

Combined Greater and Lesser Tuberosity Fracture of Proximal Humerus with Intact Humeral Head and Shaft – A Case Report

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Learning Point of the Article:

Optimal clinicoradiological outcome in such uncommon fracture phenotype depends on accurate pre-operative planning with CT scan and rigid anatomical reconstruction of the tuberosities for faster rehabilitation.

Abstract

Introduction: Combined fracture of greater and lesser tuberosity is an extremely rare injury. Such fracture pattern has not been described in the Neer's, AO Muller, and Jakob's classification system.

Case Presentation: We report a unique fracture pattern consisting of combined greater and lesser tuberosity of the proximal humerus (PH) with intact humeral head and shaft in a 32-year-old female. Routine radiographs and computed tomography scan with three-dimensional reconstruction were advised for better understanding of the fracture pattern, later managed by open reduction and fixation with PH locking plate. The patient has excellent clinical, radiological, and functional outcome at the end of 2 years follow-up.

Conclusion: This is one among the few case reports highlighting this unique variant of PH fracture, not much has been described in the literature about this injury. Anatomic reconstruction of the fractured tuberosities combined with stable construct by PH locking plate facilitates optimum bone healing and aggressive shoulder rehabilitation.

Keywords: Greater tuberosity, humeral head, lesser tuberosity, proximal humerus fracture.

Introduction

Combination of greater and lesser tuberosity fracture in isolation with head shaft continuity is an infrequent phenomenon [1]. Combined tuberosity fractures are often seen concomitantly with anterior or posterior shoulder dislocations. Precise diagnosis and assessing the degree of displacement of lesser tuberosity are difficult on plain radiographs, hence, multiple slice computerized tomography (CT) scan is must for lucid understanding of fracture morphology. Accurate appreciation of such fracture patterns aids in faultless surgical planning and execution. We report a case of displaced fracture of greater as well as lesser tuberosity of the proximal humerus (PH) with no evidence of shoulder dislocation and discontinuity between humeral head and shaft.

Case Report

A 32-year-old right hand dominant female, housemaid by occupation, presented to our outpatient department with pain in the right shoulder and restricted range of motion for 1.5 months. She had a history of fall from stairs 1.5 months back and sustained direct blow to the right shoulder for which she was managed conservatively at local hospital. On clinical examination, she had tenderness over the anterolateral aspect of the right shoulder and abduction, internal rotation and external rotation movements were restricted. There was no associated neurovascular deficit.

Initial impression on plain radiograph anteroposterior (AP) view of the right shoulder showed displaced greater tuberosity fracture with no other obvious bony injury (Fig. 1). CT scan with

Author's Photo Gallery



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Access this article online

Website:
www.jocr.co.in

DOI:
10.13107/jocr.2022.v12.i01.2606

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Submitted: 03/09/2021; Review: 25/11/2021; Accepted: December 2021; Published: January 2022

DOI:10.13107/jocr.2022.v12.i01.2606

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Figure 1: Plain anteroposterior radiograph of the right shoulder showing displaced greater tuberosity fracture with no associated subluxation/dislocation.

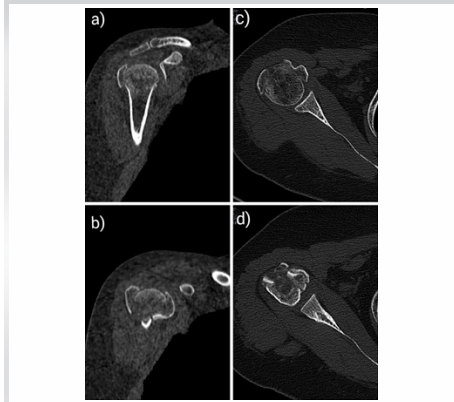


Figure 2: CT scan sagittal cuts (a and b) and axial cuts (c and d) showing greater and lesser tuberosity fragments with head shaft continuity.

