

Isolated avulsion fracture of the lesser tuberosity of the humerus

Sofian Nachawati¹, Ioan-Cristian Stoica^{1,2}, Roman Popescu¹, Gavril Gheorghievici^{1,2},
Theodor Moldoveanu¹, Emil-George Haritinian^{1,2}

¹“Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania

²Foisor Clinical Hospital of Orthopedics and Traumatology and Osteoarticular TB, Bucharest, Romania

ABSTRACT

Isolated lesser tuberosity fracture avulsion without an associated posterior shoulder dislocation or in the context of a three- or four-part proximal humerus fracture are extremely rare, with an estimated incidence rate of only 0.46 persons per 100,000. Diagnosis remains challenging, often leading to delayed treatment. In contrast with fractures of the greater tuberosity, there are no displacement guidelines to assist the surgeon in treatment decision-making for lesser tuberosity fractures. The aim of this study was to highlight diagnostic features as well as surgical treatment. We present a case of a 54-year-old male with an isolated lesser tuberosity fracture avulsion. We performed open reduction and osteosynthesis of the lesser tuberosity fragment with suture anchors and transosseous sutures. At 11-month follow-up the patient was able to normally perform his daily living and professional activities, had full, painless range of motion of the affected shoulder and regained almost full strength.

Keywords: isolated fracture, lesser tuberosity of the humerus

INTRODUCTION

Lesser tuberosity fracture may occur either isolated, associated with a posterior dislocation of the shoulder and/or in the context of a three- or four-part proximal humerus fracture [1].

Fractures which involve the proximal end of the humerus represent 5% of all humerus fractures [2]. Isolated lesser tuberosity of the humerus fractures are extremely rare with only 100 cases reported in the literature [3]. Robinson et al. reported an incidence rate for isolated lesser tuberosity fractures lower than 0.46 per 100,000 population per year [1].

Given the location of the lesser tuberosity at the medial side of the humerus it is less likely for a direct trauma to cause the fracture [3]. On that account, the most frequent cause reported in the literature is an avulsion of the lesser tuberosity from forced contraction of the subscapularis muscle tendon when abduction and excessive external rotation of the shoulder occurs [3]. In this case the fracture was caused by a far less common mechanism, electrocution, which resulted in a sudden and involuntary contraction of

the subscapularis muscle. Another infrequent cause is reported in psychiatric patients after electroconvulsive shock therapy [4].

CASE REPORT

A 54-year-old male presented to our clinics five-days after a traumatic event with painful shoulder, limited range of motion especially internal rotation (high level) and positive belly-press test. One day after the event the patient went to emergency room, was immobilized in a Desault bandage and was recommended an antero-posterior and scapular Y conventional radiographies and magnetic resonance imaging (MRI) examination of the shoulder. The injury was caused by electrocution which resulted in a violent and sudden contraction of the subscapularis muscle. On further examination, we found no associated neurovascular injury, marked deformities or ecchymosis.

The primary outcomes examined included the presence of pain, range of motion of the shoulder, belly-press or lift-off evaluation and the strength of

Corresponding author:

Sofian Nachawati

E-mail: nachawatis@yahoo.com

Article History:

