12 Arthroscopic Acromioclavicular Joint Resection

Taku Hatta and Eiji Itoi

12.1 Introduction

The acromioclavicular (AC) joint connects the scapula and the clavicle, supporting the upper limb girdle on the thorax. Osteoarthritis of the AC joint frequently occurs in the adult population, especially in the fourth decade. For patients of AC joint osteoarthritis resistant to conservative treatment, AC joint resection has been considered the gold standard. In addition to conventional open procedure, arthroscopic procedure has gained popularity due to potential advantages of quick return to activities and lower rate of complications.

12.2 Epidemiology of Acromioclavicular Joint Osteoarthritis

DePalma [1] described that the degenerative features of the AC joint could be a natural consequence of aging, beginning in the second decade. Needell et al. [2] investigated magnetic resonance (MR) images of the AC joint in 100 asymptomatic volunteers ranging from 19 to 88 years of age and found osteoarthritic changes with the prevalence of 39% in those younger than 40 years, 89% in those aged 40–60 years, and 90% in those aged 60 years or over.

Edelson [3] investigated the pattern of degenerative changes of AC joints in 280 dry bone skeletons. They revealed consistent patterns of degeneration in the joint: an anteroposterior elongation of the joint on the acromial side, broadening and rounding of the distal clavicle in the anteroposterior direction, and inferior projecting osteophytes during the progression of osteoarthritis of the AC joint. Hatta et al. [4] investigated the histological features of 38 cadaveric AC joints aged between 69 and 91 years, to evaluate the localization of arthritic changes in the joints. They found the consistent findings that the lower half of the AC joint is more subject to advanced degeneration of the articular cartilage and the intra-articular disk than the upper half.

12.3 Symptoms

The most common symptom in patients with AC joint osteoarthritis is pain on the AC joint. Especially, the pain can be induced or enhanced with the arm in forward flexion, cross-body adduction, and/or internal rotation in abduction. It is known that these positions provide the narrowing of the AC joint which results in increased pressure in the joint, whereas, arthroscopic observation reveals various narrowing patterns among these positions. Anterior joint space often

T. Hatta · E. Itoi (✉)
Department of Orthopaedic Surgery, Tohoku University School of Medicine, Sendai, Japan
e-mail: itoi-eiji@med.tohoku.ac.jp

A. B. Imhoff, F. H. Savoie III (eds.), *Rotator Cuff Across the Life Span*,
https://doi.org/10.1007/978-3-662-58729-4_12

becomes narrow with arm in cross-body adduction; in contrast, posterior joint space becomes narrow with forward flexion and internal rotation in abduction. Accordingly, it is notable that painful position may change according to the location of osteoarthritic changes in the AC joint.

12.4 Diagnosis

In addition to characteristic arm positions which induce the pain as described above, the tenderness over the AC joint is helpful to detect pain from the AC joint. Several provocative tests which indicate the AC joint pathology have been advocated, such as the cross-body adduction stress test, the active compression test, the Buchberger test, and the Paxinos test. Of these, some maneuvers have been evaluated for their sensitivity and specificity (Table 12.1).

The cross-body adduction stress test is a well-known maneuver to induce AC joint pain, which was described by McLaughlin [5]. The examiner passively elevates the arm to 90° forward flexion and brings the arm in horizontal flexion. This test is considered positive if it reproduces pain at the AC joint.

The active compression test comprises two steps of the maneuver [6]. In the first maneuver, the examiner asks the patient to elevate the arm forward with full extension of the elbow and maximal pronation of the forearm. An inferiorly directed force is applied to the arm to evaluate the pain at the AC joint. In the second maneuver, the force is released, the forearm is fully supinated, and the force is applied again. The test is considered positive if the pain is induced during the first maneuver and reduced or disappeared during the second maneuver.

The Buchberger test combines inferiorly directed force to the lateral clavicle with passive forward flexion of slightly adducted and externally rotated arm [7]. For the Paxinos test, the examiner places a thumb on the posterolateral acromion and the index and/or the middle finger on the superior aspect of the mid-clavicle and then squeezes the thumb and fingers together [8]. Both tests are considered positive if the pain is induced or intensified at the AC joint.

