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Monoplanar horizontal instability of the acromioclavicular joint: case report and stabilization surgical technique

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Acromioclavicular (AC) joint dislocation is a common diagnosis after trauma of the shoulder girdle, accounting for around 9%-12% of the injuries to the shoulder after trauma.[1,9] However, atraumatic instability of this joint is extremely rare. Only five cases were described in the previous literature,[2,7,12-14] with just two of them undergoing surgical stabilization, with disappointing results.[2,14] The lack of knowledge and the scarce literature available concerning this disabling condition can make the surgical treatment extremely challenging when the conservative treatment fails. We present a case of atraumatic horizontal AC joint instability submitted to surgical stabilization using a gracilis autograft in a figure-of-eight configuration. In addition, the literature available on the subject is discussed.

Case report

History

A 20-year-old right-hand-dominant female presented with longstanding and progressive “click” sensation in her left AC joint. History of significant shoulder trauma or previous surgeries was denied. This mild instability discomfort evolved for the last years to an increasing amplitude AC joint translation that was associated to severe pain during the bounce felt during the moment of reduction. The symptoms became a daily bother, especially during over-head activities, until she was unable to accomplish her daily activities without pain.

Physical examination and imaging studies

There was a mild tenderness on palpation of the left AC joint, without any prominence over the joint. During arm elevation, it was possible to observe anterior dislocation of the clavicle in relation to the acromion. At resting position, the lateral clavicle could be passively moved in the horizontal plane, but it was stable in the vertical plane. The glenohumeral function and range of motion were not limited and rotator cuff tests (Jobe), impingement tests (Hawkins and Neer), biceps testing (Speed’s and Yergason’s), and glenohumeral instability tests (apprehension, relocation, and sulcus sign) were all negative. The presence of bilateral arm external rotation of 100 degrees and elbow hypertension pointed to a mild degree of shoulder hyperlaxity.

Radiographic studies revealed normal left and right coracoclavicular (CC) distances. However, mild glenoid dysplasia was present, with shortening of glenoid neck (Figure 1A).[17] Predictably, the MRI of the left shoulder showed a slightly distended AC joint capsule (Figure 1B); nevertheless, no abnormalities of CC ligaments were visible (Figure 1C). The diagnosis of atraumatic monoplanar horizontal instability of the AC joint was made and the patient started a period of intensive physical therapy, with stabilization exercises to the trapezius and deltoid muscles. No improvement was seen after 6 months and we decided to proceed to a surgical stabilization using an autogenous tendon graft AC joint reconstruction (Figure 2).

Surgical technique

After interscalene brachial plexus block and general induction, the patient was prepped and draped in a beach chair position with access to the ipsilateral knee. Under general anesthesia the clavicle

Institutional review board approval was not required for this case report.

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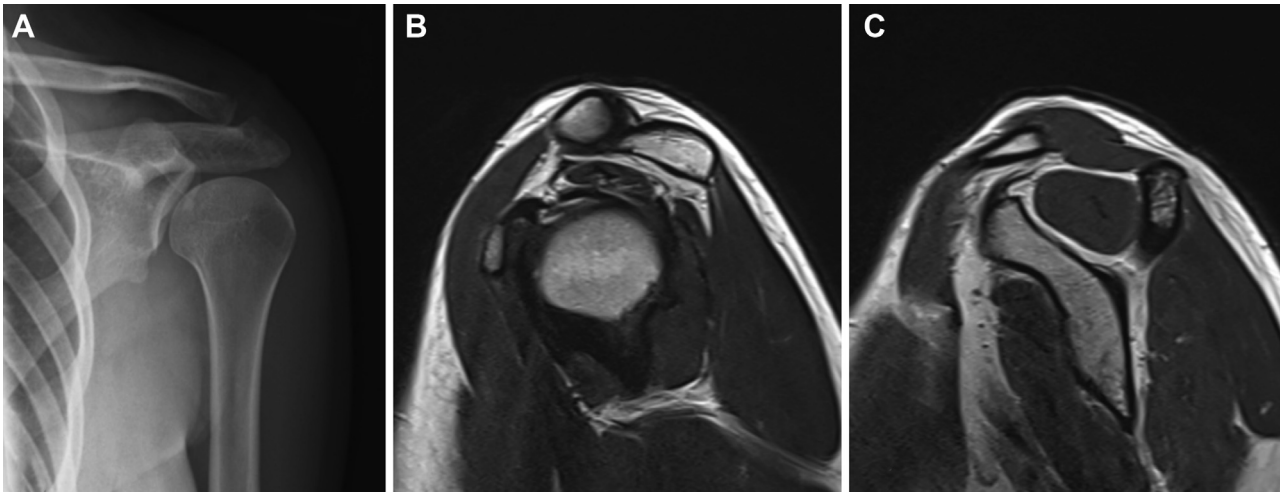