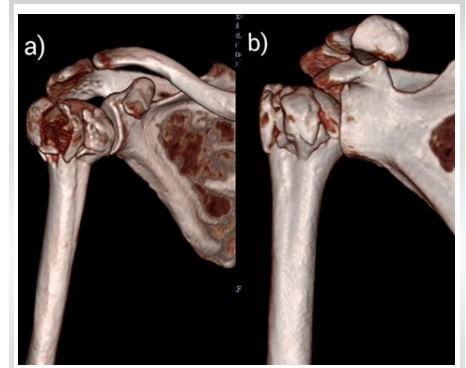


Figure 3: 3-D reconstruction images showing anterior (a) and posterior (b) aspect of the right glenohumeral joint with comminuted greater tuberosity fracture and displaced lesser tuberosity with intact glenohumeral joint.

sagittal and axial cuts demonstrated comminuted greater tuberosity fracture and displaced lesser tuberosity fracture with head shaft in continuity (Fig. 2a-d). CT scan with three-dimensional reconstruction (3-D) was done for further understanding of fracture configuration which confirmed fracture of greater tuberosity which was displaced 10 mm superiorly and 5 mm posteriorly, furthermore, to our surprise, lesser tuberosity fracture displaced 6 mm medially was also noticed (Fig. 3). It also confirmed that there was no impacted fracture between the humeral head and shaft. Open reduction and rigid internal fixation and anatomical reconstruction of tuberosities were the pre-operative plan.

The patient underwent surgery under general anesthesia through deltopectoral approach after obtaining written informed consent. The greater tuberosity was displaced superiorly and posteriorly due to the pull by supraspinatus. The lesser tuberosity was displaced medially due to subscapularis attachment. Ethibond (polyester) suture no. 5 was passed through the subscapularis tendon and lesser tuberosity was

secured. Greater tuberosity was reduced anatomically with the help of Ethibond no.5 passed through the supraspinatus bone tendon junction. The reduction of greater tuberosity was held temporarily with Kirschner wires. PH locking plate was applied and the Ethibond sutures were passed through islets of the plates (Fig. 4). Reconstruction of both the tuberosities and stability of the construct was confirmed under fluoroscopy.

Postoperatively, pendulum exercises were started from the 2nd post-operative day. Shoulder range of motion exercises (active and passive) were started from the 2nd week. At 2 years follow-up, plain radiographs of the right shoulder confirmed united greater and lesser tuberosities (Fig. 5a, 5b). Functional outcome assessed by shoulder range of motion during final follow-up revealed abduction of 160°, flexion of 140° and 30° degrees of internal and external rotations, and excellent UCLA score of 30 (range 16–35).



Figure 4: Intraoperative picture showing PHILOS plate fixation with both the tuberosities secured to the plate through Ethibond no. 5.

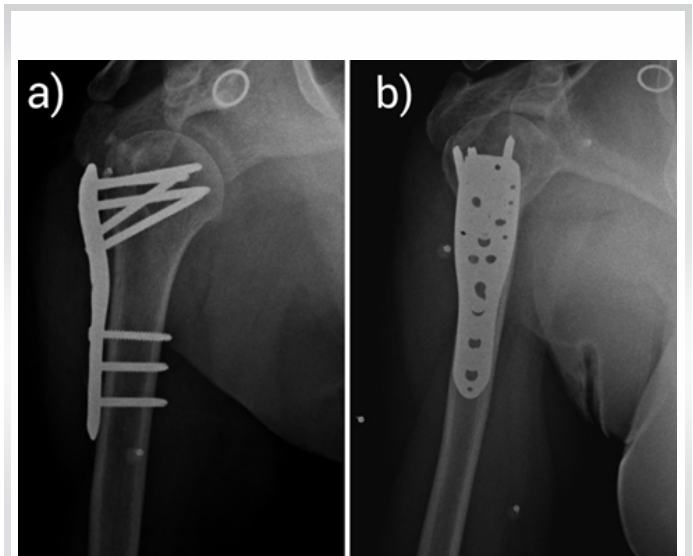


Figure 5: Two years follow-up plain radiographs anteroposterior (a) and lateral (b) views showing anatomical reduction of both the tuberosities with complete radiological healing.

