Skeletal Radiology (2019) 48:1131–1135
https://doi.org/10.1007/s00256-018-3137-8

CASE REPORT

Posterior dislocation of the long head biceps tendon: a case report, specific radiographic finding, and review of the literature

Peter Moreau[1] · Michael Bresler[1] · Benjamin Goldberg[2] · Winnie A. Mar[1]

Received: 10 October 2018 / Revised: 13 December 2018 / Accepted: 13 December 2018 / Published online: 5 January 2019

Abstract
Posterior dislocation of the long head of the biceps tendon uncommonly occurs with traumatic shoulder injury. The diagnosis is almost always associated with anterior shoulder dislocation which often cannot be reduced. We present a case of traumatic posterior dislocation of the long head of the biceps tendon with no reported history of shoulder dislocation, but instead a rare and specific radiographic finding. The imaging features are described, the relevant literature reviewed, and salient features discussed.

Keywords Posterior dislocation of the long head of the biceps tendon · Biceps tendon injuries · Shoulder dislocation

Introduction

Shoulder dislocations may be associated with a multitude of additional injuries, including fractures, rotator cuff tears, nerve damage, or vascular compromise [1]. An uncommon injury is dislocation of the long head of the biceps tendon (LHBT). Medial dislocation of the LHBT is relatively common and associated with subscapularis tendon tears [2]. A less common, but well documented injury is interposition of the LHBT between the humeral head and a large greater tuberosity fracture [3]. Posterior dislocation of the LHBT is much less common and is typically discovered after a nonreducible anterior shoulder dislocation, or in patients with a decreased range of motion after a recent shoulder dislocation. We present a case of posterior LHBT dislocation in a patient with chronic shoulder pain after trauma, no history of anterior shoulder dislocation, and a rare but specific radiographic finding.

✉ Peter Moreau
pmorea2@uic.edu

[1] Department of Radiology, University of Illinois at Chicago, 1740 W Taylor Street Rm 2483, (MC 931), Chicago, IL 60612, USA

[2] Department of Orthopaedics, University of Illinois at Chicago, 835 S. Wolcott Ave Rm 270, (M/C 844), Chicago, IL 60612, USA

Case report

A 54-year-old man presented to the orthopedic clinic for shoulder pain lasting 3 months, which was made worse with movement. His pain began immediately after a bike accident, at which time he also sustained a right tibial fracture repaired with open reduction and internal fixation at an outside institution. He denied being diagnosed with shoulder dislocation or receiving shoulder reduction at the outside institution. He does not remember if he received shoulder radiographs at that time. On examination, there was reduced passive range of motion with all movements, and examination of his strength was limited by pain.

Right shoulder radiographs (Fig. 1) obtained at this first clinic visit, which were limited by the patient's reduced mobility, did not demonstrate a fracture or dislocation at the shoulder joint. Nodular calcification was identified along the anterolateral proximal humerus, which was of uncertain etiology at the time, but appeared non-aggressive. At this time, the patient opted for physical therapy. A right shoulder MRI was scheduled 2 weeks later.

An unenhanced right-shoulder MRI (1.5 T, GE) demonstrated several abnormalities. The long head biceps tendon was not identified within the bicipital groove, but extended posterior to the humeral head with focal thickening and intermediate signal intensity (Fig. 2). The supraspinatus tendon was torn and the musculotendinous junction retracted medial to the glenohumeral joint (Fig. 3a). The infraspinatus tendon was also torn (Fig. 3b), and the muscle mildly atrophic. The size of the rotator cuff tear was 2.5 × 3.5 cm (transverse by

