

Isolated Avulsion Fracture of the Lesser Tuberosity of the Humerus in an Adult: Case Report and Literature Review

Aman Dhawan, MD, Kevin Kirk, DO, Thomas Dowd, MD, and William Doukas, MD

Isolated avulsion fractures of the lesser tuberosity of the proximal humerus are rare. We report the case of a right-hand-dominant woman in her early 30s who sustained such an injury, with an intact subscapularis tendon attached to the lesser tuberosity fragment. Treatment included surgery to restore tension to the subscapularis muscle and maintain the force couple about the shoulder joint. One year after injury, the patient reported no pain, excellent range of motion, and return to activities.

This case demonstrates the diagnostic challenge of this injury, which requires a high index of suspicion and careful review of orthogonal radiographs and advanced imaging. We

also describe our operative technique, including use of heavy, nonabsorbable suture.

CASE REPORT

A right-hand-dominant woman in her early 30s presented with right shoulder pain 1 day after a fall down a flight of stairs. During the accident, as her feet slipped out from underneath her and her torso fell

comminuted 3-cm lesser tuberosity fracture fragment retracted approximately 2 cm from the donor site (Figures 1B–1D). No biceps tendon subluxation or injury and no intra-articular pathology were noted.

The lesser tuberosity fracture was surgically repaired less than 2 weeks after injury. Through a deltopectoral approach, the rotator interval and the 3×2-cm fracture fragment were

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MAJ Dhawan, MC, USA, is Assistant Professor of Surgery, Uniformed Services University of the Health Sciences, Bethesda, Maryland.

MAJ Kirk, MC, USA, is Chief, Orthopaedic Foot and Ankle Surgery, Brooke Army Medical Center, San Antonio, Texas.

CPT Dowd, MC, USA, is Orthopaedic Surgery Resident, Brooke Army Medical Center, San Antonio, Texas.

COL Doukas, MC, USA, is Chairman, Integrated Department of Orthopaedics and Rehabilitation, National Naval Medical Center/Walter Reed Army Medical Center, Bethesda, Maryland/Washington, DC.

Address correspondence to: Aman Dhawan, MD, Department of Orthopaedic and Rehabilitative Services, Carl R. Darnall Army Medical Center, Fort Hood, TX 76544-4752 (tel, 254-288-8050; fax, 254-286-7285; e-mail, amandhawan@hotmail.com).

Am J Orthop. 2008;37(12):627-630. Copyright Quadrant HealthCom Inc. 2008. All rights reserved.

backward, she used her right hand to try to break her fall, with the shoulder in an extended and externally rotated position. She then had marked pain with shoulder motion and sought medical attention.

On examination, there was no visible asymmetry to her shoulder contours. Ecchymosis and swelling were present about the right axilla. The patient had pain with motion, particularly internal and external rotation. Strength testing demonstrated decreased strength (4/5) in internal rotation compared with the contralateral side. The patient was unable to perform liftoff and belly-press maneuvers with the right upper extremity.^{1,2}

Anteroposterior, scapular Y, and axillary (Figure 1A) radiographs showed a small avulsion fracture of the lesser tuberosity of the right proximal humerus. Magnetic resonance imaging (MRI) showed an intact subscapularis tendon attached to a non-

identified. The subscapularis tendon was intact and attached to the fracture fragment, which had retracted medially. No injury to the biceps tendon was appreciated. The donor site was visualized with external rotation of the extremity.

The donor site was prepared for fixation using curettes and irrigation. The fracture fragment was carefully dissected from surrounding fibrous tissue using a freer. As the surgery was performed in the acute setting, the subscapularis maintained the excursion necessary for anatomical reduction. Fiberwire suture was placed through the fracture fragment to allow for manipulation (Figure 2). Heavy, nonabsorbable suture (No. 5 Ticron) on a large cutting needle was used to secure the reduction. The suture was passed from medial to lateral through the fracture fragment, through the donor site, and out through the lateral cortex of the prox-

