



## Two patients with giant acromioclavicular joint cysts underwent reverse shoulder arthroplasty for cuff tear arthropathy



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Acromioclavicular joint (ACJ) cysts are a relatively rare condition, with less than 60 cases reported to date. This condition is believed to result from the subcutaneous transport of synovial fluid through the ACJ.<sup>3</sup> However, certain details, such as the site of synovial fluid production and the formation of a unidirectional valve at the ACJ, remain unknown.

There are 2 primary types of ACJ cysts: type 1 is primary, while type 2 is dependent on the complete tear/rupture of the rotator cuff, primarily involving the avulsion of the supraspinatus tendon/muscle.<sup>10</sup> Most ACJ cysts fall into type 2.<sup>11</sup> On imaging studies, such as arthrography and magnetic resonance imaging (MRI), the synovial fluid appears to erupt subcutaneously from the ACJ, a phenomenon known as the “geyser sign”.<sup>3,10,12</sup> Recurrence can be problematic in this condition, even with conservative therapies such as aspiration and steroid injections.<sup>2-4,7,14-17</sup> Various surgical treatments have been reported, including cyst resection and acromioclavicular resection.<sup>14</sup> However, these options are generally limited to excision of the cyst itself or destruction of the unidirectional valve structure at the ACJ.

In this report, we present 2 cases of patients with cuff tear arthropathy (CTA) and the geyser sign who were treated with reverse shoulder arthroplasty (RSA) without direct intervention for the cyst. This approach resulted in favorable outcomes without cyst recurrence.

### Presentation of cases

#### Case 1

A 72-year-old man presented with a mass in his left shoulder area that had been present for the preceding 3 years. He experienced pain and limited range of motion in his left shoulder. The patient initially underwent multiple needle aspiration treatments by a local physician, but no improvement in the mass was noted. Eventually, the patient sought further treatment at our hospital. A mass above the left ACJ was observed and an echo-guided puncture yielded drainage of 76 mL of yellow-colored translucent fluid. The range of motion of the left shoulder was greatly limited, with 20° of active flexion, 50° of abduction, and 0° of external rotation. Physical examination revealed a positive drop arm sign and reduced muscle strength during right shoulder flexion and external rotation movements. X-ray imaging showed superior migration of the humeral head, and rotator CTA was classified as stage 4a in the Hamada classification<sup>8</sup> (Fig. 1, A and B). MRI revealed a homogeneous, large, lobulated ACJ cyst in addition to extensive rotator cuff tears. The shoulder joint edema was connected to the subcutaneous cyst through the rotator cuff tear and ACJ (Fig. 1, C and D). Since the patient's CTA condition and age met the indications of the RSA guidelines issued by the Japanese Orthopedic Association, the patient underwent routine RSA without any specific treatment for the mass itself (Fig. 2, A and B). No surgical treatment was performed on the ACJ cyst, although the cyst remained immediately after the surgery. Externally, the cyst gradually shrank spontaneously and completely disappeared 3 months after surgery. MRI showed that there was no recurrence after 2 years (Fig. 2, C and D).