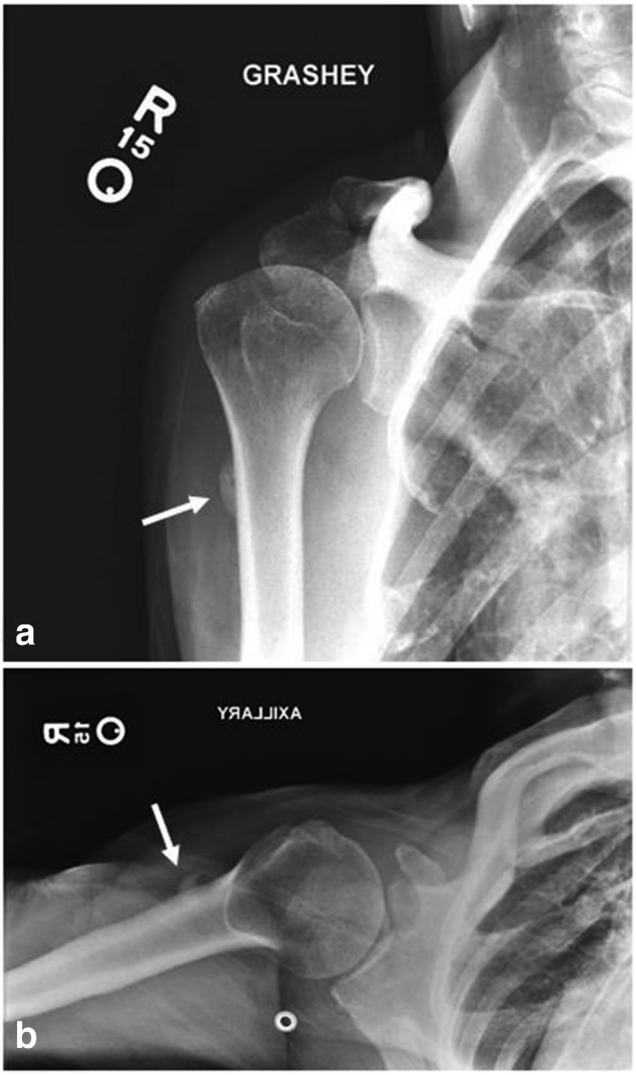

Fig. 1 **a** Antero-posterior Grashey radiograph of the right shoulder shows the normal relationship of the humeral head with the glenoid. Curvilinear calcifications (*arrow*) are seen along the proximal lateral humeral diaphysis. **b** Axillary view radiograph of the right shoulder shows no fracture or dislocation. Again, curvilinear calcifications are seen along the proximal humeral diaphysis (*arrow*)

anteroposterior). Although the subscapularis tendon was intact, a defect in the transverse ligament was present (Fig. 2c). There was no bony Bankart, Hill–Sachs deformity or bone contusions. No labral tear was visible (Fig. 4). Last, edema is present within the anterior deltoid muscle with thickening and increased signal in the anterior deltoid tendon. At this time, the patient opted to continue the plan of physical therapy.

After several months of physical therapy, the patient demonstrated no improvement in pain or mobility. At this time, patient opted for surgery, 9 months after the initial injury.

Arthroscopy revealed frayed and loose synovial tissue, and a capsular release was performed. At this point, the long head biceps tendon was visualized and confirmed to travel posterior to the humeral head (Fig. 5). A biceps tenotomy was performed, as it was felt that the patient would not benefit from tenodesis. Attention was turned to the rotator cuff, which was underneath a large amount of fibrous tissue, consistent with scarring. The rotator cuff demonstrated a large tear that was felt to be too large to repair. Subacromial decompression was completed, and finally the distal clavicle was excised.

The patient was followed in the orthopedic clinic at 3 days and then 6 weeks postoperatively. At the 6-week follow-up, the patient reported improvement in pain, but residual stiffness and decreased range of motion. On examination, the patient showed improvement in all range of motion activities, though still reduced compared with the contralateral limb.

