Post-traumatic Coracoclavicular Ligament Ossification

A Case Report and Surgical Technique

Justine Fleurette, MD, Nicolas Solignac, MD, and Jean-David Werthel, MD, PhD

Investigation performed at the University of Versailles Saint-Quentin-en Yvelines, Hôpital Ambroise Paré, Boulogne-Billancourt, France

Abstract

Case: A patient presented with complete coracoclavicular ligament ossification after an unnoticed acromioclavicular joint Rockwood Type IV dislocation. He had full passive range of motion in the glenohumeral joint but was disabled by a loss of both active (80°) and passive (90°) abduction due to insufficient passive scapulo-thoracic motion. He was treated with an arthroscopic osteotomy of the coracoclavicular ligament ossification.

Conclusion: One year after the surgery, active abduction was improved by 45° (80°-125°) with no recurrence of the ossification on the radiographs. Arthroscopic osteotomy of complete coracoclavicular ligament ossification seems effective in restoring abduction in these patients.

Level of evidence: IV.

Calcification or ossification of the coracoclavicular ligament (CCL) is an occurrence described after acromioclavicular joint (ACJ) trauma, surgery of the ACJ, renal failure, or even paraplegia[1-5]. According to the authors, its incidence after surgical treatment of acromioclavicular injury has been reported to range between 37.3% and 67.9%[6-8]. On standard radiographs, these ossifications are classified into 4 grades: none, mild (bone formation around CCL), moderate, or complete (bridging)[6-8]. Formerly seen as a complication, it now seems to be a good prognostic factor after surgery of the ACJ[7,9]. One case of open surgical removal of a CCL ossification has been described in the literature because it blocked the reduction of an ACJ dislocation[10]. Arthroscopic removal of coracoacromial ligament ossification has previously been described with good outcomes and no relapse[11]. However, this technique has not been described for the coracoclavicular ligament ossification.

However, we report on a case with a complete post-traumatic CCL ossification that led to a limitation in the scapulothoracic motion and, therefore, in a loss of abduction.

The purpose of this article was to describe this case and the arthroscopic technique used to treat the CCL ossification.

The patient was informed that data concerning the case would be submitted for publication, and he provided consent.

Case Report

A 32-year-old right-handed man, taxi driver, and active smoker was involved in a scooter accident. He had no medical history. He fractured both bones of his right forearm and was treated by open reduction and internal fixation with 2 locking plates 4 days after the trauma. He also had a right obturator frame fracture treated nonoperatively and a left shoulder trauma for which no lesion was found at that time. In addition, he presented with a bilateral hemothorax and splenic devascularization complicated by peritonitis, necessitating several operations and 3 weeks of intubation and intensive care hospitalization.

Four months after the trauma, he consulted an upper limb surgeon for stiffness and pain in his left shoulder. His

J. Fleurette: study design, manuscript drafting, data interpretation, revision for important intellectual content, and approval of the version to be published; N. Solignac: revision for important intellectual content, and approval of the version to be published; J.D. Werthel: study design, data interpretation, revision for important intellectual content and approval of the final version to be published.

J.D. Werthel: Stryker consulting & royalties; Zürimed stock, Precision OS stock.

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJSCC/C398).

Keywords arthroscopy; coracoclavicular ligament; ossification; acromioclavicular disjunction

TABLE I Total Ranges of Motion Before and After Treatments

	Initial Review	4 Months Postconservative Treatment	8 Months Postfirst Surgery	1 Year Postsecond Surgery
AE (°)				
Active	90	110	120	160
Passive	90	110	120	160
ABD (°)				
Active	50	70	80	125
Passive	50	90	90	125
ER-1 (°)				
Active	30	45	60	45
Passive	50	50	80	80
IR (vertebrae)				
Active	T10	T8	T8	T8
Passive	T8	T8	T8	T8

active range of motion (ROM) was 90° in anterior elevation (AE), 50° in abduction (ABD), 30° in external rotation at the side (ER-1), and internal rotation at the side (IR) reached the T10 vertebra. Passive ROM was also limited in every direction except IR. All ROMs are gathered in Table I. On the anteroposterior radiographs, ossification of the coracoclavicular ligament and ACJ arthritis were visible. The patient was sent to physiotherapy to regain his shoulder's full passive ROM.

