견관절 골절 및 탈구 환자에서 관절내로의 액와신경의 노출

Axillary nerve Exposure in Shoulder Fracture-Dislocation

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Introduction

No report has been previously issued on axillary nerve exposure in combination with a Bankart lesion and capsular tear in a case of fracture-dislocation of the shoulder. Here, the authors report such a case and review relevant literature.

Case

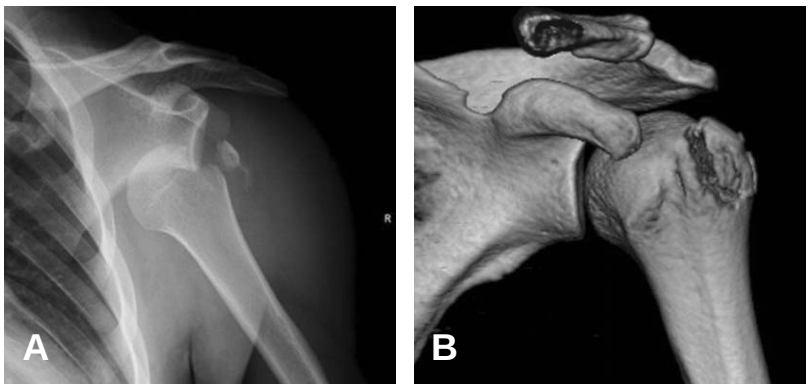

Fig. 1. Anteroposterior radiograph of the left shoulder showing an avulsion fracture of the greater tuberosity and anterior dislocation (**A**). Post-reduction three-dimensional CT (**B**) shows a comminuted avulsion fracture in the greater tuberosity of the proximal humerus (**B**).

A 27-year-old man sought evaluation in our emergency room for a presumed left shoulder dislocation which he sustained falling off a mountain bike. The patient complained of severe swelling and ecchymosis in the anterior aspect of the shoulder joint. He could not move the shoulder joint whatsoever, but did not complain of a tingling sensation or numbness. An anteroposterior radiograph of the left shoulder revealed an avulsion fracture of the greater tuberosity (GT) and anterior dislocation (Fig. 1A). Closed reduction was performed using the modified Hippocrates method, and a sling and swathe were applied. Post-reduction three-dimensional CT evaluation showed a comminuted avulsion fracture in the GT of the proximal humerus (Fig. 1B). T2 fat-suppressed oblique coronal MR imaging revealed a capsular tear in an

oblique direction and axillary nerve exposure in the direction of the inferior aspect of the capsular midportion, and T2-fat suppressed oblique sagittal MR imaging revealed a rupture in the inferior aspect of the subscapularis muscle and axillary nerve exposure (Fig. 2A, B). Three days after the injury, shoulder swelling had diminished and arthroscopic treatment was initiated.

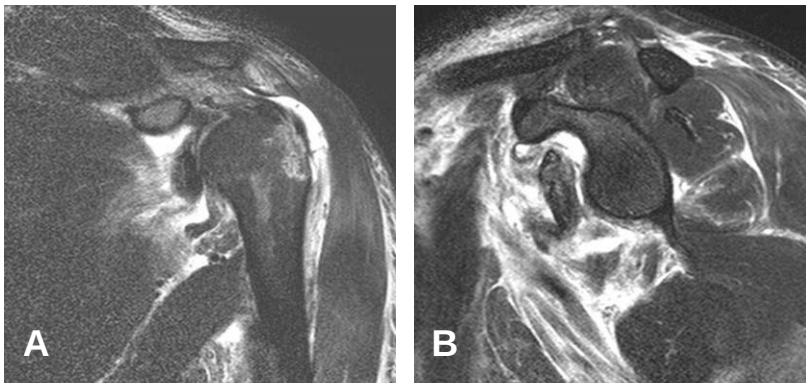

Fig. 2. (**A**) T2 fat suppressed oblique coronal MR image showing a capsular tear with an oblique direction and exposure of the axillary nerve in the same direction at the inferior aspect of the capsular midportion. (**B**) T2 fat suppressed oblique sagittal MR image showing rupture in the inferior aspect of subscapularis muscle and the exposed axillary nerve.

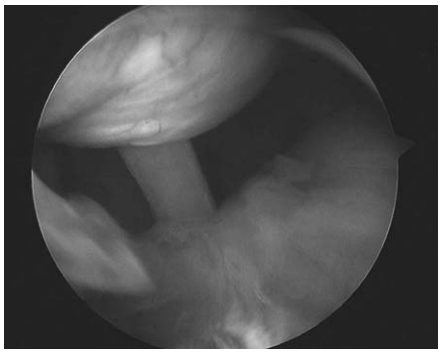

Fig. 3. Arthroscopy finding showing the axillary nerve and sheath between the torn capsule.