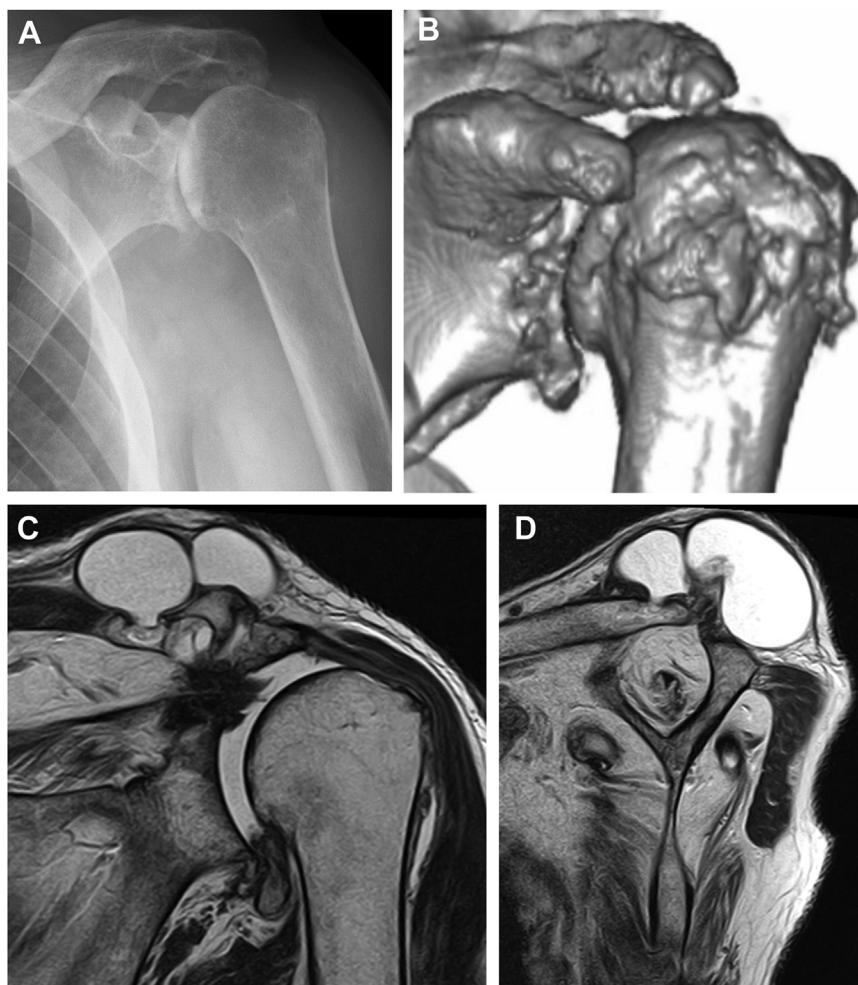
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**Figure 1** (A) The frontal radiograph of the left shoulder joint shows joint narrowing of the joint gap, osteosclerosis of the subchondral bone, and femoralization. (B) The 3D CT image of the left shoulder joint reveal arthropathic changes. (C) The T2-enhanced coronal plane of the MRI shows the presence of a massive rotator cuff tear and an ACJ cyst, which is depicted as a homogeneous, large, lobulated structure near the acromioclavicular joint. (D) The T2-enhanced sagittal plane of the MRI reveals atrophic changes in the supraspinatus, infraspinatus, and subscapularis muscles. 3D, three dimensional; CT, computed tomography; MRI, magnetic resonance imaging; ACJ, acromioclavicular joint.

