

# Irreducible superolateral dislocation of the glenohumeral joint

Alvin R. Wyatt II<sup>1</sup> · Jack Porrino<sup>1</sup> · Samir Shah<sup>1</sup> · Jason E. Hsu<sup>2</sup>

Received: 24 April 2015 / Revised: 18 May 2015 / Accepted: 25 May 2015 / Published online: 9 June 2015  
© ISS 2015

**Abstract** The overwhelming majority of glenohumeral dislocations are anterior dislocations that either spontaneously reduce or are reduced at the point of care without significant complications. Posterior dislocations are uncommon, and superior and inferior dislocations are even rarer. We present a case of “superolateral” shoulder dislocation in which the entire rotator cuff was torn either off its insertion or at the musculotendinous junction in combination with a large longitudinal split tear of the deltoid muscle. This allowed the humeral head to dislocate both superiorly and laterally into a subcutaneous position through the tear of the anterolateral deltoid muscle with an associated de-gloving soft tissue lesion. Buttonholing of the humeral head through the deltoid and interposition of the dislocated long head of the biceps tendon and macerated rotator cuff prevented closed reduction of the glenohumeral joint. The resultant radiographic appearance and treatment of this dislocation is unique. To our knowledge, this is the first reported case of this dislocation in the literature.

**Keywords** Superior dislocation · Glenohumeral dislocation · Biceps interposition · Irreducible shoulder dislocation · Massive rotator cuff tear

## Introduction

Shoulder stability is dependent upon a complex of static stabilizers (capsule, glenoid labrum, glenohumeral ligaments, articular congruity) and dynamic stabilizers (rotator cuff, deltoid, periscapular musculature) working in concert. Different combinations of derangement to these stabilizers result in the variable forms of shoulder dislocation that have been observed and described in the literature [1]. Shoulder dislocation is one of the most common musculoskeletal injury presentations in the acute care setting. The overwhelming majority of shoulder dislocation can be classified as anterior (95–97 %), in which the humeral head translates anterior relative to the glenoid. Less common forms of shoulder dislocation include the posterior (2–4 %), inferior, and superior subtypes. These can be more challenging to diagnose on radiographs than the anterior shoulder dislocation [2].

Most dislocations either spontaneously reduce prior to presentation or are amenable to closed reduction at the point of care if the dislocation persists at the time of presentation [3, 4]. In certain instances, operative management is required when closed reduction of the dislocated shoulder fails. We present the diagnostic workup and therapeutic intervention for a patient who presented to our institution with a “superolateral” shoulder dislocation that proved irreducible with closed maneuvers due to buttonholing of the humeral head through a longitudinal split tear of the deltoid muscle and interposed soft tissue. To our knowledge, this form of shoulder dislocation has not yet been described in the literature.

---

✉ Jack Porrino  
jporrino@uw.edu

Alvin R. Wyatt, II  
awyatt@uw.edu

Samir Shah  
shshah@uw.edu

Jason E. Hsu  
jehsu@uw.edu

<sup>1</sup> Department of Radiology, University of Washington, 4245 Roosevelt Way NE, Box 354755, Seattle, WA 98105, USA

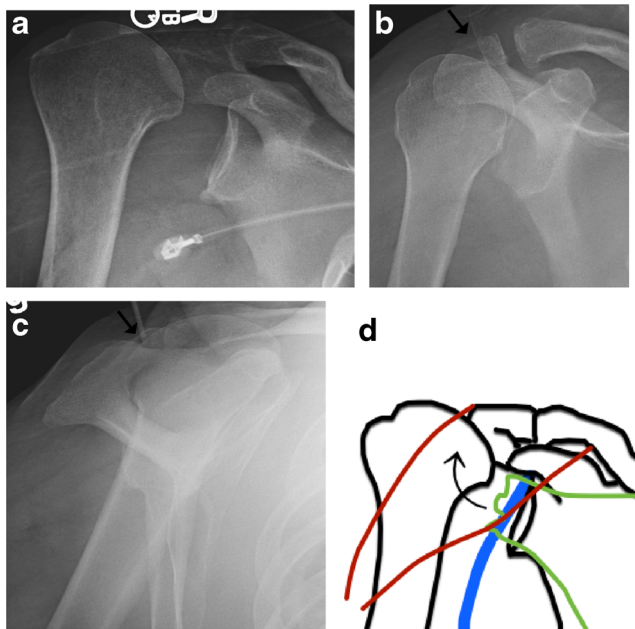
<sup>2</sup> Department of Orthopedic Surgery, University of Washington, 1959 N.E. Pacific St, Box 356500, Seattle, WA 98195-6500, USA