Discussion

This case adds to a small cohort of reports on posterior dislocation of the LHBT—with 10 case reports found to our knowledge in the past 40 years. Except for two cases in which the mechanism of injury stated was "falling" [4, 5] and another in which trauma could not be determined because the patient's developmental delay limited her ability to provide a history [6], all cases of posterior dislocation of the LHBT involved high-energy trauma, including falling from a tall height [7], bicycle collision, or motor vehicle accident [8–12]. The symptoms of posterior dislocation of the LHBT are nonspecific, including shoulder pain and decreased range of motion, and are present in all reports where symptoms are specified, including this case [5, 7, 8, 11–13]. All previous reports are also associated with anterior shoulder dislocation, whether observed on physical examination or seen radiographically. Our case is unique as there is no clear clinical history of anterior shoulder dislocation. However, it remains possible that our patient did initially have a shoulder dislocation, which spontaneously reduced without the patient realizing or understanding the occurrence, as no other mechanism can be conceived.

The posterior dislocation of LHBT is almost always associated with rotator cuff tear. Rotator cuff tears are a commonly accepted associated injury of anterior shoulder dislocation, with Itoi and Tabata reporting a 15% incidence of rotator cuff tears in a prospective cohort of 109 patients with anterior glenohumeral dislocation [14]. Although several additional studies find similar results, the methods used to distinguish acute versus chronic rotator cuff years are not well described. In a prospective study, Loew et al. found that kinking of the torn rotator tendon (sensitivity 64%, specificity 68%) and edema of the musculotendinous junction of the torn supraspinatus or infraspinatus tendon (sensitivity 62.5%, specificity 96%) on MRI are indicators of an acute rotator cuff tear [15]. In their study, all patients with a history of acute shoulder injury underwent MRI within 6 weeks of the injury. Our patient had an MRI 3 months after his injury and shows neither tendon