Received: 26 December 2022

Accepted: 30 December 2022

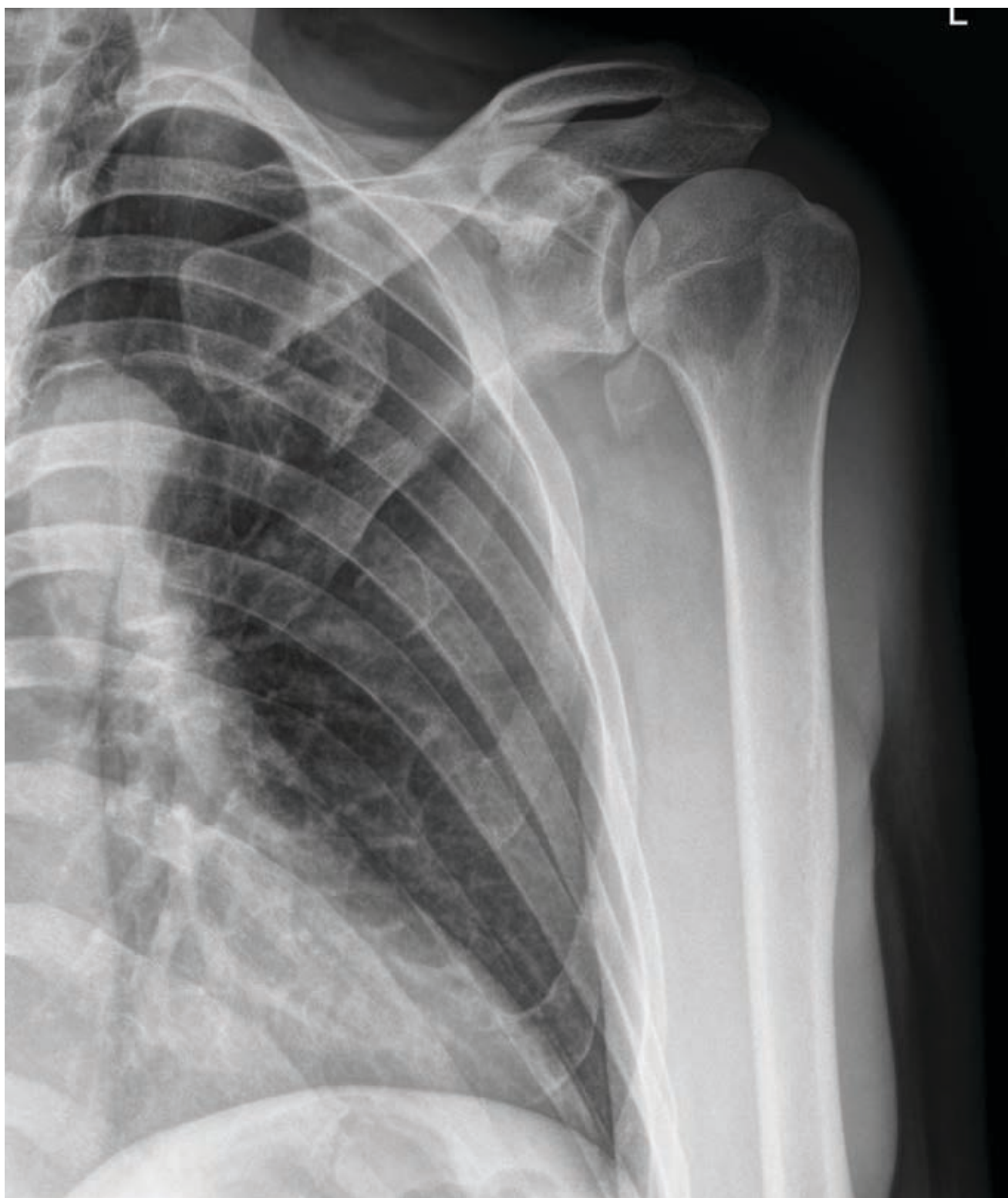


FIGURE 1. Anteroposterior radiograph of the left shoulder shows the displaced lesser tuberosity

the shoulder. We assessed the shoulder range of motion (ROM) by measuring the active anterior elevation (AAE) using a goniometer, abduction (ABD), active external rotation (ER) elbow at the side and internal rotation (IR). For evaluating the internal rotation of the shoulder, we asked the patient to reach the maximal vertebral level using his thumb (the Constant-Murley score methodology was used: zero points were given if the patient was only able to

reach the thigh, two points for buttock, four points for sacrum, six points for L3 lever, eight points for T12 level and ten points for T7 level). Also, we recorded ER (elbow at the side) strength and the Constant-Murley score of 8 points.

The lesser tuberosity avulsion was clearly seen on the shoulder AP x-ray (Figure 1). No other injuries (cuff tears, cartilage) were observed on the shoulder MRI (Figure2).