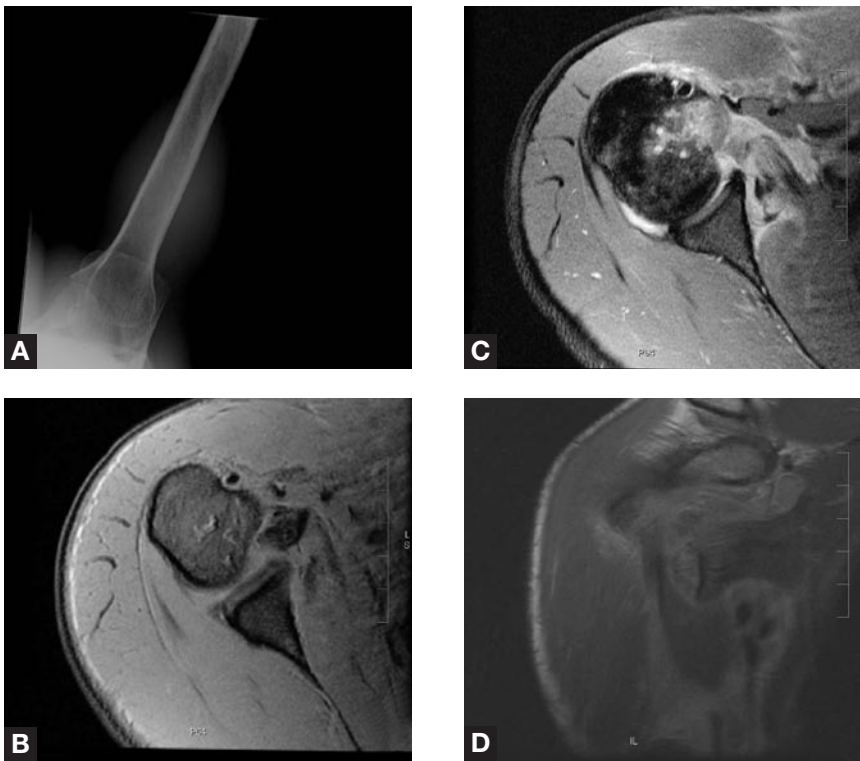


Figure 1. Fracture fragment as seen on (A) axillary radiograph and (B) T₁-weighted axillary magnetic resonance imaging (MRI). (C) T₂-weighted axillary MRI shows donor site at lesser tuberosity. (D) T₂-weighted coronal MRI shows intact subscapularis tendon attached to retracted lesser tuberosity fracture fragment.

imal humerus. The suture was then passed again from lateral to medial back through the proximal humerus, through the fracture, and again out through the fracture fragment from lateral to medial. The result was a mattress suture. The knot was hand-tied and secured down to maintain the reduction of the lesser tuberosity to its anatomical position while the arm was held in neutral rotation (Figure 3). The rotator interval capsule was repaired using a side-to-side stitch. No redundancy was noted in the capsule at this point, and examination under anesthesia demonstrated glenohumeral translation within normal limits; therefore, capsular imbrication was not performed.

After surgery, the patient was placed into a shoulder immobilizer for soft-tissue rest for 3 weeks, and pendulum-type shoulder exercises were begun. External rotation to neutral and active-assist forward elevation and abduction to 90° were allowed; however, active internal rotation was restricted. At 3 weeks, active internal rotation, full exter-

nal rotation, and full forward flexion and abduction were permitted. At 6 months, the patient had painless range of motion; however, active forward flexion was limited to 120° because of stiffness. Internal and external rotation was symmetric to the contralateral shoulder.

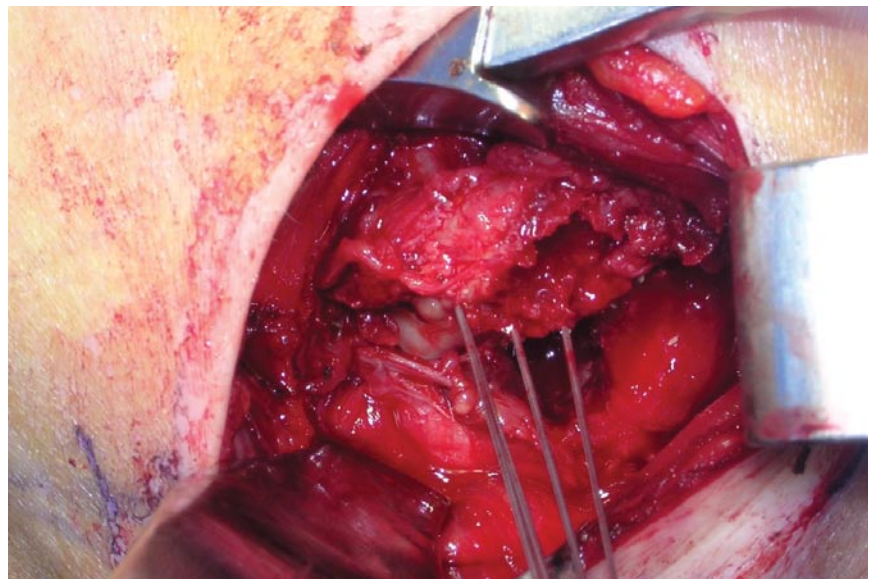


Figure 2. Intraoperative photograph of fracture fragment after dissection and placement of grasping suture.

One year after surgery, range of motion was near symmetric with forward elevation of 180°, abduction of 180°, external rotation with the elbow at the side to 60°, and internal rotation to T6. There was no appreciable strength deficit on manual muscle testing, and the patient reported no deficits in activities of daily living. In objective evaluation using the Neer criteria, she received a score of 85 of a possible 100 points (satisfactory score, >80 points; excellent score, >89 points). The pain score reflected the patient's only deficit; she reported slight occasional pain with no compromise in activity level.³