Table 12.1 Accuracy of clinical tests

	Sensitivity (%)	Specificity (%)
Tenderness on the acromioclavicular joint	96	10
Provocative tests		
Active compression	16–100	90–97
Cross-body adduction	77	79
Paxinos test	79	50

12.5 Radiologic Assessment

Because of the high prevalence of age-related changes of the AC joint regardless of symptoms, radiologic assessment may be very difficult to make a diagnosis of AC joint osteoarthritis. Especially in plain radiographs, we should note degenerative findings including the joint narrowing, spur formation with sclerotic changes relatively consistent patterns of asymptomatic AC joint by the fourth decades. The primary aim of computed tomography is to achieve more accurate assessment of the morphology of the distal clavicle and the acromion. Magnetic resonance imaging could be helpful to detect fluid collection or reactive bone edema in the distal clavicle and acromion. Ultrasonography has been recognized as a useful diagnostic tool for AC joint pathologies [9, 10]. Especially, a dynamic provocative maneuver performed with ultrasonography can aid in detecting mild pathologies such as superior capsular bulging due to increased fluid in the AC joint [11].

12.6 Treatment

Symptomatic AC joint osteoarthritis may require conservative treatment including anti-inflammatory medications, physiotherapy, and intra-articular corticosteroid injection or surgical treatment for cases with failed conservative treatment. Since the initial reports by Mumford [12] and Gurd [13], open resection of the distal clavicle has been an

established technique for the treatment of symptomatic AC joint osteoarthritis. Arthroscopic distal clavicle resection has been recognized to provide similar results in terms of pain relief [14, 15]. A systematic review including 17 studies published from 1966 to 2008 demonstrated the arthroscopic distal clavicle resection would provide faster return to activities than the open procedure; in contrast, both procedures might result in similar long-term outcomes [16]. More recently, a database-based analysis described that the number of open procedures for the AC joint osteoarthritis had decreased among newly trained, board-eligible orthopedic surgeons [17]. They indicated that open resection could be associated with an overall higher surgical complication rate when compared with arthroscopic procedure (9.4% vs 7.6%, $P < 0.001$). Gaillard et al. [18] introduced a modified technique, bipolar AC joint resection, to gain a better visualization of the superoposterior part of the distal clavicle from the mid-lateral portal by extending a resection of the inferomedial part of the acromion.

12.7 Arthroscopic Acromioclavicular Joint Resection: Authors' Preferred Technique

The patient is in the beach chair position. In addition to the standard arthroscopic equipment, an electrical tissue ablator, a motorized burr, and a full-radius soft tissue resectors are prepared. Arthroscopic AC joint resection can be performed through two approaches; the lateral subacromial (indirect) approach and the superior (direct) approach. Because of minimal damages to the AC ligaments and the coracoacromial arch, we prefer to use the superior (direct) approach. First, an anterior portal is created just in front of the AC joint (Fig. 12.1). Through this portal, a needle is inserted into the joint to confirm the orientation of the joint space. Then, a Wissinger rod is inserted into the AC joint from the anterior portal and passed through the joint to create a posterior portal at the exit point of the rod. Through the posterior portal, an arthroscopy cannula is inserted into the AC joint along the Wissinger rod. Once the cannula is inside the joint, a standard 4.5-mm arthroscope is inserted through this cannula into the joint. The degenerated disk and proliferated synovia inside the AC joint are removed with use of the soft tissue resector inserted through the anterior portal. The electrical ablation device is also useful to remove the soft tissues and visualize the distal clavicle and the medial aspect of the acromion. Next, changing the arthroscope to the anterior portal and the soft tissue resector to the posterior portal, the debridement is continued until all the soft tissues inside the joint are removed (Fig. 12.2). It should be noted that the superior and inferior capsuloligamentous structures are completely kept intact during this procedure. After the debridement, the presence/absence of contact between the clavicle and the acromion is carefully observed both through the anterior and posterior views by moving the arm toward the three directions: forward elevation, cross-body adduction, and internal rotation in abduction. This "dynamic assessment" is considered important to determine the optimal amount and area to be resected.

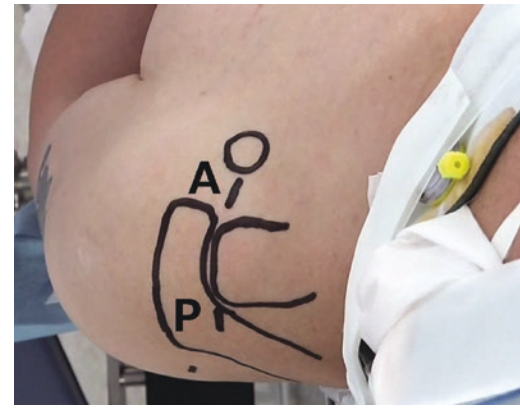

Fig. 12.1 Anterior and posterior portals. The anterior portal (A) is directly anterior to the AC joint, and the posterior portal (P) is directly posterior to the AC joint

Excision of the distal clavicle and the acromion begins with the burr through the posterior portal because this is the narrowest part of the joint. To date, several studies investigated to address the optimal amount of resection without damaging capsuloligamentous structures of the AC joint. Renfree et al. [19] investigated the