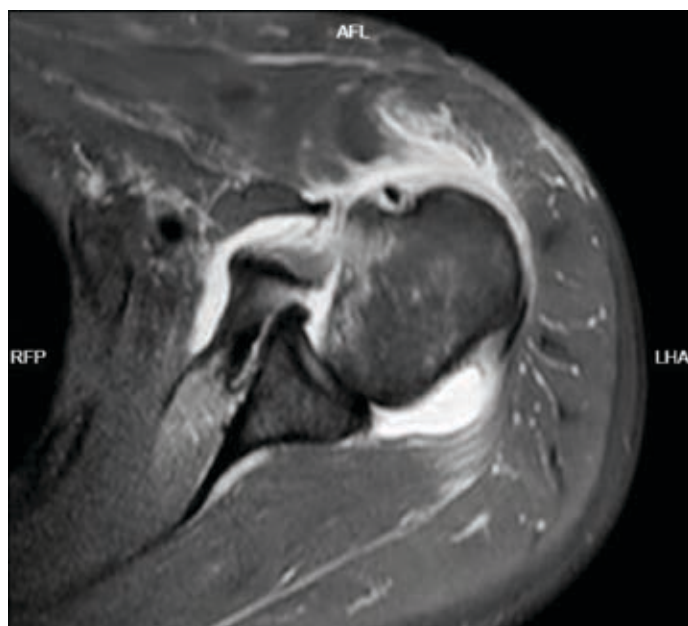


FIGURE 2. Preoperative MRI axial view - avulsion fracture of left lesser humeral tuberosity with an intact attached subscapularis



FIGURE 3. Anteroposterior radiograph after osteosynthesis of the lesser tuberosity

The patient was positioned supine in beach-chair position, under general anaesthesia. A standard deltopectoral approach was performed. The injury pattern of the lesser tuberosity was confirmed through intraoperative visualization. We identified the lesser tuberosity displaced medially relative to the coracoid and measuring less than 2 cm in diameter. The articular surface and the bicipital groove were not affected by the injury. First, we reduced the fracture using traction sutures passed through the subscapularis tendon. Definitive internal fixation of the lesser tuberosity fragment was performed with one all-suture anchor and transosseous sutures, placed through the bone tendon junction.

For four weeks after surgery a shoulder sling in internal rotation and adduction was used. The patient underwent a progressive physical therapy regimen. Hand, wrist and elbow active range-of-motion exercises were started immediately after the surgery. Shoulder passive mobilisation was started five days after surgery and active assisted exercises were begun at two weeks, avoiding external rotation and abduction greater than 90°. After sling removal, active range-of-motion exercises and isometric rotator cuff exercises were commenced and were continued for three months after the surgery. After three months following the surgery, the patient was able to perform exercises against resistance. At 11 months follow-up the patient was able to normally perform his daily living and professional activities and had full, painless range of motion of the affected shoulder [Figure 4]. The Constant-Murley score of 81 points, was evaluated at 11 months follow-up which confirmed the clinical findings. The patient regained most of his internal rotation strength, belly-press, lift-off and bear-hug tests were negative.

DISCUSSION

The radiographic appearance of these fractures can be subtle, they are difficult to diagnose, frequently missed, and poor functional outcomes can result if these injuries are not detected or if



FIGURE 4. Anteroposterior radiograph of the left shoulder at the eleven-month follow-up showing union of the lesser tuberosity

treated inappropriately [5]. A standard antero-posterior and scapular view can confirm the diagnoses in most cases, however Robinson et al. concluded that the size and extent of the avulsed lesser tuberosity can be ill-defined on conventional radiography, and recommends the use of a spiral computed tomography scanning with three-dimensional reconstruction [1]. Computer tomography is useful in analyzing the

size, shape and degree of dislocation of the fragment [6]. The most efficient way to measure the displacement is with antero-posterior view in external rotation and the antero-posterior view with 15° caudal tilt [7]. Ultrasonography and magnetic resonance imaging (MRI) are used when a rotator cuff tear is suspected; however, they can also detect occult tuberosity fractures which were missed on routine plain

radiographs [3]. We were able to successfully confirm the diagnoses with an antero-posterior view, also the MRI helped us in assessing the avulsed lesser tuberosity.