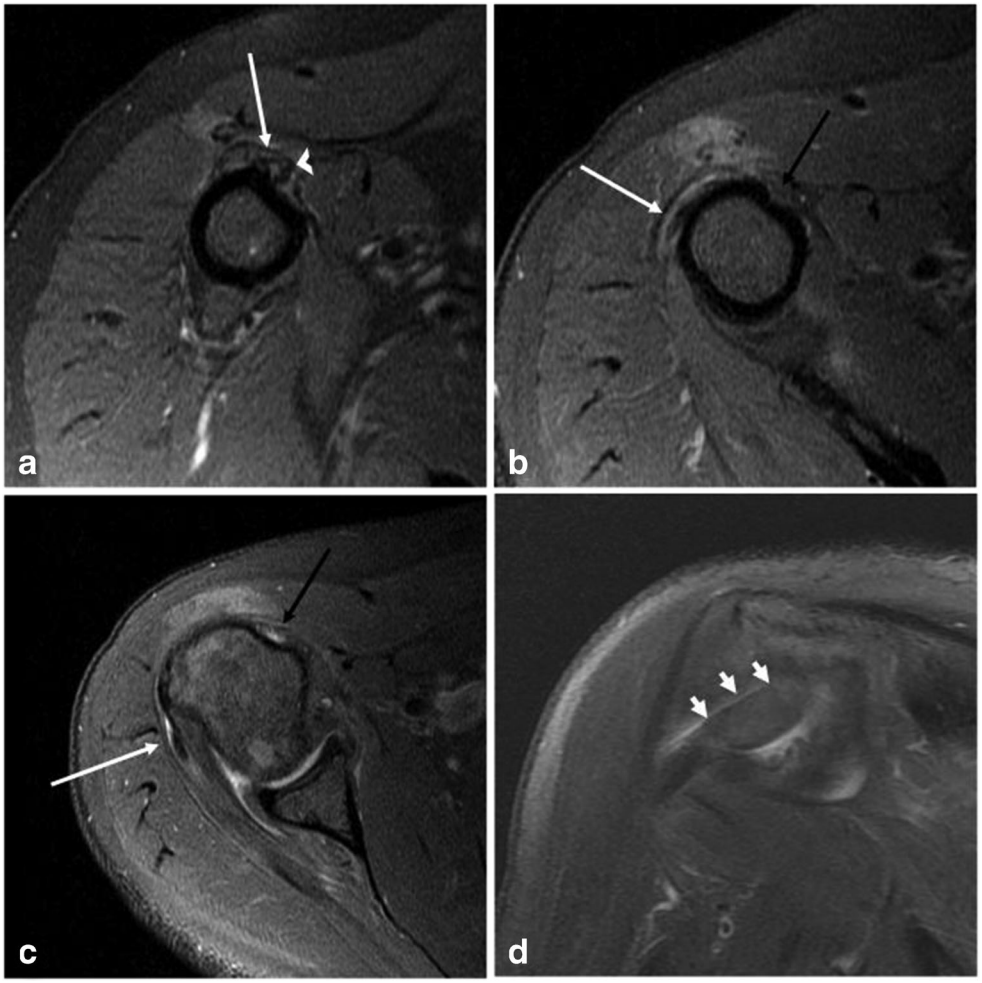

Fig. 2 **a** Axial proton density image with fat suppression shows the long head biceps tendon (LHBT) in the proximal intertubercular groove (*white arrow*), where it can be seen lateral to its torn tendon sheath (*arrowhead*). There is periosteal edema at the lateral aspect of the humeral shaft, likely related to the humeral periosteal sleeve avulsion and correlating with the area of calcification on radiographs. Additional edema is present within the adjacent deltoid muscle. **b** More superiorly, the intertubercular groove is empty (*black arrow*) and the LHBT is seen along the lateral aspect of the proximal humeral metaphysis (*white arrow*). **c** At the level of the inferior glenohumeral joint, the intertubercular groove is again empty (*black arrow*) and the LHBT is posterior to the humeral head, superficial to the teres minor tendon (*white arrow*). **d** Coronal proton density-weighted image with fat suppression shows the aberrant location of the LHBT (*white arrows*) posterior to the humeral head. The tendon is thickened, as shown by intermediate signal

kinking nor edema at the musculotendinous junction. However, patients with posteriorly dislocated LHBT may demonstrate a unique mechanism of rotator cuff tears as the displaced LHBT must physically violate at least one lateral stabilizer to become posteriorly displaced, including the transverse humeral ligament, the supraspinatus tendon, and/or the infraspinatus tendon. This sequence of injury is not well established. It is possible that at the time of anterior shoulder dislocation, the LHBT tears through the transverse humeral ligament, dislocates posteriorly, and tears the supraspinatus and infraspinatus tendon in the process [8]. Alternatively, the supraspinatus and infraspinatus tendons may tear as a result of glenohumeral dislocation, providing a path of least resistance for the dislocated LHBT [10]. In an article by Rakofsky et al., there was no observed rotator cuff tear. However, the authors did hypothesize that the LHBT might strip the periosteal insertions of the rotator cuff [7]. In Mullaney et al., the supraspinatus tendon remained intact and attached to a greater tuberosity fracture; the infraspinatus and teres minor tendons were however disrupted [10]. In Day et al., CT was performed, which is limited in evaluation for rotator cuff tear, and the provided intraoperative findings did not address the rotator cuff [6]. Our patient had a defect in the transverse humeral ligament and large supraspinatus and infraspinatus tendon tears, likely subacute tears given the mechanisms described above.

Our patient also demonstrated increased signal in the anterior deltoid tendon and muscle, compatible with a partial tear. Deltoid tendon and muscle tears have been reported to be a potential sequela of chronic large rotator cuff tear, likely the