After 4 months of well-conducted nonoperative treatment, his passive ROM improved, but his shoulder remained stiff with 110° (+20°) of AE, 90° (+40°) of ABD, 50° (+0°) of

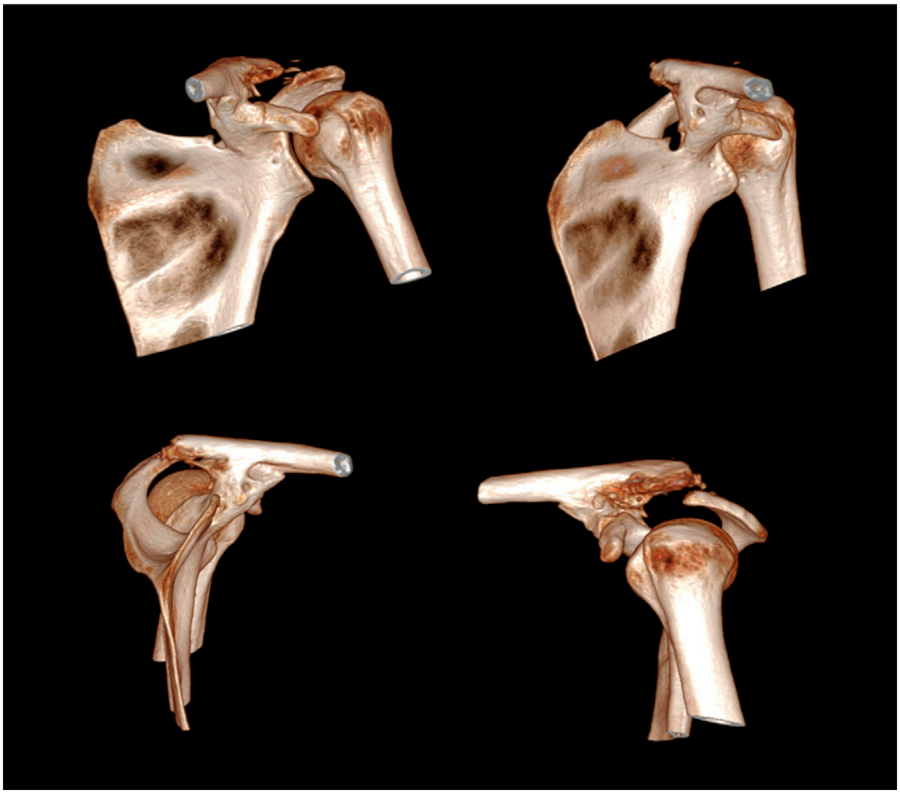

Fig. 1
CT scan 8 months after the trauma with ossification of the coracoclavicular ligament and displacement of the acromioclavicular joint. CT = computed tomography.