Discussion

A combined fracture of greater and lesser tuberosity is an extremely uncommon injury due to different injury mechanisms for both. Lesser tuberosity fractures which are commonly associated with posterior glenohumeral dislocation usually occur due to contraction of subscapularis muscle when the arm is forced into abduction and external rotation. Approximately 5–30% of anterior shoulder dislocations are complicated by greater tuberosity fractures [2]. Greater tuberosity fracture occurs with a fall on the outstretched hand with the elbow in full extension or flexion or after a direct blow to the lateral aspect of the shoulder. Another reason for their rarity is that they predominantly occur in the young age group, elderly people with osteoporosis usually had three- or four-part PH fracture (PHF) or associated rotator cuff tendon tear [3].

Combined tuberosity fracture with intact humeral shaft is not mentioned in Neer, AO Muller, and Jakob classification [4, 5, 6], few of the commonly followed classification systems for PHFs. In 1934, Codman divided PH into four separate fragments – head, greater tuberosity, lesser tuberosity, and shaft. According to his classification, there are 14 different fracture types possible [7]. This unique fracture pattern can be allocated under Codman's classification system. Operative treatment is indicated if greater tuberosity is displaced by 5 mm or displaced by 3 mm in the case of athletes due to the risk of rotator cuff dysfunction [8]. In lesser tuberosity, fracture operative treatment is recommended for fragment displacement by 5 mm or 45° of angulation, mechanical block to internal rotation, and weakness of terminal internal rotation [9]. The majority of lesser tuberosity fractures are often missed on initial plain radiographs so CT scan with 3-D helps to confirm diagnosis [10].

There are few case reports of combined tuberosity fracture mentioned in the literature [1, 10, 11, 12]. Takase et al. reported a case of combined fracture of greater and lesser tuberosity with head shaft continuity which was managed with screws [13]. Arthroscopic evaluation of the affected glenohumeral joint was done simultaneously to further understand the mechanism of injury and the examination did not reveal any defects, thinning or damage to the articular cartilage, or superior labrum AP

lesions. Based on the above findings, they concluded that this rare fracture pattern was not associated with shoulder dislocation. Pauly et al. managed a similar case by arthroscopic fixation of both the tuberosities through suture anchors [11]. They concluded that in such rare scenario, arthroscopic fixation allows for better visualization and anatomical refixation of the fractured tuberosity as well as therapy for concomitant intra-articular lesions. Meyer et al. reported a similar case a combined tuberosity fracture in a 44-year-old female managed by open reduction and internal fixation using two screws and anatomical reconstruction of tuberosities by reattaching them with sutures [12]. The mechanism of injury in their case was road traffic accident.

In our case, the patient presented to us 1.5 months after the index injury with poor shoulder function and imaging revealed comminuted greater tuberosity fragment, hence, open reduction with stable internal fixation by PHILOS plate and anatomic reconstruction of fractured tuberosities with Ethibond sutured over the plate were planned to promote aggressive post-operative rehabilitation which has ultimately led to acceptable clinical, radiological, and functional outcome at the end of 2-year follow-up.

Conclusion

Combined tuberosity fracture is a distinctive fracture pattern not described well in literature that requires biomechanical in vitro studies to appreciate mechanism of injury, better radiological imaging modalities to understand the fracture anatomy, and meticulous execution of surgical procedure, leading to anatomical reconstruction of both the tuberosities for optimal clinical and functional outcome.

Clinical Message

This rare fracture configuration requires surgical intervention in the form of anatomical reconstruction of greater and lesser tuberosity for optimal functional outcome. Understanding the pathomechanics and diagnosing this fracture type by various radiological modalities allow for pertinent surgical planning and execution.

Declaration of patient consent : The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient's parents have given their consent for patient images and other clinical information to be reported in the journal. The patient's parents understand that his names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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Conflict of Interest: Nil
Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this case report

How to Cite this Article

Yadav AK, Gawhale S, Panchal S, Akshay KS, Mohanty T. Combined Greater and Lesser Tuberosity Fracture of Proximal Humerus with Intact Humeral Head and Shaft – A Case Report. *Journal of Orthopaedic Case Reports* 2022 January;12(1):34-37.