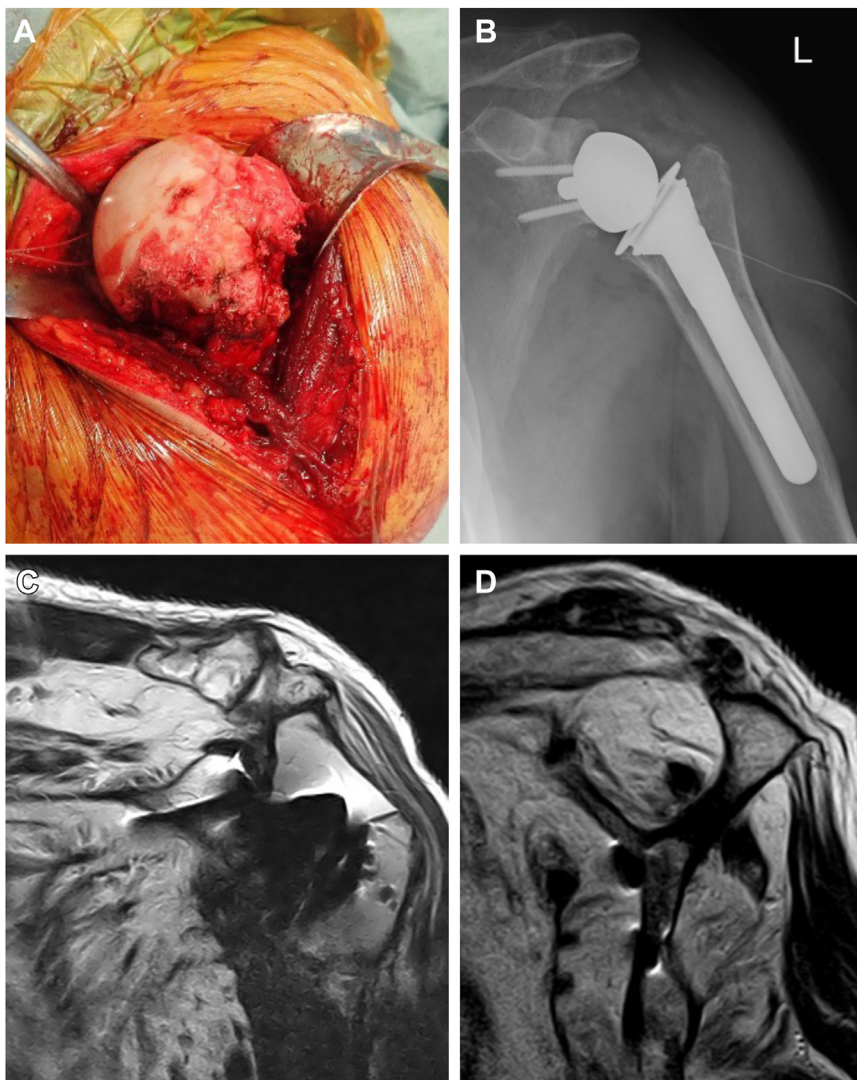
## Case 2

An 80-year-old livestock farmer visited our hospital seeking surgical treatment for shoulder pain that he had been experiencing for more than 2 years. A mass above the right ACJ was evident (Fig. 3, A), and he had not undergone puncture of or injections in the cyst. The range of motion of the right shoulder was greatly limited, with 80° of active flexion, 80° of abduction, and 0° of external rotation. Physical examination revealed a positive drop arm sign and reduced muscle strength during right shoulder flexion, internal rotation, and external rotation movements. X-ray imaging showed severe rotator CTA with acetabularization and femoralization,<sup>19</sup> classified as stage 4b in the Hamada classification<sup>8</sup> (Fig. 3, B and C). MRI revealed massive tears in the supraspinatus and infraspinatus muscles as well as large cysts in the ACJ. The shoulder joint edema communicated with the subcutaneous cyst through the rotator cuff tear and ACJ (Fig. 3, D and E). To alleviate pain and improve function in the patient with CTA and ACJ mass accompanied by arthropathic changes, RSA was performed. The surgeon performed RSA without any specific procedures on the mass. Because no surgical treatment was performed on the ACJ cyst, the cyst remained immediately after surgery, but it gradually shrank spontaneously and completely disappeared 3 months after the surgery. At 1-year follow-up, the patients reported satisfaction with pain relief and

improved shoulder function, with no recurrence of the ACJ cyst (Fig. 4, A), and MRI showed disappearance of the ACJ cyst (Fig. 4, B and C).

## Surgical techniques

Each procedure was performed by separate surgeons using the same technique. The patients were positioned in the beach-chair position, and the surgeries were performed under general anesthesia with brachial plexus block. The deltopectoral approach was used, and the long head tendon of the biceps brachii was identified and sutured to the biceps groove. The proximal part of the tendon was resected. The anterior circumflex humeral vessels were identified and ligated, followed by dissection of the subscapularis muscle from the humeral head and resection of the capsule. The humeral head was dislocated, and osteophytes were adequately resected before osteotomy of the humeral head. The glenoid fossa was exposed, and a baseplate and glenosphere were inserted. The humerus was then prepared for stem insertion with bone impaction grafting using autologous bone from the resected humeral head. After repositioning the implant, the surgeon repaired the subscapularis muscle to the lesser and greater tuberosities with nonabsorbable sutures to further improve abduction function.<sup>11</sup> A suction drain was placed under the deltoid muscle, and the wound was closed.



**Figure 2** (A) The intraoperative image of the humeral head shows the loss of cartilage. (B) The postoperative frontal radiograph of the left shoulder joint demonstrates that the implants were properly placed. (C) The postoperative T2-enhanced coronal plane of the MRI shows resolution of the ACJ cyst and no recurrence. (D) The postoperative T2-enhanced sagittal plane of the MRI shows the disappearance of the ACJ cyst. MRI, magnetic resonance imaging; ACJ, acromioclavicular joint.

### Postoperative therapy

Both patients wore an abduction brace for 4 weeks to immobilize the shoulder joint in abduction. Passive shoulder joint exercises were allowed starting 2 weeks postoperatively, and active exercises were initiated over a period of approximately 6 weeks with the goal of gradually returning to light work.