## Case report

A 53-year-old man who was riding in the back of a pickup truck fell out and was subsequently run over by a 1,000-pound compressor that was in tow. He was transferred to our institution with multiple injuries including fractures of the thoracic and lumbar spine with spinal epidural hematoma, fracture of the sternum, multiple bilateral segmental rib fractures resulting in bilateral flail chest, right pneumothorax and pulmonary contusion, bilateral hemothoraces, and extensive liver lacerations.

Dedicated radiographs of the right shoulder acquired due to pain demonstrated a humeral head dislocation superior to the glenoid and lateral to the acromion. There was also fracture of the anterolateral tip of the acromion and regional soft tissue swelling (Fig. 1). His motor examination was normal, aside from minimal weakness of the anterior deltoid. While this could have been the result of stretch/injury to the anterior branch of the axillary nerve, an EMG was not obtained, as the injury was acute, and the middle and posterior deltoid exhibited a normal motor response. The sensory examination was normal, and a 2+ radial pulse, equivalent to the contralateral extremity, was present.

An unsuccessful attempt at closed reduction with conscious sedation was performed by the orthopedic surgery service in the trauma bay of the emergency department. Post-reduction



**Fig. 1** Fifty-three-year-old man with a “superolateral” dislocation of the right glenohumeral joint as well as fracture of the acromion (*black arrow*). Grashey (*a*), frontal (*b*), and scapular-Y (*c*) views demonstrate the humeral head superior to the glenoid and lateral to the acromion. Illustration *d* depicts the abnormal “superolateral” orientation of the humeral head relative to the glenoid, dissecting laterally through the deltoid muscle (*red*), with interposition of the long head biceps tendon (*blue*) and torn rotator cuff, in this case subscapularis (*green*)

radiographs demonstrated persistent “superolateral” dislocation of the joint (Fig. 2).

After his spinal fractures and visceral injuries were addressed, the patient was transferred to the trauma intensive care unit in stable condition. Due to persistent “superolateral” shoulder dislocation despite a previous closed reduction attempt, an MRI was obtained.

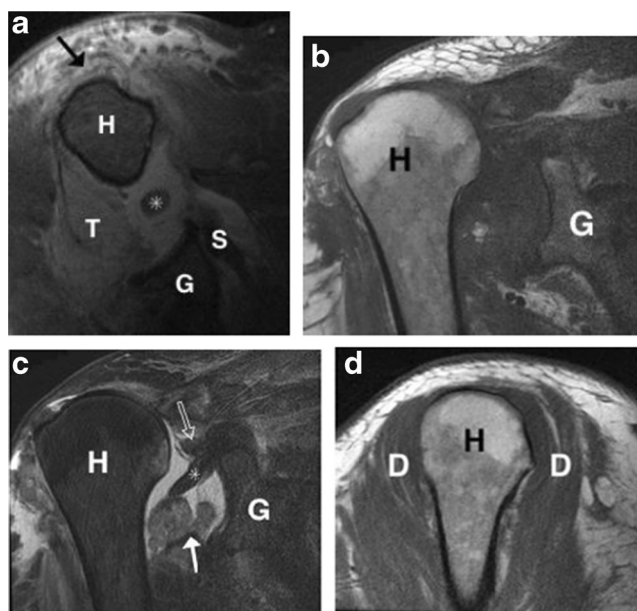
The non-contrast MRI of the right shoulder demonstrated dislocation of the long head biceps tendon into the glenohumeral joint. The tendon was interposed between the glenoid and humeral head. In addition, there were full thickness tears of the supraspinatus, infraspinatus, and subscapularis tendons off their respective footprints, and a full thickness tear of the teres minor at the musculotendinous junction. The humerus was superiorly dislocated relative to the glenoid and also laterally deviated through a large longitudinal split tear within the adjacent deltoid muscle (Fig. 3). This placed the humeral head lateral to the acromial edge. Additional findings on this study included tear of the inferior glenoid labrum and adjacent hyaline cartilage. A degloving-type fluid collection within the subcutaneous fat plane superficial to the deltoid muscle was also present.