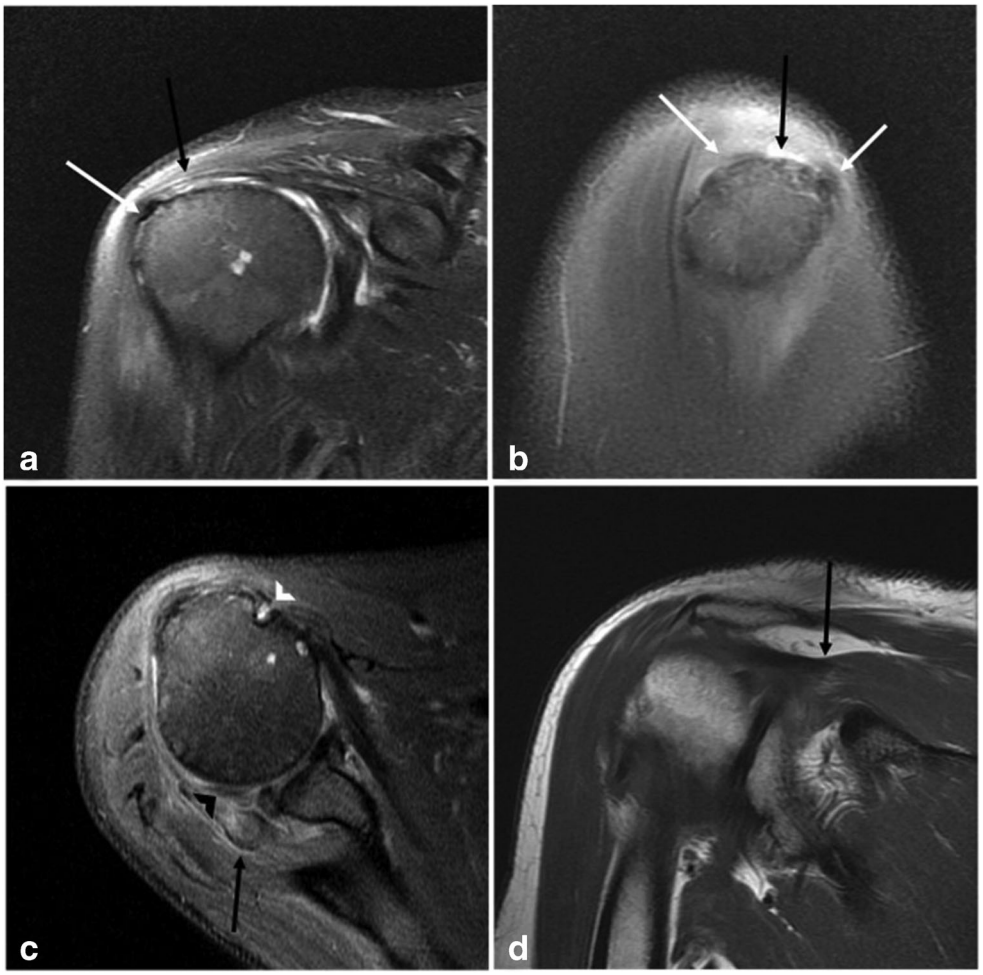

Fig. 3 **a** Coronal proton density-weighted image with fat suppression shows a large full-thickness tear of the supraspinatus tendon (*black arrow*). A portion of the footprint is still attached to the greater tuberosity (*white arrow*). **b** Sagittal proton density-weighted image with fat suppression shows a full-thickness tear of both the supraspinatus tendon (*black arrow*) with an infraspinatus tendon stump seen posteriorly and a supraspinatus tendon stump seen anteriorly (*white arrows*). **c** Axial proton density-weighted image with fat suppression shows a tear in the transverse ligament (*white arrowhead*). Posterior to the glenoid is the torn, retracted, and thickened infraspinatus tendon (*black arrow*) and posteriorly dislocated LHBT (*black arrowhead*). **d** Coronal proton density-weighted image shows the retraction of the supraspinatus musculotendinous junction medial to the glenoid (*black arrow*)

etiology in our case [16]. Greater tuberosity fractures, not seen in our case, occurred in half of reported cases [4, 10, 11, 13]; however, it should be noted that there was no interposition of the LHBT between the greater tuberosity fragment and the humeral head, making these cases distinct from other reported cases [3].