The patient was placed in the lateral decubitus position. Standard anterior and posterior portals were used with a pump inflow of 50 mmHg. A 30° 4.5-mm arthroscope (Stryker, Kalamazoo, MI) was inserted through the posterior portal and the intra-articular lesions were examined. A complete capsular tear was observed and the muscle belly of the subscapularis was recognized through the torn capsule. The axillary nerve was identified under the torn subscapularis muscle between the 4- and 8-o'clock position and was enclosed within the nerve sheath under the ruptured inferior joint capsule and the inferior glenohumeral ligament (IGHL)

(Fig. 3). The inferior capsule and anterior and posterior bundles of the IGHL had torn together.

In the anteroinferior aspect, a Bankart lesion was identified from 4 to 6 o'clock. The capsular tear was identified on the anteroinferior aspect (from 4 to 6 o'clock) of the glenoid. The lower portion of the capsular tear was at the 7:00~8:00 o'clock position. Initially, we repaired the upper portion of the torn capsule to the glenoid rim at the 4:00 to 5:00 o'clock position using 2 FASTEK anchors (Arthrex, Naples, FL), a suture hook (Linvatec, Largo, FL) was then used to pass a shuttle relay suture (2-0 nylon, Somerville, NJ) and the upper and lower margins of the capsular tear were repaired using two No. 2 Ethibond sutures (Ethicon, Somerville, NJ) in a side-to-side fashion (Fig. 4A, B). The muscle belly of the subscapularis and the exposed axillary nerve, which had been visible through the tear site, were covered completely by the repaired capsule. After complete capsular repair, we turned the arthroscope superiorly and found superior displacement of a bone fragment formed by the GT fracture. Debridement was performed using a shaver on the intra-articular fracture surface. A double row suture anchor fixation method was used to achieve rigid GT fracture fixation.

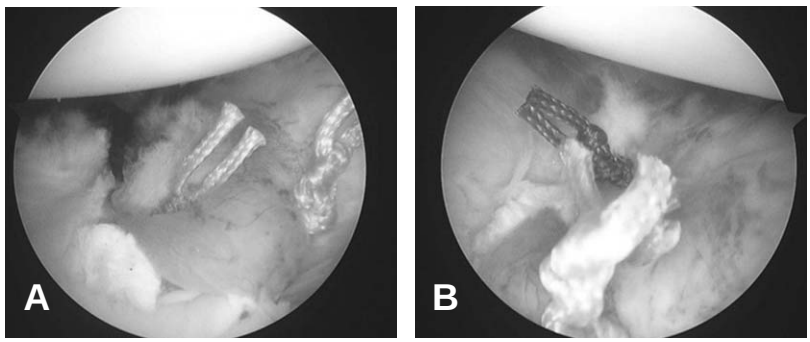

Fig. 4. Bankart repair was performed using a Fastack (×2) screw (Arthrex, Naples, FL) from 4 to 6 o'clock (**A**). The severe capsular tear was then repaired using a direct side-to side suture technique using No. 2.0 Ethibond sutures (**B**).

Postoperative 3 month radiographs and follow up MR scans showed complete healing of the capsular tear and Bankart lesion (Fig. 5A, B). The patient returned to his normal daily activities at 3 months postoperatively. At 6 month postoperatively, he participated in sports at his preinjury level, including mountain biking and his ranges of motion were forward flexion 170 degrees, abduction 160 degrees, and external rotation 30 degrees; his internal rotation was at the L1 level. A follow-up MRI scan revealed a well-healed capsular injury and Bankart lesion and complete union of the GT fracture.

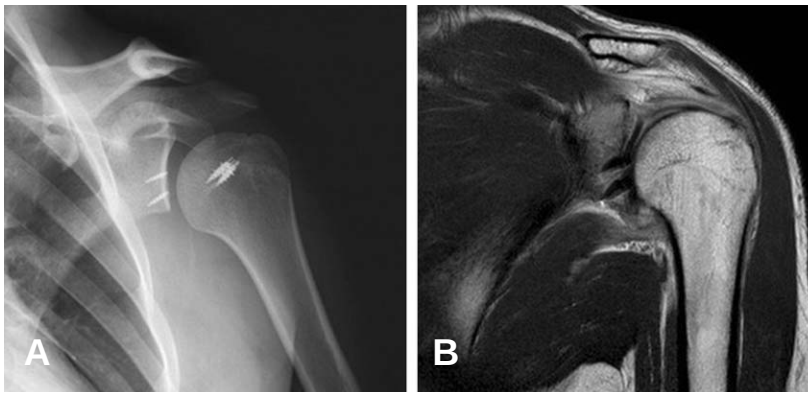

Fig. 5. Postoperative 3 month radiographs and follow up MR scans showed complete healing of the capsular tear and Bankart lesion.