Surgical repair of the shoulder was delayed by the development of bilateral pulmonary emboli. Following inferior vena cava filter placement, surgical repair was attempted. Intraoperatively, but prior to surgical intervention, the greater and lesser tuberosities of the humerus could be felt protruding under the anterolateral skin. A superficial abrasion to the anterolateral soft tissues of the shoulder was present (Fig. 4).

A degree of closed reduction was achieved by pulling traction onto the arm, allowing the humerus to be released from the longitudinal split tear of the deltoid muscle. However, as expected, complete reduction could not be achieved due to interposition of the long head biceps tendon and macerated rotator cuff.



**Fig. 2** Fifty-three-year-old man with a “superolateral” dislocation of the right glenohumeral joint as well as fracture of the acromion (*black arrow*). Grashey radiograph after initial attempt at closed reduction demonstrates improvement of a “superolateral” dislocation, however with persistent abnormal superior and lateral displacement of the humerus



**Fig. 3** Fifty-three-year-old man with a “superolateral” dislocation of the right glenohumeral joint. Axial T2-weighted fat-suppressed (a), coronal T1 (b) and T2-weighted fat-suppressed (c), and sagittal T1-weighted (d) images demonstrate superolateral dislocation of the humerus relative to the glenoid, interposition of the long head biceps tendon (*asterisk*) and macerated rotator cuff (*open and closed white arrows*) within the joint, and a large longitudinal split tear of the deltoid muscle (*black arrow*) which the humerus has dissected through. *D* deltoid, *G* glenoid, *H* humerus, *S* subscapularis, *T* teres minor

The patient was placed in the beach-chair position, and a standard deltopectoral approach was utilized. A lateral-based incision was avoided due to the superficial abrasion and severity of the soft tissue injury. There was abundant

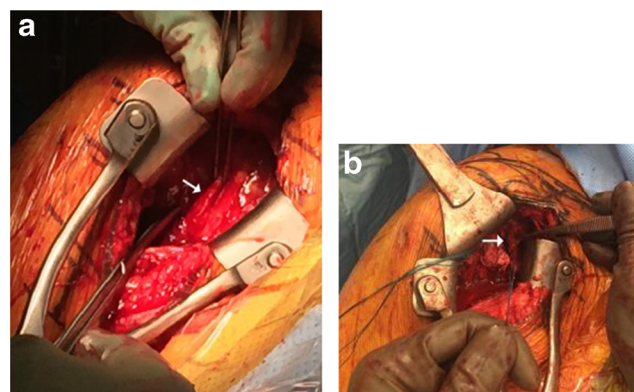


**Fig. 4** Fifty-three-year-old man with a “superolateral” dislocation of the right glenohumeral joint. Intra-operative images demonstrate asymmetry of the shoulders in a neutral upright position (a) and hypermobility of the superolaterally displaced humeral head (b)

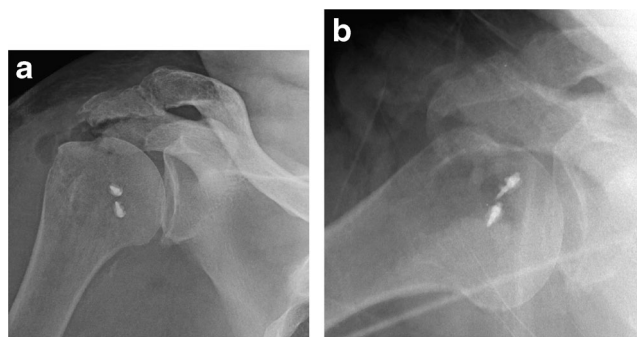
serosanguinous fluid within the subcutaneous tissues of the lateral shoulder, and a 4-cm longitudinal split was found at the junction of the anterior and middle deltoid muscle. After development of the deltopectoral interval, the long head of the biceps tendon was found to be interposed between the humeral head and glenoid (Fig. 5). This was tenotomized at its insertion off the superior labrum. The subscapularis was found to be retracted medially under the conjoined tendon and muscle. The supraspinatus and infraspinatus were found to be torn off their insertion and retracted medially. The teres minor insertion could be palpated on the posterior greater tuberosity and neck. Only the anterior supraspinatus and subscapularis could be repaired through the anterior approach to the shoulder (Fig. 5). A more posterior approach to address the posterior cuff was initially planned, again to avoid the lateral soft tissue injury, but hemodynamic instability precluded repair. After being medically optimized, the patient returned for arthroscopic repair of the remainder of his rotator cuff. Post-operative radiographs confirmed concentric reduction of the humeral head within the glenoid concavity (Fig. 6).