Figure 1 (**A**) Left shoulder radiograph (Grashey view) depicting normal coracoclavicular distance and inferior glenoid dysplasia. (**B** and **C**) Sagittal T2-weighted magnetic resonance imagings showing distended acromioclavicular joint capsule (**B**) and normal coracoclavicular ligaments (**C**).

was grossly loose horizontally and could be moved anterior and posteriorly without any resistance. However, there was no vertical instability and it moved in continuity with the shoulder girdle when downward traction was applied to the arm (Video 1). Gracilis graft harvesting procedure was carried out in a standard fashion using a tendon stripper and both ends of the tendon (2 cm) were whip-stitched using nonabsorbable sutures (FiberWire No. 2; Arthrex, Naples, FL, USA).

Approach and bone tunnels

A 5 cm incision through the skin and subcutaneous tissue was made from anterior to posterior and centered over the AC joint. Careful dissection was carried down to the superior joint capsule. A very loose appearance of the AC capsule was found (Figure 3A). An incision in line with the clavicle was made into the AC joint capsule and a periosteal elevator was used to elevate the periosteum anteriorly and posteriorly in preparation for later coverage of the repair.

A 4-mm unicortical V-shaped tunnel was drilled into the superior cortex of the acromion (15 mm lateral and parallel to the AC joint) (Figure 2). A looped suture was passed through the acromion tunnel. Then, a 2.4 mm pin was drilled in posterior-anterior direction through the lateral clavicle, 15 mm medial to the AC joint line, which was overdrilled with 4.5 mm cannulated drill. Two looped sutures were passed through this tunnel, leaving a loop for graft passage on each side of the tunnel.

Graft passage and fixation

The graft was shuttled in a sequential manner. First, it was passed through the V-shapped acromial tunnel and care was taken to ensure equal lengths of the graft on each side outside the tunnel (Figure 3B). Then, the graft was crossed over the AC joint, creating a figure-of-eight configuration. The anterior limb of the graft was then passed through the clavicle tunnel from anterior to posterior and the posterior limb of the graft trough the same clavicle tunnel in an opposite direction. The graft was tensioned, and a 4.75 mm diameter bioabsorbable SwiveLock anchor (Arthrex, Naples, FL, USA) was used as interference screw in the clavicle tunnel, blocking the graft (Figure 3C). The excessive graft was pulled over the clavicle and sutured side by side with a nonabsorbable suture (Figure 3D). The deltotrapezoid fascia (DTF) was closed over the figure-of-eight graft construct with a running absorbable suture, the wound was closed in a layered fashion, and the extremity was placed in a sling for 4 weeks.

Postoperative rehabilitation protocol

Shoulder motion was restricted for four weeks, with only elbow, wrist, and hand exercises being allowed. Active-assisted exercises were only started after that period. Progressive return to noncontact physical activity was started after four months.

Clinical and radiographic follow-up

One year after surgery, the patient was still pain-free, satisfied about the clinical and cosmetical result, and present a complete glenohumeral range of motion. The AC joint remained stable even after the return to her regular sports activities and she was not able to luxate the clavicle anymore (Video 2). Postoperative radiographs revealed correct position of the clavicle in relation to the acromion in the two planes, and bone tunnels were visible but not obviously widened (Figure 4).

Discussion

In 1977, Janecky et al[7] first described this pattern of injury with a case report of a 19-year-old female who could voluntarily dislocate both AC joints anteriorly. Besides the absence of a connective tissue disorder diagnose, some Marfanoid features were present. By avoiding the provocative maneuvers, the patient remained asymptomatic after one month. The first surgical report of this condition was published in 2005 by Sahara et al.[14] A 19-year-old male presented with persistent right shoulder pain and click due to atraumatic posterior dislocation of both AC joints. Operative stabilization of the AC joint was performed by transferring the coracoid tip with conjoint tendon to the anterior aspect of lateral clavicle. The aim of this procedure was to create a dynamic stabilization of the AC joint with the anterior force vector of the conjoined tendon neutralizing the posterior clavicle dislocation during arm elevation. Almost two years after surgery, the posterior displacement returned. Another surgical attempt to address this pathology was made by Barchick et al,[2] using an arthroscopic transclavicular-transcoracoidal button technique, combined with CC ligament augmentation using a semitendinosus allograft