Discussion

Reeves[1] reported that capsular rupture occurs predominantly in elderly patients over 50 years old. Arcielo[2] reported that 97% of acute anterior dislocations show complete detachment of the capsulolabral complex in the glenoid and added that capsular tear occurs only rarely. Kuriyama et al.[3] and Tijmes et al.[4] reported rates of capsular tears of 33% and 15% respectively. In a cadaveric study, Bigliani et al.[5] reported that 40% of inferior glenohumeral ligament tears occurred at the glenoid insertion, 25% at the humeral insertion, and 35% in the substance of ligament. Ogawa and Yoshida[6] suggested that an extensive capsular tear could not heal spontaneously and would lead to IGHL insufficiency. In our patient, a severe capsular tear, combined with axillary nerve exposure, was found with shoulder dislocation and a subscapularis muscle tear.

Multiple investigations have been undertaken to define the neuroanatomy relevant to arthroscopic procedures of the shoulder, with particular reference to the axillary nerve. Loomer and Graham[7] described that the axillary nerve courses from a position immediately posterior to the coracoid, and crosses the inferolateral border of the subscapularis, 3~5 mm medial to the myotendinous junction. Bryan and colleagues[8] examined the relationship between the nerve and the posterior arthroscopy, and quantified distances from standard posterior arthroscopy to the nerve. The main trunk of the nerve averaged 0.32 cm from the inferior capsule and was 1.89 cm inferior to the standard posterior arthroscopy portal. More recently, Eakin and coworkers [9] found that as long as arthroscopically-placed sutures entered the capsule 1 cm from the glenoid, all were further than 7 mm from the axillary nerve at any position around the capsule during arthroscopic anterior capsular stabilization. Uno et al.[10] reported that the axillary nerve was attached to the shoulder capsule by loose areolar tissue in the zone between 5:00 and 7: 00 o' clock and that the capsule became taut and the axillary nerve moved away from the glenoid during shoulder abduction, external rotation, and perpendicular traction. Yoo et al.[11] reported

the axillary nerve appeared in the joint near the inferior edge of the subscapularis muscle, and that it had a mean running angle of 23° with respect to the inferior glenoid rim horizontally. The closest points from the glenoid were between 5:30 and 6:00 o'clock (right) or 6:00 and 6:30 o'clock (left). Price et al.[12] reported the axillary nerve lies, throughout its course, at an average of 2.5 mm from the inferior glenohumeral ligament, and thus, it appears to be positioned at a relatively fixed distance with respect to the inferior glenohumeral ligament. In our case, the axillary nerve was in the 6:00 to 6:30 o'clock positions in the left shoulder and also ran inferolaterally, which suggested that it was closest to the 6: 00 o'clock position. Many patients complain of arm numbness and/or a tingling sensation after arthroscopic procedures. Moreover, it has been recommended that abduction neutral rotation may be more helpful for procedures in the anteroinferior glenoid because the nerve is further away from the working field. However, in our case, the axillary nerve was too tight in 45으 of abduction and neutral rotation, and thus, we recommend that caution be exercised concerning degree of arm abduction during shoulder procedures.

In our case, Bankart repair, capsular repair, and GT fixation were performed simultaneously, and during surgery, which lasted approximately 2 hr, arthroscopic fluid leaked out of the ruptured articular capsule, and this was found to be associated with the development of severe soft tissue swelling in the shoulder joint. Furthermore, due to severe swelling of the shoulder joint and the neck, the respiratory intubation could not be weaned. The patient's clinical course was determined over the first 24 hours in an intensive care unit. However, several hours after surgery all symptoms were substantially improved. After arthroscopic double row suture anchor fixation of the GT fracture 13 and complete capsulolabral repair, early movement became possible, and thus, we were able to prevent fibrosis and adhesions caused by soft tissue damage and operation. Our experience of this case of combined injury indicates that great care must be taken when maneuvering an arthroscope during surgery.

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