## Discussion

Shoulder dislocation refractory to closed reduction has been described in the literature dating back to the early 20th century [5]. Open surgical reduction is often necessary to address these injuries [6]. Irreducible anterior shoulder dislocation is well documented in the literature [7] and has been attributed to impaction of the humeral head at the glenoid [7, 8], as well as interposition of the rotator cuff muscles/tendons [9–12] or long-head biceps tendon [12–15] within the joint. Interposition of the long head of the biceps tendon within the glenohumeral joint has also been described with an irreducible



**Fig. 5** Fifty-three-year-old man with a “superolateral” dislocation of the right glenohumeral joint. Intra-operative images (*top* is superior, *bottom* is inferior, *left* is lateral, and *right* is medial) demonstrate tendon of the long head of the biceps after being reduced from the glenohumeral joint (in a, the *arrow* points to long head biceps tendon), and stitches within the subscapularis tendon during initial rotator cuff repair (in b, the *arrow* points to the subscapularis tendon)



**Fig. 6** Fifty-three-year-old man with a “superolateral” dislocation of the right glenohumeral joint. Frontal (**a**) and axillary (**b**) postoperative radiographs demonstrate glenohumeral reduction back to anatomic alignment. The metal anchors are at the medial portion of the subscapularis footprint and represent the medial row of a double row repair. The sutures arising from these anchors are tied down and brought out laterally and docked into PEEK (polyether ether ketone) suture anchors. Therefore, the metal sutures are lying on top of the subscapularis, pushing the tendon down onto its footprint. The remainder of the rotator cuff repair (superior and posterior rotator cuff) was performed with PEEK suture anchors, and therefore none are apparent on X-ray

posterior shoulder dislocation [13]. Other less common causes of an irreducible glenohumeral joint to be considered include an entrapped fracture fragment [8, 16] or surrounding nerve, such as the musculocutaneous [17] or axillary nerve [4].

Traditionally, glenohumeral joint dislocation has been classified as anterior (with additional subtypes of subcoracoid, subglenoid, subclavicular, intrathoracic, and retroperitoneal), posterior, inferior (luxatio erecta), or superior [18]. A case report by O’Conner and Klarren [19] in 1956 described an irreducible anterosuperior dislocation with radiographs provided but predating cross-sectional imaging and without surgical correlation. de Laat et al. [20] described a superior dislocation in 1997 where radiographs demonstrated the humeral head anterior to the acromioclavicular joint, and requiring traction in the operating room that provided only temporary reduction. To our knowledge, a case of “superolateral” glenohumeral joint dislocation has not yet been described in the literature.

In our case, the superior and lateral components of this dislocation pattern required a unique combination of a massive rotator cuff tear resulting in mobilization of the humeral head and lack of a superior boundary, as well as a large longitudinal split tear of the anterolateral deltoid muscle in combination with soft tissue interposition within the glenohumeral joint, forcing the humeral head to dislocate lateral to the acromion into the subcutaneous tissues. The radiographic appearance of the “superolateral” shoulder dislocation is unique and suggests complete tear of the rotator cuff with concomitant tear of the deltoid muscle with possible soft tissue interposition within the glenohumeral joint. The radiographic injury pattern should alert the radiologist to the possibility of these extensive underlying soft tissue injuries for which MRI can be obtained for confirmation.

The intervention chosen for our patient was an open glenohumeral reduction and rotator cuff repair. Despite the severity of the injury, there was little damage to the cartilage of the humeral head and the glenoid that would necessitate shoulder arthroplasty. While a reverse shoulder arthroplasty may have more reliably restored shoulder elevation, our patient was extremely young for a constrained implant. Additionally, there was a severe injury to the deltoid muscle, which is required for such a prosthesis to function optimally. An anatomic shoulder replacement (hemiarthroplasty) would not have provided any additional function given the severity of his rotator cuff injury. Further, with the amount of soft tissue injury and degloving, there was a high risk of periprosthetic infection.

