JSES International 6 (2022) 743–747

Contents lists available at ScienceDirect

JSES International

journal homepage: www.jsesinternational.org

Traumatic avulsion of the anterior half of the glenoid cartilage in a 15-year-old boy: a case report

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ARTICLE INFO

Keywords:
Shoulder
Glenoid
Child
Case report
Osteochondral
Screwing

Shoulder injuries during competitive sports are common in children and adolescents.[12] Among them, glenoid fractures are often associated with an episode of anterior instability,[7] but isolated fractures of the glenoid are rare.[2] We present the case of an isolated anterior half osteochondral fracture of the glenoid of the scapula that occurred during a sports accident. The medical information was anonymized, and the consent for use of these data was obtained from the parents of this underage child.

Case report

A 15-year-old right-handed boy, a high-level gymnast, presented with a partial and painful loss of motion of the right upper limb following an indirect trauma to the shoulder during gymnastics. He missed his landing while performing a front somersault during practice, with landing on the palmar surface of the hand in wrist and elbow extension and shoulder abduction and external rotation (Video S1). No vasculo-nerve complications were observed. Radiographic findings confirmed a congruent glenohumeral joint, confirmed the absence of a fracture of the proximal end of the humerus, and showed a bony fragment that appeared to be free and localized superiorly (Fig. 1).

Computed tomography and magnetic resonance imaging (MRI) scans were performed. Computed tomography confirmed a bony fragment in the posterior and superior regions and an area of bony defect in the anterior half of the glenoid. MRI showed a larger fragment of osteochondral signal and confirmed a large cartilage defect of the anterior half of the glenoid surface, with no avulsion or tear of the labrum (Figs. 2 and 3).

Four days after the trauma, an arthroscopic exploration was performed under general anesthesia in a beach chair position. A posterior soft-point optical approach and an anterior instrumental approach in the rotator interval were realized. The exploration confirmed a large osteochondral avulsion of the anterior half of the glenoid articular surface. The fragment remained attached at its cranial and caudal ends to the glenoid labrum and was found in the posterior and superior portion of the joint flipped 180°. By mobilizing the upper limb and pulling it forward to decoapt the joint and by using a palpating hook through the anterior portal, the fragment was repositioned (Fig. 4). Osteosynthesis by direct screw fixation on either side of the head via an anterolateral accessory approach and a posterolateral approach was performed using 2 2-mm-diameter Herbert screws. Each screw was placed through the anterolateral and posterolateral portals, respectively, and was driven in so that it did not protrude (Figs. 4 and 5). The exploration also revealed a lesion of the deep aspect of supraspinatus Ellman type 1 but no lesion of the labrum.

Postoperatively, a shoulder brace in neutral rotation was placed for 3 weeks. Pendular rehabilitation was performed at 3 weeks

Institutional review board approval was not required for this case report.
The authors confirm they have obtained patient informed consent form(s) for this case report.
This study was conducted at the Department of Orthopaedic Surgery of the University Hospital of Montpellier, France.

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https://doi.org/10.1016/j.jseint.2022.05.012
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Figure 1 Right shoulder anteroposterior radiograph shows an osteochondral fracture with a free bony fragment (*arrow*) superiorly displaced.

postoperatively followed by active rehabilitation after 6 weeks. The brace was removed at 6 weeks.

Partial removal of the hardware under arthroscopy was performed at 7 months to prevent impingement of the cartilage of the humeral head by articular protrusion of a screw head. During this arthroscopy, cartilage healing was observed with no deterioration of the humeral cartilage. Only one of the two screws was removed, and the other was left in because of the difficulty of its removal and its lack of joint protrusion.

At the 24th month visit, shoulder mobility was 170° of active and passive anterior elevation, 150° of abduction, 45° of external rotation, and internal rotation at T7, inferior to the contralateral shoulder concerning external rotation and abduction (Fig. 6). The subjective shoulder value was 90%, and the Constant score was 92 of 100. No pain was reported by the patient, and sports activities were resumed at the same level as before the accident.

Discussion

No description of this type of fracture has been found in the literature.

Concerning the mechanism of injury

It is likely that there was a forced lateromedial compression and posterior translation of the humeral head on the anterior part of the glenoid with the shoulder in a position of pure abduction.