On radiographs, calcifications along the proximal humerus are identified in patients with a delay in initial imaging [7, 8, 12]. Rakofsky et al. hypothesized that these calcifications might represent myositis ossificans associated with the LHBT injury [7]. Freeland and Higgins reported the source of calcification in their paper as avulsion of the proximal humerus periosteal sleeve [12]. This finding is rare but demonstrates a characteristic appearance in both the prior reports and our case, suggesting a specific radiographic sign for subacute posterior dislocation of the LHBT. Had this association been

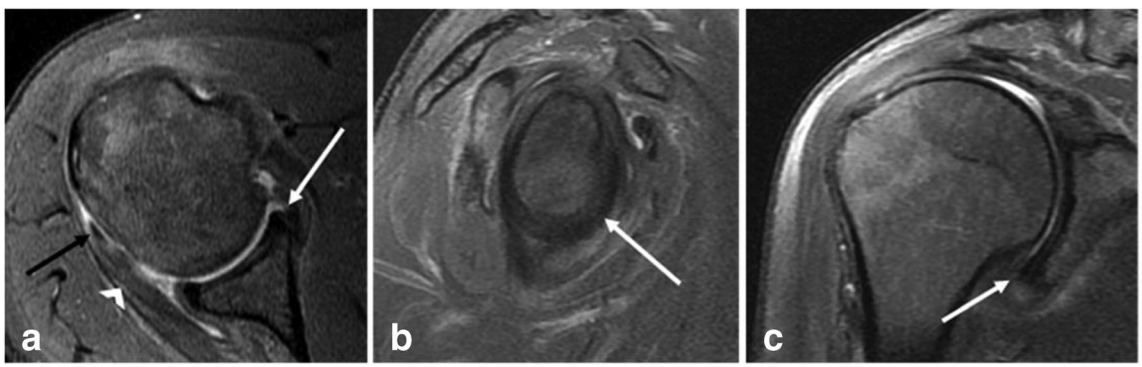

Fig. 4 **a** Axial, **b** sagittal, and **c** coronal proton density-weighted images with fat suppression show that the anterior–inferior labrum is intact (*white arrow*). In **a**, the posteriorly dislocated LHBT (*black arrow*) is shown in close approximation to the torn infraspinatus tendon (*white arrowhead*)

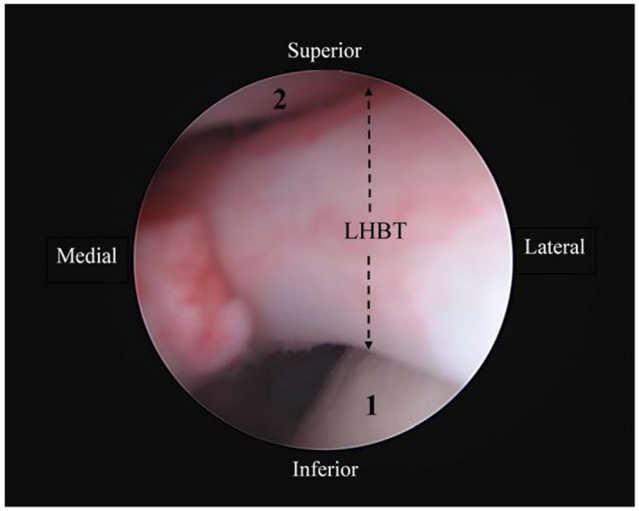

Fig. 5 Arthroscopic image from a posterior portal shows a thickened LHBT posterior to the humeral head (*1*). Label *2* marks the rotator cuff

recognized in our case, the correct diagnosis could have been made sooner. MRI provides the definitive diagnosis and clearly depicts the aberrant location of the LHBT.

Open surgery—rather than arthroscopy—was pursued in all the patients for whom the surgical approach was noted. Six patients were treated by tenodesis [6, 8, 9, 11–13]. Another case "re-sited" the LHBT within the bicipital groove [10]. In 2 cases, like this one, it was decided to perform a tenotomy [4, 7]. All patients with rotator cuff tear, except ours, elected to repair the injury.

In summary, posterior dislocation of the LHBT is a rare occurrence, previously always associated with anterior shoulder dislocation. This is the first reported case of posterior LHBT dislocation without a known shoulder dislocation. This case also raises awareness of the unique calcifications that can be adjacent to the proximal humerus on delayed radiographs with these injuries. Last, this case also provides a unique arthroscopic correlation of this injury.