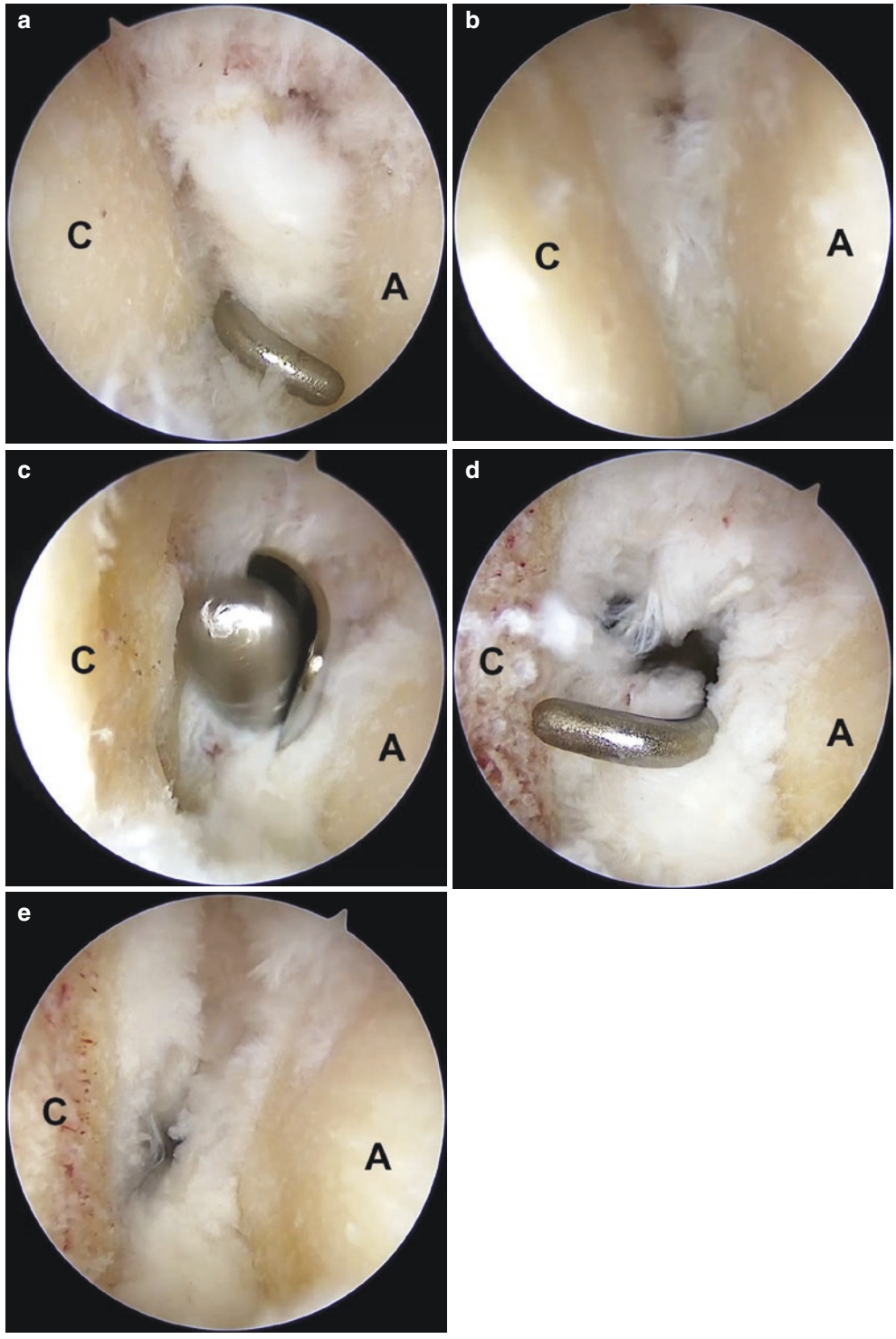

Fig. 12.2 Anterior portal view of the AC joint. (**a**) After the soft tissues were removed, the posterior joint space was measured using the probe tip (5 mm). The posterior joint space was about 3 mm. *C* clavicle, *A* acromion. (**b**) Dynamic examination with the arm in abduction and internal rotation demonstrated the narrowing of the posterior joint space. (**c**) Mechanical burr was used for bone resection on both the clavicular side and the acromion side. (**d**) As the posterior joint space was about 7 mm, the amount of bone resection was about 4 mm. (**e**) The same dynamic examination as in (**b**) showed sufficient clearance between the two bones

insertion of the superior AC ligament and suggested a safety amount of the resection on the distal clavicle less than 5.2 mm in female and 7.6 mm in male and on the acromion less than 4.7 mm in female and 8.0 mm in male. Stine and Vangsness [20] investigate the AC joint capsular insertion on the anterior, posterior, superior, and inferior edges and concluded that a safe amount of resection should be 2–3 mm of the medial acromion and 3–4 mm of the distal clavicle to avoid damaging the capsular attachments. Our goal is to achieve the loss of abutment; therefore, we gradually increase the amount of bone resection from both the clavicle and acromion until the dynamic examination revealed no more abutment between these two bones. At this point, the amount of resection is usually 3–4 mm on the clavicular side and 1–2 mm on the acromion side.