Absence of injury to the anterior structures (middle and inferior glenohumeral ligaments, subscapularis tendon, anterior capsule), absence of labrum tearing, and absence of the posterior humeral head notch or bone contusion in MRI confirm the absence of anterior glenohumeral dislocation typically observed in Bankart lesions.[6] There is no established description of this type of glenohumeral lesion, but it has been described in elbow lesions and included in the so-called The Radiographic Appearance Seemed Harmless (TRASH) lesions.[16] We can hypothesize that the shearing forces that detached the osteochondral fragment ran through a zone of weakness related to incomplete closure of the glenoid growth plate. This mechanism is described in adolescent Tillaux fractures.[10]

The scapular primary ossification center is present at birth, while the distal glenoid remains cartilaginous.[14] The primary ossification center of the coracoid process typically appears at birth or within the first few months.[11] By the second year, a bipolar growth plate develops between the advancing primary ossification centers of the coracoid and the scapula. The subcoracoid, also called infracoracoid, secondary ossification center is the first of the scapular secondary centers to ossify, between 8 and 10 years of age, and has physeal surfaces for future fusion with both the coracoid process and the remainder of the glenoid. It is responsible for the formation of the upper third of the glenoid articular surface. Based on literature, fusion of the subcoracoid ossification center begins at about the age of 14-15 years and completes by the age of 16-17 years.[11] The secondary ossification centers for the inferior two-thirds of the glenoid develop around 14-15 years of age, as small islands of ossification around the glenoid rim. They gradually merge to form a horseshoe-shaped epiphysis, which fuses with the periphery of the glenoid and the subcoracoid secondary ossification center as well as expands toward the center of the glenoid. Complete fusion of the epiphysis with the glenoid articular surface occurs between 17 and 18 years of age.[8,11] In this case, the osteochondral fracture passes through the remaining growth plate, which is a zone of fragility, but the fragment does not appear to

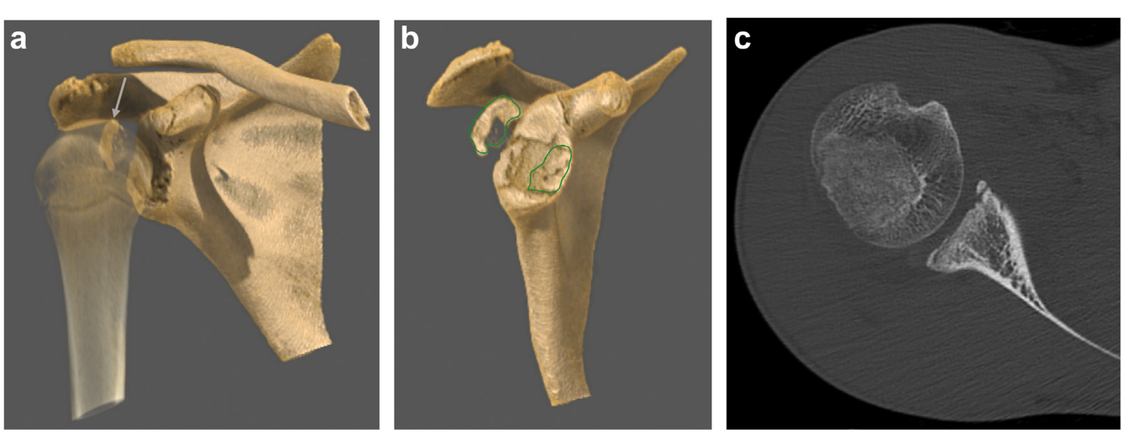

Figure 2 CT scan showing a bony fragment localized posteriorly and superiorly and an osseous glenoid anterior-half defect: (**a**) 3D anterior view with a free bony fragment (*arrow*). (**b**) 3D posterior view without the humeral head. (**c**) Axial view. *3D*, 3-dimensional; *CT*, computed tomography.