Authors' contribution Peter Moreau: primary manuscript author, manuscript design, literature review, data acquisition, provided initial draft and revisions, corresponding author.

Michael Bresler: initial concept, editing/revision of the manuscript.

Benjamin Goldberg: editing/revision of the manuscript, orthopedic clinical expertise, provided the arthroscopic image.

Winnie A Mar: initial concept, editing/revision of the manuscript, principal mentor to the first author.

Compliance with ethical standards

Conflicts of interest The authors declare that they have no conflicts of interest.

Disclosure No disclosures.

References

1. Robinson CM, Shur N, Sharpe T, Ray A, Murray IR. Injuries associated with traumatic anterior glenohumeral dislocations. J Bone Joint Surg. 2012;94(1):18–26.
2. Walch G, Nové-Josserand L, Boileau P, Levigne C. Subluxations and dislocations of the tendon of the long head of the biceps. J Shoulder Elbow Surg. 1998;7(2):100–8.
3. Pantazis K, Panagopoulos A, Tatani I, Daskalopoulos B, Iliopoulos I, Tyllianakis M. Irreducible anterior shoulder dislocation with interposition of the long head of the biceps and greater tuberosity fracture: a case report and review of the literature. Open Orthop J. 2017;11(1):327–34.
4. McArthur C, Welsh F, Campbell C. Posterior dislocation of long head of biceps tendon following traumatic anterior shoulder dislocation: imaging and intra-operative findings. J Radiol Case Rep. 2013;7(9):19.
5. Seradge H, Orme G. Acute irreducible anterior dislocation of the shoulder. J Trauma. 1982;22(4):330–2.
6. Day MS, Epstein DM, Young BH, Jazrawi LM. Irreducible anterior and posterior dislocation of the shoulder due to incarceration of the biceps tendon. Int J Shoulder Surg. 2010;4(3):83.
7. Rakofsky M, Arias C, Wagner JJ. Case report 633. Posterior dislocation of the long head of the biceps tendon without fracture of the tuberosity. Skeletal Radiol. 1990;19(7):532–4.
8. Bauer T, Vuillemin A, Hardy P, Rousselin B. Posterior dislocation of the long head of the biceps tendon: a case report. J Shoulder Elbow Surg. 2005;14(5):557–8.
9. Inao S, Hirayama T, Takemitsu Y. Irreducible acute anterior dislocation of the shoulder: interposed bicipital tendon. J Bone Joint Surg Br Vol. 1990;72(6):1079–80.
10. Mullaney P, Bleakney R, Tuchscherer P, Boynton E, White L. Posterior dislocation of the long head of biceps tendon: case report and review of the literature. Skeletal Radiol. 2007;36(8):779–83.
11. Wortley P, Omar L, Robertson W, Moore D, Sims GC, Omar H. Nonreducible shoulder due to acute posterior dislocation of the long head of the biceps tendon. JBJS Case Connect. 2014;4(1):e26.
12. Freeland AE, Higgins RW. Anterior shoulder dislocation with posterior displacement of the long head of the biceps tendon. Arthrographic findings. A case report. Orthopedics. 1985;8(4):468.
13. Strobel K, Treumann TC, Allgayer B. Posterior entrapment of the long biceps tendon after traumatic shoulder dislocation: findings on MR imaging. AJR Am J Roentgenol. 2002;178(1):238.
14. Itoi E, Tabata S. Rotator cuff tears in anterior dislocation of the shoulder. Int Orthop. 1992;16(3):240–4.
15. Loew M, Magosch P, Lichtenberg S, Habermeyer P, Porschke F. How to discriminate between acute traumatic and chronic degenerative rotator cuff lesions: an analysis of specific criteria on radiography and magnetic resonance imaging. J Shoulder Elbow Surg. 2015;24(11):1685–93.
16. Ilaslan H, Iannotti JP, Recht MP. Deltoid muscle and tendon tears in patients with chronic rotator cuff tears. Skeletal Radiol. 2007;36(6):503–7.