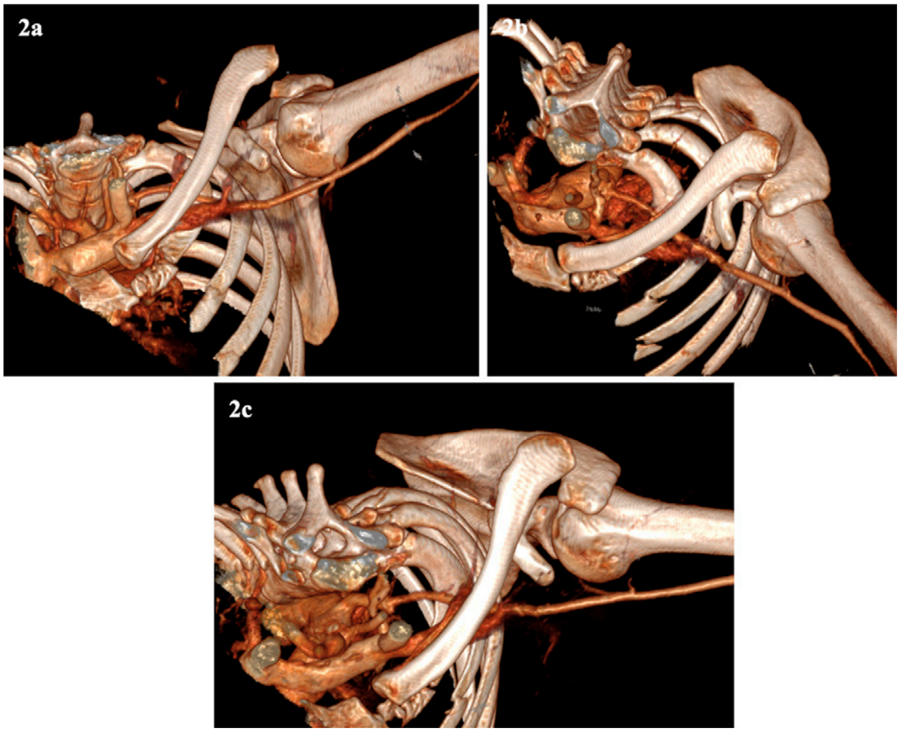

Fig. 2
CT scan at the time of the trauma with acromioclavicular joint Rockwood Type IV dislocation. CT = computed tomography.

ER-1, and IR at T8 (Table I). The ACJ was also painful with a positive cross-arm test.

Anteroposterior radiographs and a computed tomography (CT) scan of his shoulder showed a displacement of his ACJ and a complete ossification of his CCL, creating a bridge between the clavicle and the coracoid (Fig. 1).

On review of the CT scan taken at the time of the accident, an ACJ Rockwood Type IV dislocation was identified (Fig. 2).

Fig. 3
Passive ROM before arthroscopic osteotomy of the coracoclavicular ligament ossification. **Fig. 3-A** Passive abduction (90°); **Fig. 3-B** Passive external rotation at the side (80°). ROM = range of motion.

Fig. 4

Active ROM 1 year after arthroscopic osteotomy of the coracoclavicular ligament ossification. **Fig. 4-A** Active abduction (125°); **Fig. 4-B** Active external rotation at the side (45°). ROM = range of motion.

Nine months after the accident, he had an arthroscopic release of subacromial and subclavicular spaces associated with an acromioplasty. The CCL ossification was not removed. An open distal clavicle excision was also performed. The ACJ remained stable after the intervention.

Eight months after the surgery, the patient presented at our clinic. He was not painful anymore. Active ROM was 120° of AE, 80° of ABD, and 60° of ER-1. Passive ROM was limited to 120° of AE and 90° of ABD (Table I). He recovered full symmetrical passive external/internal rotation (80°/T8) meaning that his glenohumeral joint had recovered full passive ROM and that his loss of both active (80°) and passive (90°) abduction was probably due to the CCL ossification which limited his scapulothoracic passive ROM (Fig. 3). He underwent a new CT scan, which confirmed complete excision of his distal clavicle and complete ossification of both conoid and trapezoid fascicles of the CCL.

The month after, we performed, under fluoroscopic control, an arthroscopic osteotomy of the CCL ossification.

One year after the second surgery, active ROM was improved with 125° of ABD (+45°), 160° of AAE (+40°), 45° of ER-1, and IR was T8 vertebra (Fig. 4 and Table I). He had no pain, and his VAS was 0.

There was no recurrence of the CCL ossification on the anteroposterior radiographs (Fig. 5).

Fig. 5

X-ray 1 year after arthroscopic osteotomy of the coracoclavicular ligament ossification.

Surgical Technique

The patient was operated on under general anesthesia associated with an interscalene nerve block in lateral decubitus.