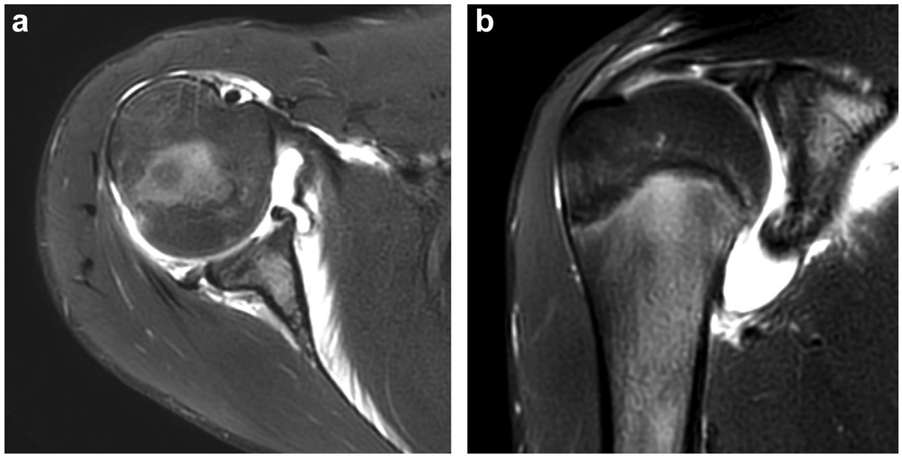

Figure 3 Magnetic resonance imaging in proton density–weighted sequence in axial view (**a**) and coronal view (**b**) showing the osteochondral defect of the anterior-half portion of the glenoid without abnormality in the anterior glenoid rim.

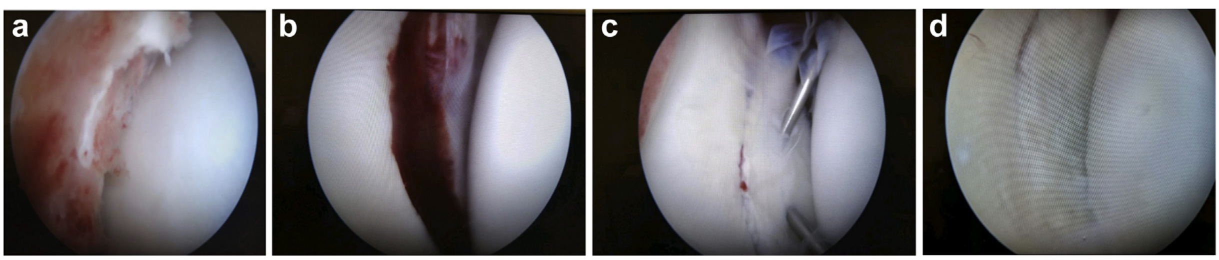

Figure 4 Arthroscopic views: (**a**) Displaced and returned fragment (posterior view). (**b**) Glenoid defect. (**c**) Reduction and temporary fixation with k-wires. (**d**) Postoperative view.

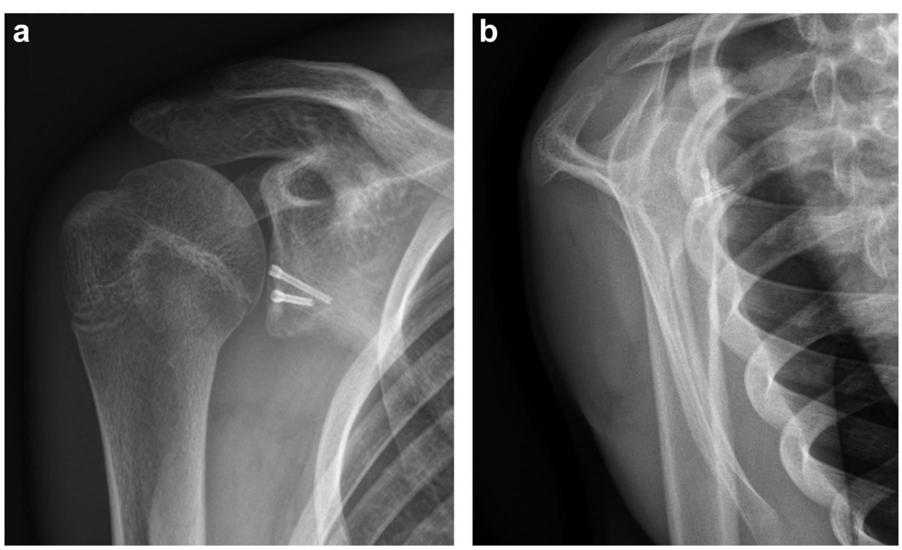

Figure 5 Postoperative anteroposterior (**a**) and lateral (**b**) radiographs with screws.

separate at the junction of the described secondary ossification centers.

