the humerus: case report and literature review. *J Orthop Trauma Rehabil* 2012; 16: 78–81.
5. Le Huec JC, Schaeverbeke T, Moinard M, et al. Isolated avulsion fracture of the lesser tubercle of the humerus in children. *Acta Orthop Belg* 1994; 60: 427–29.
6. Levine B, Pereira D and Rosen J. Avulsion fractures of the lesser tuberosity of the humerus in adolescents: review of the literature and case report. *J Orthop Trauma* 2005; 19: 349–52.
7. Neogi DN, Bejjanki N and Ahrens P. The consequences of delayed presentation of lesser tuberosity avulsion fractures in adolescents after repetitive injury. *J Shoulder Elbow Surg* 2013; 22: e1–5.
8. Paschal SO, Hutton KS and Weatherall PT. Isolated avulsion fracture of the lesser tuberosity of the humerus in adolescents. A report of two cases. *J Bone Joint Surg Am* 1995; 77: 1427–30.
9. Provance AJ and Plousky JD. Isolated avulsion fracture of the subscapularis tendon with medial dislocation and tear of biceps tendon in a skeletally immature athlete: a case report. *Curr Opin Pediatr* 2010; 22: 366–8.
10. Sugalski MT, Hyman JE and Ahmad CS. Avulsion fracture of the lesser tuberosity in in an adolescent baseball pitcher. *Am J Sports Med* 2004; 32: 793–6.
11. Vezeridis PS, Bae DS, Kocher MS, Kramer DE, Yen YM and Waters PM. Surgical treatment for avulsion injuries of the humeral lesser tuberosity apophysis in adolescents. *J Bone Joint Surg Am* 2011; 93: 1882–8.