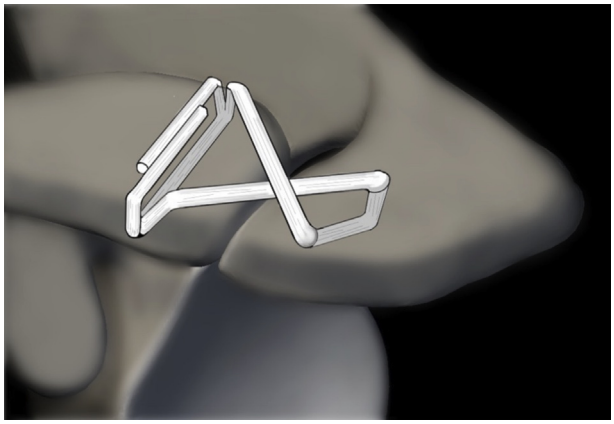

Figure 2 Schematic drawing of the figure-of-eight graft used for acromioclavicular joint reconstruction (front view of a left shoulder).

tendon. At the 6-month follow-up, the patient reported severe pain with overhead activities and recurrence of AC joint subluxation.

Before addressing the treatment of the horizontal component of AC joint instability, we will focus on the biomechanics of this joint and in the importance of AC ligaments and DTF to its stability, to support our technical choices. It is generally accepted that horizontal stability is mediated by the AC ligaments while vertical stability is maintained by the CC ligaments.[3,5,8] However, most of the published surgical techniques for AC joint reconstruction only address the vertical component of instability, and so, most of the unsatisfactory outcomes may be related to residual or neglected horizontal instability. This might explain the growing published literature over the last few years about the biomechanical properties and function of the AC ligaments and its applicability to AC joint stabilization techniques. To accomplish that, many biomechanical studies have analyzed the contribution of different portions of the AC ligaments and capsule by sequential sectioning these structures in cadaveric specimens. Dyrna et al[4] performed a detailed biomechanical evaluation of capsular structures and their contributions to translational and rotational stability. When the entire capsule was sectioned (with intact CC ligaments), resistance to horizontal and rotational stress testing was reduced to less than 25% and 10% compared with the native state, respectively. These findings were important to recognize the vital function of AC capsule and ligaments in centering the acromion in relation to clavicle during scapulothoracic motion. Disruption of this dynamic stability could lead to a loss of clavicular strut function and consequently scapulothoracic and glenohumeral dyskinesia.[6,10,16] The deltotrapezoid fascia, although frequently neglected, accounts for another important structure concerning this matter. Pastor et al[11] quantified the effect of the DTF and AC ligaments on multidirectional translation and rotation of the clavicle in relation to the acromion. No significant increase in horizontal translation and rotation was found after isolated AC ligament dissection, but it reached a significant level after a combined lesion of the AC ligaments and the DTF, confirming that both structures acted synergistically and that a lesion of the DTF could aggravate the AC ligament dissection effect.

Despite the anatomic structures (CC ligaments, AC ligaments, AC joint capsule, and DTF) being described as intact in our case and also in the previous reports, we believe that their function was disturbed by underdevelopment or laxity. Interestingly, our patient also presented with dysplasia of the glenoid inferior third, a rare condition characterized by developmental abnormalities of the lower glenoid and scapular neck. The pathogenesis of glenoid hypoplasia remains obscure, but it is suggested that it can be the result of inferior glenoid cartilage abnormal ossification. This was the first report to describe an association between AC joint atraumatic horizontal instability and other underdeveloped shoulder girdle structure, which could suggest that disturbance of common growing modulators pathways may be involved in this condition.

The presence of a monoplanar horizontal AC joint instability, combined with the normal CC ligaments on the MRI, drove us away from the temptation of using a CC suspension device, minimizing the surgery time and the risk of unnecessary adverse complications. In fact, because the native CC ligaments provided inherent vertical stability, this device was not expected to provide additional stability to the construct. Our technique focused on reproducing the anatomical, biological, and biomechanical function of the AC ligaments, the most important structures for AC joint stability in horizontal plane. To accomplish this, an AC ligaments reconstruction with a figure-of-eight gracilis graft was preferred. One debatable step of this technique is the creation of a V-shaped acromial tunnel. It was conceptually used to avoid possible impingement symptoms as a result of subacromial graft passage; however, this adverse outcome was not clinically evident in recent reconstruction technique reports.[15] In accordance, this technical variant could also be used.

Despite the favorable outcome achieved so far, we are aware that the risk of recurrence is always present in an atraumatic instability, and so, we are still following the patient to assure a durable result.