The intra-articular exploration was performed via a posterior viewing portal. No abnormalities were found. Then, the subacromial exploration was performed via the same portal. A bursectomy and a rotator cuff release were realized through an instrumental anterolateral portal. No tear of the rotator cuff was found. The distal clavicle excision and acromioplasty performed previously were assessed and were deemed sufficient.

We then switched to an anterolateral viewing portal and an anterior instrumental portal to release the coracoid process. The pectoralis minor was preserved. Under C-arm control, the ossification of both coronoid and trapezoid fascicles of the CCL was entirely resected using a motorized burr (Retractable FlushCut Burr, Oval 8 Flute, 5.0 mm, Arthrex) with the wide release of the coracoclavicular space (Fig. 6).

All incisions were sutured with resorbable sutures.

JBJS Case Connector
Volume 14 · Number 3 · July 19, 2024

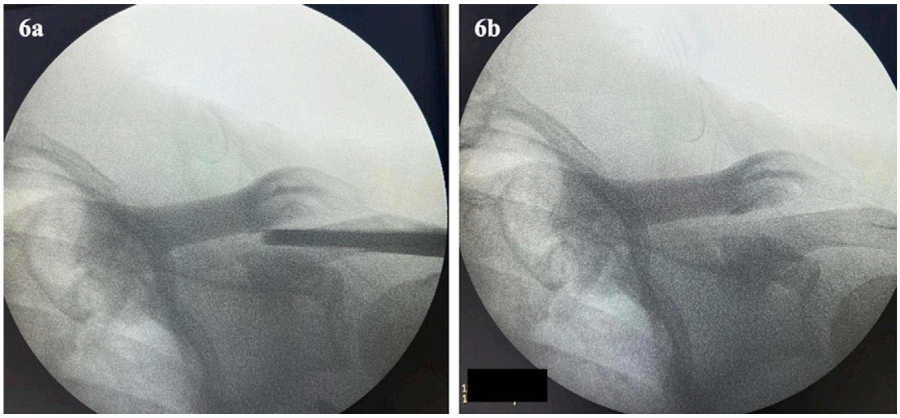

Fig. 6

Intraoperative x-rays. **Fig. 6-A** Osteotomy of the CCL ossification with motorized burr; **Fig. 6-B** X-ray at the end of the surgery with complete excision of the CCL ossification. CCL = coracoclavicular ligament.

The patient wore a sling for 1 week for postoperative pain control, and active rehabilitation was started immediately.

Discussion

The patient suffered from painful ACJ due to arthritis, which was treated previously by distal clavicle excision. He was not painful anymore after this surgery. The CCL ossification was, therefore, not a source of pain in this case.

Biomechanical studies have shown that the conoid fascicle of the CCL varies in length during abduction. Indeed, Seo et al. demonstrated, using a 3-dimensional finite element model based on computed tomography images from standard human shoulders, that with increasing shoulder abduction, the length of the conoid ligament gradually increased[12]. Moreover, an in vivo analysis of CCL kinematics during shoulder abduction conducted by Izadpanah et al. concluded that the conoid fascicle increased by 6 mm during ABD[13]. Both articles seem to confirm that our patient's loss of abduction was affected by the CCL ossification.

The literature suggests that the rotation of the ACJ varies with the different shoulder movements, up to about 35° in maximal abduction and about 30° in full arm elevation[14,15]. Our patient had an ACJ stiffness that probably limited him. Still, the extension of the CCL ossification resulted in a greater limitation that blocked the normal and harmonious movement of the scapulothoracic joint.

In our case, the arthroscopically assisted osteotomy of the CCL restored both active and passive abduction. Indeed, the patient went from 80°/90° preoperatively to 125°/125° postoperatively. Although the patient had no complaints, his AE was also restricted (120° both active and passive) preoperatively. After the intervention, he gained 40° of active and passive AE (160°/160°).

Contrary to the open surgery described by Westermann et al., which detaches the trapezius from the posterior clavicle, the arthroscopic technique is less invasive and spars the surrounding muscles[10]. Moreover, this technique enables the removal of the CCL ossification while checking the integrity of the glenohumeral joint, the rotator cuff, and the subacromial space.