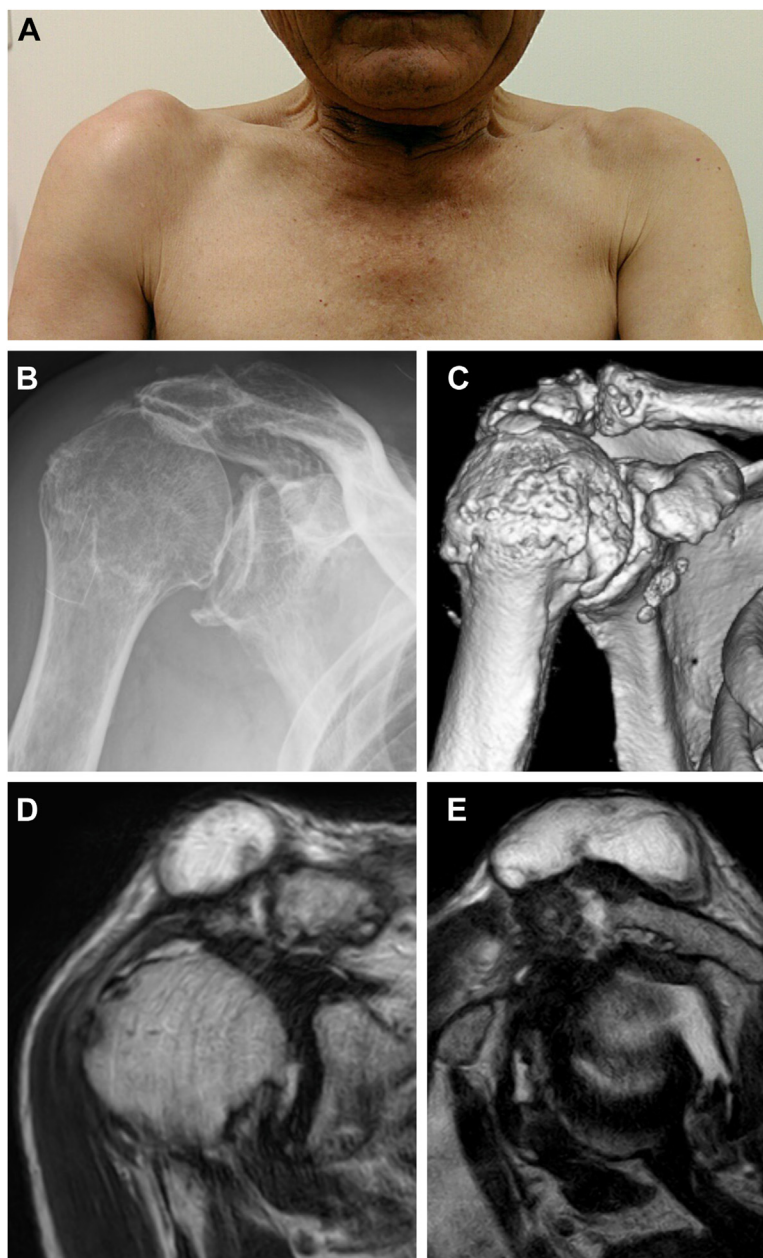
### Discussion

ACJ cysts are rare and classified into 2 types: type 1, caused by acromioclavicular osteoarthritis, and type 2, caused by rotator cuff tears.<sup>10</sup> The development of ACJ cysts is attributed to synovial fluid escaping through the ACJ, facilitated by a 1-way valve mechanism.<sup>3</sup> Surgical treatment for ACJ cysts often involves procedures such as cyst resection, distal clavicle resection, and acromioclavicular arthrodesis, which have shown good results with low recurrence rates.<sup>1</sup> Regarding the etiology of ganglion cysts, there have been reports suggesting that the degeneration of the shoulder joint's disc

and destruction of the superior joint capsule in the acromioclavicular joint are associated with ganglion formation.<sup>13</sup> It is believed that the shoulder joint cavity becomes a 1-way check valve, which cannot be resolved conservatively. Therefore, it is considered necessary to eliminate the 1-way check valve for definitive treatment.