Conclusion

Despite being a rare condition, some characteristics seem to be shared by the six cases described in the literature—mainly horizontal instability, associated hyperlaxity conditions, normal MRI

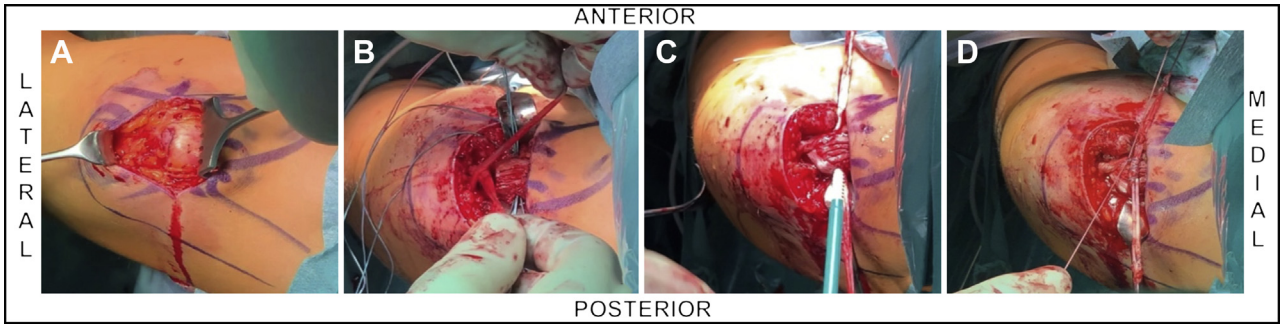

Figure 3 Superior view of the left shoulder, (**A**) anterior to posterior approach over the acromioclavicular joint. Note the bulging of the joint capsule. (**B**) Gracilis graft passed through the V-shaped acromial tunnel and crossed over the acromioclavicular joint. (**C**) After clavicular passage, the graft was blocked in the clavicle tunnel using a 4.75 mm diameter bioabsorbable SwiveLock anchor (Arthrex, Munich, Germany). (**D**) Excessive graft being pulled over the clavicle and sutured side by side.

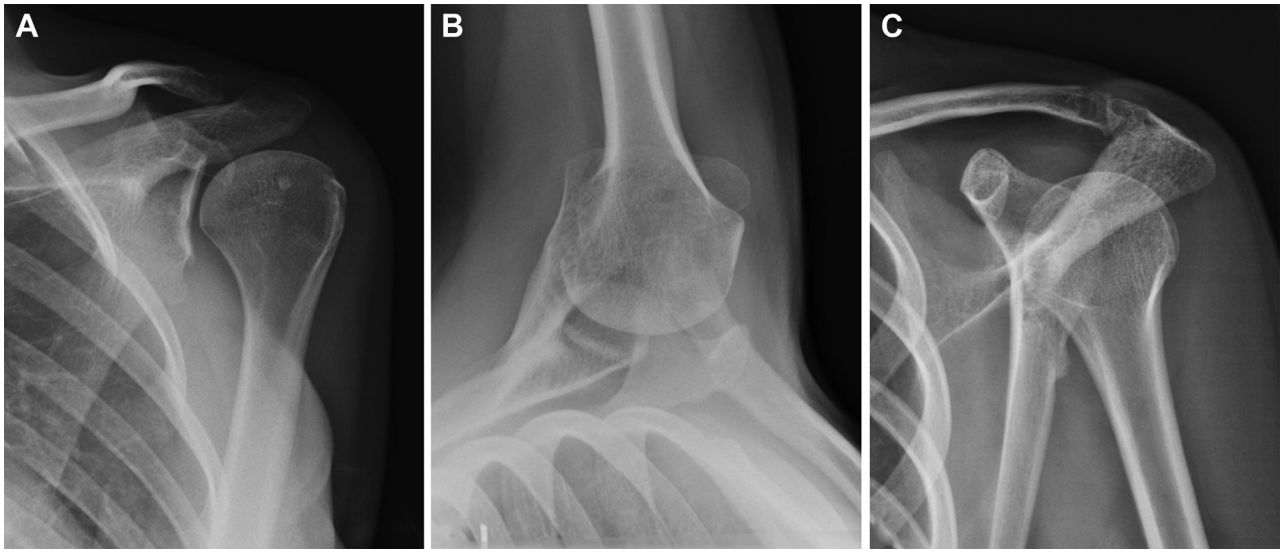

Figure 4 Postoperative radiographs showing correct reduction of the AC joint and no complications regarding bone tunnel positioning. AC, acromioclavicular.

findings, and initial symptoms usually manifest in the second decade of life. Stabilization of the acromioclavicular joint with the aforementioned technique provided good clinical and radiological results and a CC suspension device is not necessary unless vertical instability is present. This case report represents a relevant and important advance in the comprehension of this rare condition and also highlights the importance of AC ligaments reconstruction to achieve a good clinical outcome.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jseint.2020.09.013.

Disclaimer

João Afonso had no conflict of interest.
Jens Agneskirchner is a paid consultant for Arthrex.

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