There is a lack of consensus regarding the management for fractures of the lesser tuberosity of the humerus. Some authors consider the best approach is non-operatively, whilst others consider that any amount of displacement is an indication for open reduction and internal fixation, in order to avoid progressive displacement, malunion, non-union, impingement or dislocation of the biceps tendon [5]. It is generally accepted that more than 5mm displacement of the avulsed fragment and 45° of angulation represent an indication for operative treatment [3]. There are a variety of fixation techniques of the lesser tuberosity described in the literature using cannulated screws with or without washers, heavy sutures and cerclage wire [3]. Recently has been described an arthroscopic assisted repair technique using knotless anchors [5]. Cregar et al. have stated that there is no significant difference in clinical results following either surgical or arthroscopic procedure [5]. Also, the benefits of an arthroscopic approach are that there are no instruments that pass through the bone tendon junction, which could lead to further fragmentation, less postoperatively pain, smaller scars and shorter rehabilitation periods [5]. Nevertheless, after arthroscopic repair there is less evidence regarding the long-term functional outcome [1]. The choice of treatment in our case was suture anchor and trans

osseous sutures, placed through the bone tendon junction which made it easier to achieve a secure, anatomic reduction with minimal morbidity. The only suture technique used in this case comes with the advantage of avoiding a second surgery and complication related to implants.

The article has several limitations. Firstly, there is a need for bigger series with a longer follow-up. Secondly, although the clinical follow-up was short, the patient restored the subscapularis function without limitation at the most recent clinical evaluation, thus supporting the assertion that the proposed surgical treatment is effective. Regarding the potential to re-fracture and loss of functional limitations, there is a need for a longer follow-up.

CONCLUSION

A clear understanding of fracture patterns associated lesions and patient characteristics are recommended to obtain satisfactory results. Considering the excellent results, even after a shorter follow-up, associated with surgical treatment as well as the risk of the patient to develop chronic shoulder pain should a non-union develop after nonoperative treatment, it appears beneficial to treat these avulsions surgically. Surgical treatment is recommended in the presence of significant displacement of the lesser tuberosity or limitation of shoulder mobility. Open reduction and internal fixation can provide excellent restoration of movement and shoulder function.

Conflict of interest: none declared

Financial support: none declared

REFERENCES

1. Robinson M, Teoh KH, Baker A, Bell L. Fractures of the Lesser Tuberosity of the Humerus. *J Bone Jt Surg - Ser A*. 2009;91(3):512–20.
2. Kristiansen B, Barfod G, Bredesen J, Erin-madsen J, Grum B, Horsnaes MW et al. Epidemiology of proximal humeral fractures. *Acta Orthop*. 1987;58(1):75–7.
3. Gruson KI, Ruchelsman DE, Tejwani NC. Isolated tuberosity fractures of the proximal humeral: Current concepts. *Injury*. 2008; 39(3):284–98.
4. Earwaker J. Isolated avulsion fracture of the lesser tuberosity of the humerus. *Skeletal Radiol*. 1990;19(2):121–5.
5. Cregar WM, MacLean IS, Verma NN, Trenhaile SW. Lesser Tuberosity Avulsion Fracture Repair Using Knotless Arthroscopic Fixation. *Arthrosc Tech* [Internet]. 2018;7(9):e899–905.doi:10.1016/j.eats.2018.04.015
6. Ohzono H, Gotoh M, Mitsui Y, Kanesaki K, Okawa T, Higuchi F et al. Isolated fracture of the lesser tuberosity of the humerus: A case report. *Kurume Med J*. 2011;58(4):131–3.
7. Parsons BO, Klepps SJ, Miller S, Bird J, Gladstone J, Flatow E. Reliability and reproducibility of radiographs of greater tuberosity displacement: A cadaveric study. *J Bone Jt Surg - Ser A*. 2005;87(1):58–65.