Postoperatively, the arm is kept in a sling for a week. Active motion is allowed within the range of comfort. As the pain decreases, active and passive range of motion exercise is started. After 3 weeks, muscle strengthening exercises are started.

References

1. Depalma AF. Surgical anatomy of acromioclavicular and sternoclavicular joints. Surg Clin North Am. 1963;43:1541–50.
2. Needell SD, Zlatkin MB, Sher JS, Murphy BJ, Uribe JW. MR imaging of the rotator cuff: peritendinous and bone abnormalities in an asymptomatic population. AJR Am J Roentgenol. 1996;166(4):863–7.
3. Edelson JG. Patterns of degenerative change in the acromioclavicular joint. J Bone Joint Surg Br. 1996;78(2):242–3.
4. Hatta T, Sano H, Zuo J, Yamamoto N, Itoi E. Localization of degenerative changes of the acromioclavicular joint: a cadaveric study. Surg Radiol Anat. 2013;35(2):89–94.
5. Mc LH. On the frozen shoulder. Bull Hosp Joint Dis. 1951;12(2):383–93.
6. O'Brien SJ, Pagnani MJ, Fealy S, McGlynn SR, Wilson JB. The active compression test: a new and effective test for diagnosing labral tears and acromioclavicular joint abnormality. Am J Sports Med. 1998;26(5):610–3.
7. Buchberger DJ. Introduction of a new physical examination procedure for the differentiation of acromioclavicular joint lesions and subacromial impingement. J Manip Physiol Ther. 1999;22(5):316–21.
8. Walton J, Mahajan S, Paxinos A, Marshall J, Bryant C, Shnier R, et al. Diagnostic values of tests for acromioclavicular joint pain. J Bone Joint Surg Am. 2004;86-A(4):807–12.
9. Naredo E, Aguado P, De Miguel E, Uson J, Mayordomo L, Gijon-Banos J, et al. Painful shoulder: comparison of physical examination and ultrasonographic findings. Ann Rheum Dis. 2002;61(2):132–6.
10. Alasaarela E, Tervonen O, Takalo R, Lahde S, Suramo I. Ultrasound evaluation of the acromioclavicular joint. J Rheumatol. 1997;24(10):1959–63.
11. Peetrons P, Bedard JP. Acromioclavicular joint injury: enhanced technique of examination with dynamic maneuver. J Clin Ultrasound. 2007;35(5):262–7.
12. Mumford EB. Congenital dislocation of the patella; case report with history of four generations. J Bone Joint Surg Am. 1947;29(4):1083–6.
13. Gurd FB. The treatment of complete dislocation of the outer end of the clavicle: an hitherto undescribed operation. Ann Surg. 1941;113(6):1094–8.
14. Gartsman GM. Arthroscopic resection of the acromioclavicular joint. Am J Sports Med. 1993;21(1):71–7.
15. Snyder SJ, Banas MP, Karzel RP. The arthroscopic Mumford procedure: an analysis of results. Arthroscopy. 1995;11(2):157–64.
16. Pensak M, Grumet RC, Slabaugh MA, Bach BR Jr. Open versus arthroscopic distal clavicle resection. Arthroscopy. 2010;26(5):697–704.
17. Amirtharaj MJ, Wang D, McGraw MH, Camp CL, Degen RA, Dines DM, et al. Trends in the surgical management of acromioclavicular joint arthritis among Board-Eligible US Orthopaedic Surgeons. Arthroscopy. 2018;34(6):1799–805.
18. Gaillard J, Calo M, Nourissat G. Bipolar acromioclavicular joint resection. Arthrosc Tech. 2017;6(6):e2229–e33.
19. Renfree KJ, Riley MK, Wheeler D, Hentz JG, Wright TW. Ligamentous anatomy of the distal clavicle. J Shoulder Elbow Surg. 2003;12(4):355–9.
20. Stine IA, Vangsness CT Jr. Analysis of the capsule and ligament insertions about the acromioclavicular joint: a cadaveric study. Arthroscopy. 2009;25(9):968–74.