Regarding management

The use of arthroscopy in the management of glenoid fractures in adults has been widely described, with good results.[13] Arthroscopy allows good visual control of joint reduction[5] and preservation of soft tissue.[17] Another advantage is the sparing of the glenoid vascularization, coming from the anterior and posterior circumflex arteries, the suprascapular artery, and the muscular branches of the infraspinatus. Since the periphery of the glenoid is avascular, open surgery would have carried a higher risk of pseudarthrosis or osteonecrosis of the fragment.[1] Arthroscopic reduction, although difficult, was facilitated by the persistence of the

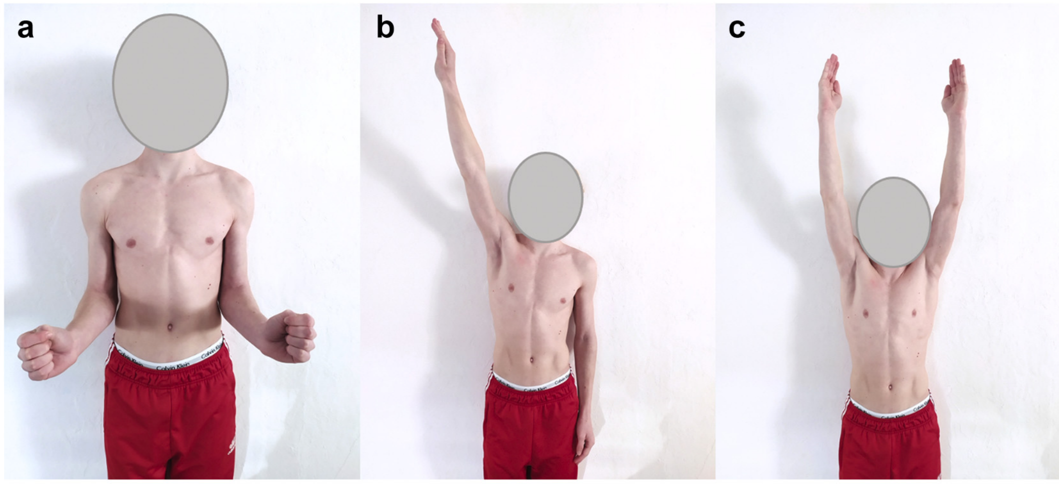

Figure 6 24th month examination: (**a**) External rotation. (**b**) Abduction. (**c**) Flexion.

superior and inferior labral insertions of the fragment and by gentle traction movements and modification of the rotations on the limb. Once turned, the fragment repositioned relatively well and was stabilized by the humeral head.

As an osteosynthesis, an absorbable device could also have been considered, as well as a SwiveLock-type (Arthrex, Naples, FL, USA) anchor technique described in knee deepening trochleoplasty.[4] Wafaisade proposed an arthroscopic transosseous button fixation technique for the treatment of large anterior glenoid fractures.[15] The superficial position of the fracture in our case did not allow this technique. In order to reduce the likelihood of penetration into the joint or splitting smaller fragments during screw insertion, Baxter described an arthroscopic technique using knotless suture anchors in the case of posterior glenoid fracture.[3] We finally decided to realize a direct osteosynthesis using a Herbert-type cannulated screw, which allowed us to obtain satisfactory stability.

Regarding the decision to remove the hardware

It is standard practice to remove or push in Herbert's screws in the case of osteochondral lesions of the knee,[9] in order to prevent the screws from escaping into the joint and causing iatrogenic chondral lesions. The upper limb is a non–weight-bearing limb, and the question was raised whether or not to perform this procedure. Since the patient was a high-level gymnast with repeated weight-bearing on the upper limb, it was decided to remove the screws. One of them did not recede and was pushed in. A second arthroscopic look was also the best way to evaluate morphologic result.

Conclusion

To our knowledge, this is the first description of such an osteochondral glenoid fracture in the literature, without involvement of the labrum and capsular structures. Early arthroscopic management by direct fixation with screws allows rapid recovery and an optimal functional result.

Disclaimers:

Funding: No funding was disclosed by the authors.

Conflicts of interest: The authors, their immediate families, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

Patient consent: Obtained.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jseint.2022.05.012.

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