In conclusion, arthroscopic osteotomy of a complete coracoclavicular ligament ossification could be an option to restore active abduction after failed nonoperative management in this rare condition. ■

Justine Fleurette, MD[1]
Nicolas Solignac, MD[1]
Jean-David Werthel, MD, PhD[1]

[1]Department of Orthopedic surgery, Hôpital Ambroise Paré, AP-HP, UVSQ University, Boulogne-Billancourt, France

E-mail address for J. Fleurette: jfleurette@icloud.com

References

1. Chen YM, Bohrer SP. Coracoclavicular and coracoacromial ligament calcification and ossification. Skeletal Radiol. 1990;19(4):263-6.

2. Mouhsine E, Garofalo R, Crevoisier X, Farron A. Grade I and II acromioclavicular dislocations: results of conservative treatment. J Shoulder Elbow Surg. 2003;12(6):599-602.

3. Qureshi AZ, AlSaleh AJ, AlHalemi AA. Ossification of coracoclavicular ligament in complete paraplegia: a case report. Spinal Cord Ser Cases. 2015;1:15008.

4. Schubert F. Duplication' of the clavicle or ossification in coracoclavicular ligament. Australas Radiol. 1997;41(1):70-2.

5. Torkaman A, Bagherifard A, Mokhatri T, Haghighi MH, Monshizadeh S, Taraz H, Hasanvand A. Double-button fixation system for management of acute acromioclavicular joint dislocation. Arch Bone Joint Surg. 2016;4(1):41-6.

6. Calvo E, Lopez-Franco M, Arribas IM. Clinical and radiologic outcomes of surgical and conservative treatment of type III acromioclavicular joint injury. J Shoulder Elbow Surg. 2006;15(3):300-5.

7. Ertogrul R, Sahin K, Celik H, Kapicioglu M, Ersen A, Bilsel K. Is coracoclavicular ossification a complication or a good prognostic factor after surgical treatment of acromioclavicular joint injury? JSES Int. 2022;6(5):769-74.

8. Scheibel M, Droschel S, Gerhardt C, Kraus N. Arthroscopically assisted stabilization of acute high-grade acromioclavicular joint separations. Am J Sports Med. 2011;39(7):1507-16.

9. Masionis P, Bobina R, Ryliskis S. The relationship between the clinical and radiological findings and the outcomes of early surgical treatment after tossy type III acromioclavicular joint dislocation. Cureus. 2020;12(1):e6681.

10. Westermann RW, Wolf BR. Extensive posterior-inferior heterotopic ossification in chronic grade v acromioclavicular injury blocking reduction during surgical repair: a report of two cases. HSS J. 2014;10(2):186-90.

11. Moon K, Hwang Y, Kim K, Kim J, Chae J. Ossification of the coracoacromial ligament in subacromial impingement syndrome: a case report. Clin Shoulder Elbow. 2017;20(3):167-71.

12. Seo Y-J, Yoo Y-S, Noh K-C, Song S-Y, Lee Y-B, Kim H-J, Kim HY. Dynamic function of coracoclavicular ligament at different shoulder abduction angles: a Study using a 3-dimensional finite element model. Arthroscopy. 2012;28(6):778-87.

13. Izadpanah K, Weitzel E, Honal M, Winterer J, Vicari M, Maier D, Jaeger M, Kotter E, Hennig J, Weigel M, Südkamp NP. In vivo analysis of coracoclavicular ligament kinematics during shoulder abduction. Am J Sports Med. 2012;40(1):185-92.

14. Ludewig PM, Behrens SA, Meyer SM, Spoden SM, Wilson LA. Three-dimensional clavicular motion during arm elevation: reliability and descriptive data. J Orthop Sports Phys Ther. 2004;34(3):140-9.

15. Sahara W, Sugamoto K, Murai M, Tanaka H, Yoshikawa H. 3D kinematic analysis of the acromioclavicular joint during arm abduction using vertically open MRI. J Orthop Res. 2006;24(9):1823-31.