In the presented cases where ACJ cysts were classified as type 2 cysts, the primary concern was pain and limited range of motion rather than cosmetic issues. Repairing massive rotator cuff tears in these cases is challenging,<sup>6</sup> and even successful rotator cuff repair may not alleviate pain caused by osteoarthritis. Thus, RSA was deemed the optimal treatment for advanced CTA, and substitute for cystectomy and acromioclavicular arthrodesis were not considered fundamental treatments. This approach resulted in favorable outcomes without cyst recurrence. There have been 3 reports of RSA for ACJ cysts where the cyst was additionally treated during RSA surgery.<sup>5,9,18</sup> In contrast, a study by Groh et al suggests that hemiarthroplasty can effectively address ACJ cysts without additional treatment.<sup>7</sup> According to their findings, the edema associated with





**Figure 3** (A) Preoperative visual photograph of case 2 showing the ACJ cyst on the right shoulder. (B) The frontal radiograph of the right shoulder joint shows several arthropathic changes, superior migration, acetabularization, and femoralization. (C) The 3D CT image of the right shoulder joint demonstrates the arthropathic changes. (D and E) T2-enhanced coronal plane MRI (D) and sagittal plane MRI (E) show a massive rotator cuff tear and the presence of an ACJ cyst. ACJ, acromioclavicular joint; 3D, three dimensional; CT, computed tomography; MRI, magnetic resonance imaging.

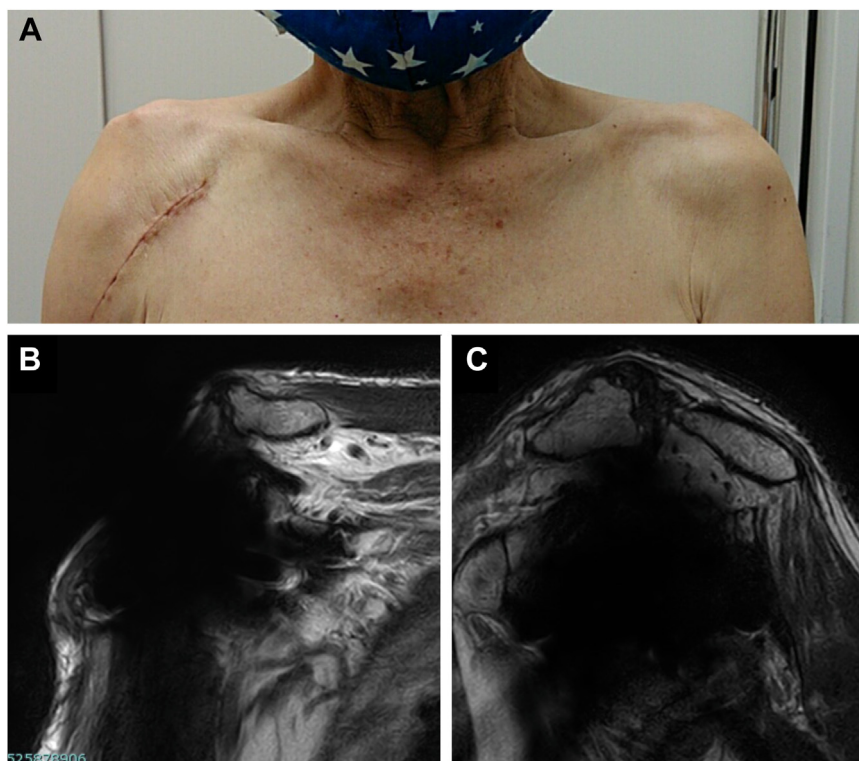
the ACJ cyst was alleviated by artificial head replacement alone. However, in our cases, hemiarthroplasty might not be the optimal treatment option, considering the challenge of repairing massive rotator cuff tears. Our findings suggest that RSA for CTA with extensive rotator cuff tears can simultaneously address joint degeneration and ACJ cysts.

As our current report is based on only 2 cases, the pathogenesis and cause of cyst disappearance remain unclear. Hiller et al asserted that a massive rotator cuff tear can lead to CTA, a disease with distinct morphologic characteristics, such as increased production of intra-articular synovial fluid and upward displacement of the humeral head. Over time, this can erode the ACJ and allow fluid to

flow from the glenohumeral joint into the ACJ.<sup>10</sup> Based on this theory, we hypothesize that RSA may interrupt this vicious cycle in the pathology of ACJ cysts caused by CTA, potentially leading to the resolution of ACJ cysts. Conducting further studies with larger sample sizes may help clarify these unresolved issues.

### Conclusion

The present report highlights the value of performing pure RSA for CTA with ACJ cysts, as the cysts showed no recurrence without specific cyst treatment. The mechanism underlying the disappearance of ACJ cysts requires further investigation.



**Figure 4** The 1-year postoperative visual photograph (A), T2-enhanced coronal plane MRI (B), and sagittal plane MRI (C) show the resolution of the ACJ cyst and no recurrence. MRI, magnetic resonance imaging; ACJ, acromioclavicular joint.

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