DISCUSSION

Isolated avulsion fractures of the lesser tuberosity of the proximal humerus are rare, and few cases have been reported in the English-language literature.⁴⁻¹⁷ The injury is often reported in combination with posterior humeral head dislocations and in association with a comminuted fracture of the proximal humerus.^{18,19} Most authors agree that the avulsion fracture occurs as the subscapularis muscle contracts eccentrically to resist a sudden abduction and external rotation force of the proximal humerus.^{4,8} Another proposed mechanism involves an axial load along the long axis of the humerus with the glenohumeral joint extended and exter-

nally rotated.⁴ This injury mechanism, consistent with our patient's, results in anterosuperior migration of the humeral head and increased tension of the subscapularis muscle and the superior glenohumeral ligament.^{4,9}

Diagnostic Considerations

Diagnosis of an isolated lesser tuberosity fracture can be challenging, and a high index of suspicion

provides satisfactory results, consistently better outcomes (including improvements in pain and function) occur with operative fixation of a displaced fracture.^{4,6-8} Operative repair restores tension and insertion of the subscapularis muscle tendon and preserves the anteroposterior rotator cuff force couple to the shoulder. Of the literature cases diagnosed acutely, approximately 60% were treated

CONCLUSIONS

Lesser tuberosity fractures are a diagnostic dilemma and should be suspected in patients who present with anterior shoulder pain, particularly after trauma. A complete set of orthogonal radiographs is mandatory, and advanced imaging can be helpful in both diagnosis and treatment planning.

For displaced lesser tuberosity fractures, we recommend using

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is required. Evidence of missed diagnoses is demonstrated by the number of reported cases in which the injury is found to be chronic.⁴ The injury may be difficult to see on plain radiographs.^{6,10,11} On an anteroposterior radiograph, a lesser tuberosity fracture is visible only when the fracture fragment is large or significantly displaced.¹⁰ Internally rotating the proximal humerus provides the best view of this injury.¹⁰ Smaller fracture fragments, with less displacement, are better imaged with an axillary radiograph.^{9,10} MRI, computed tomography, and sonography are helpful in further evaluating subscapularis tendon status, fracture fragment size, donor site location, fragment comminution and complexity, and concomitant pathology (eg, biceps tendon injury).^{4,6,10}

In our patient's case, MRI helped with our treatment algorithm and surgical planning—it showed a large, noncomminuted fracture fragment, without significant retraction, attached to an edematous but intact subscapularis tendon. No additional pathology was noted.

Treatment

Lesser tuberosity fractures have been treated both operatively and nonoperatively.⁴⁻¹⁷ Although nonoperative treatment with physiotherapy

operatively.⁴ Chronic symptomatic lesser tuberosity fracture nonunions communicate pain anteriorly about the shoulder, and this pain is exacerbated by overhead activity.²⁰ Ogawa and Takahashi⁴ described hyperexternal rotation and pain induction by the anterior apprehension test as findings specific to this injury pattern. Conservative treatment initially should be tried for chronic avulsion of the lesser tuberosity.⁴ Persistence of symptoms warrants surgical repair; symptom improvement after surgery has been well documented.^{4,6-8}

operative fixation to restore the normal mechanics about the shoulder and prevent chronic symptoms. Our patient had satisfactory results after open reduction and suture fixation of the fracture fragment.

AUTHORS' DISCLOSURE STATEMENT AND ACKNOWLEDGMENTS

The authors report no actual or potential conflict of interest in relation to this article.

The authors are employees of the US government. The opinions and assertions contained herein are their

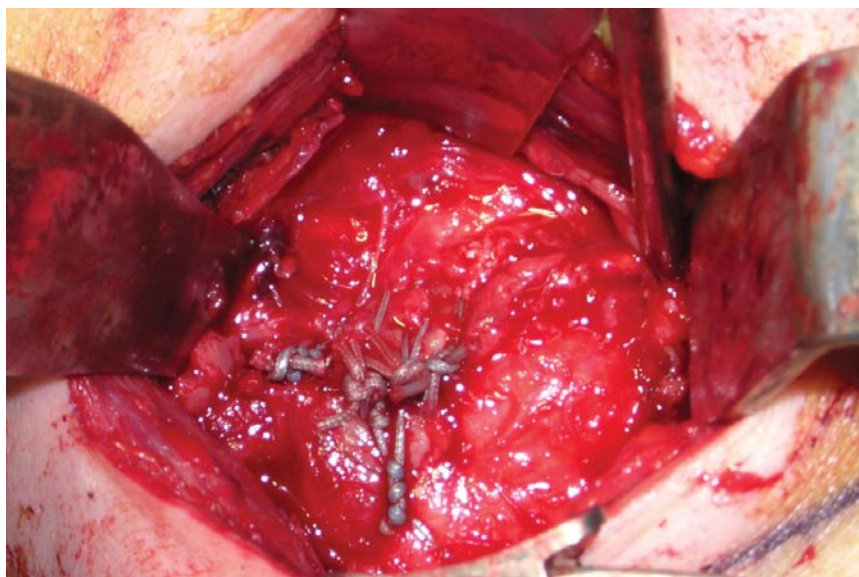


Figure 3. Lesser tuberosity fracture is reduced and secured with heavy, nonabsorbable suture using a mattress stitch.

private views and are not to be construed as official or as reflecting the views of the US Army or the US Department of Defense.

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