Traumatic rotator cuff tears in our patient’s age group reliably heal back down to their respective footprint after repair. However, the tear size, tear location (intratendinous and at the musculotendinous junction, rather than at the tendon–bone interface), tendon retraction, tissue quality, and subsequent stiffness as a result of the severity of the injury all represented poor predictors of shoulder function outcome. In addition, stiffness after injury and the act of rotator cuff repair also contribute to functional limitations. With an understanding of these restrictions, the procedure was carried out with the goal of providing a stable shoulder capable of performing activities of daily living. At 6-week follow-up, the patient demonstrated limited elevation due to immobilization after rotator cuff repair and adhesion formation. There were no neurologic deficits. If necessary, a reverse shoulder arthroplasty could be considered in the future.

**Conflict of interest** The authors declare that they have no conflicts of interest.

## References

1. Farrar NG et al. An overview of shoulder instability and its management. *Open Orthop J.* 2013;7:338–46.
2. Downey Jr EF et al. Unusual dislocations of the shoulder. *AJR Am J Roentgenol.* 1983;140(6):1207–10.
3. Gahu AR, Jago ER. Irreducible acute anterior shoulder dislocation. *Int J Clin Pract.* 2004;58(12):1184–6.
4. Frank MA et al. Irreducible luxatio erecta humeri caused by an aberrant position of the axillary nerve. *J Shoulder Elb Surg.* 2012;21(7):e6–9.
5. Jonas AF. Old irreducible dislocations of the shoulder joint. *Ann Surg.* 1910;51(6):890–908.
6. Jonas AF. Contribution to the literature of old irreducible dislocations of the shoulder-joint. *Ann Surg.* 1903;37(5):756–65.
7. Lam SJ. Irreducible anterior dislocation of the shoulder. *J Bone Joint Surg (Br).* 1966;48(1):132–3.
8. Mihata T et al. Case report: irreducible acute anterior dislocation of the shoulder caused by interposed fragment of the anterior glenoid rim. *J Orthop Sci.* 2000;5(4):404–6.

9. Vichard P. Irreducible shoulder dislocation caused by interposition of the rotator cuff. Apropos of 2 cases. *Acta Orthop Belg.* 1981;47(1):113–22.
10. Bridle SH, Farris BD. Irreducible acute anterior dislocation of the shoulder: interposed subscapularis. *J Bone Joint Surg (Br).* 1990;72(6):1078–9.
11. Connolly S et al. Irreducible anterior dislocation of the shoulder due to soft tissue interposition of subscapularis tendon. *Cases J.* 2009;2: 9075.
12. Seradge H, Orme G. Acute irreducible anterior dislocation of the shoulder. *J Trauma.* 1982;22(4):330–2.
13. Day MS et al. Irreducible anterior and posterior dislocation of the shoulder due to incarceration of the biceps tendon. *Int J Should Surg.* 2010;4(3):83–5.
14. Allard JC, Bancroft J. Irreducible posterior dislocation of the shoulder: MR and CT findings. *J Comput Assist Tomogr.* 1991;15(4): 694–6.
15. Inao S et al. Irreducible acute anterior dislocation of the shoulder: biceps tendon. *J Bone Joint Surg (Br).* 1990;72(6):1079–80.
16. Oni OOA. Irreducible anterior dislocation of the shoulder due to a loose fragment from an associated fracture of the greater tuberosity. *Injury.* 1983;15:138.
17. Gudena R et al. Irreducible shoulder dislocation—a word of caution. *Orthop Traumatol Surg Res.* 2011;97(4):451–3.
18. Sheehan SE, Gaviola G, Gordon R, Sacks A, Shi LL, Smith SE. Traumatic shoulder injuries: a force mechanism analysis—glenohumeral dislocation and instability. *AJR Am J Roentgenol.* 2013;201(2):378–93.
19. O’Conner SJ, Klarren HE. Recurrent anterior superior dislocation of the glenohumeral joint. *J Bone Joint Surg Am.* 1956;38-A(4): 889–90.
20. de Laat EA, Posthuma BJ, van Douveren FQ, Kieft GJ. An irreducible superior dislocation of the glenohumeral joint. *Arch Orthop Trauma Surg.* 1997;116(4):249–50.