

Letter to the Editor

## Geyser Sign: Biomechanics and Clinical Implications

### Dear Editor,

Acromioclavicular joint (ACJ) cysts may infrequently develop in the setting of a chronic full-thickness rotator cuff tear with concomitant ACJ degeneration. They usually present as a mass over the superior aspect of the ACJ and may occasionally be mistaken for an abscess or tumour.<sup>1</sup> For symptomatic cysts, management has traditionally been surgical, including excision of the cyst and base of the cyst, ACJ excision, shoulder arthroplasty and rotator cuff repair.<sup>2</sup> However, conservative management should be considered too, especially in immunocompromised patients with an increased risk of post-operative infective complications. We present a case of a type 2 ACJ cyst on a background of known polymyositis with secondary Sjögren's syndrome on active immunosuppression, who improved with conservative treatment alone.

### Case report

A 71-year-old Chinese male presented to our clinic with a 1-month history of a progressively enlarging left shoulder lump. He had known polymyositis with secondary Sjögren's syndrome, first diagnosed in 2013 when he presented with proximal weakness, keratoconjunctivitis sicca, raised muscle enzymes, myopathic electromyographic features, as well as positive anti-nuclear antibody, anti-Ro antibody and Schirmer's tests. His disease had been stable on hydroxychloroquine and low-dose prednisolone titrated according to his clinical weakness. He was previously on azathioprine as a steroid-sparer, but this was stopped due to recurrent complicated soft tissue infections with *Staphylococcus aureus* bacteraemia. He had also been diagnosed with a left-sided rotator cuff tear on a magnetic resonance imaging (MRI) of the shoulder in 2016, which was being managed conservatively.

He reported a worsening swelling over his left shoulder for the last 1 month, associated with pain and warmth, but denied any fever, malaise, recent

antecedent trauma or intervention to the affected shoulder. He had a low-grade temperature of 37.5°C, but haemodynamically stable with a blood pressure of 149/67mmHg and heart rate of 86 per minute. Examination revealed a large, golf ball-sized fluctuant, erythematous, non-pulsatile swelling over the left ACJ (Fig. 1A), associated with a decreased range of motion in all axes, but no overlying punctum nor discharge. Laboratory investigations revealed normal inflammatory markers (white cell count  $10.2 \times 10^9/L$ , C-reactive protein  $<5\text{mg/L}$ , erythrocyte sedimentation rate 5mm/hr, serum procalcitonin  $<0.06\text{mcg/L}$ ), and the serum creatine kinase of 1344 U/L was at baseline. Blood cultures did not yield any bacterial growth. An X-ray of the left shoulder (Fig. 1B) showed soft tissue swelling over the ACJ with rotator cuff tear arthropathy, including a superiorly migrated humeral head with subacromial sclerosis and wear of the glenoid fossa.

The differential diagnoses at this point included a shoulder abscess (in view of the overlying inflammatory changes, his immunocompromised state and predisposition to complicated soft tissue infections); an ACJ cyst (given his history of an ipsilateral chronic rotator cuff tear); and lastly, a tumour (in particular, pigmented villo-nodular synovitis PVNS).

After plain radiographs, MRI is usually the imaging of choice in demonstrating soft tissue abnormalities in rotator cuff tears and its associated pathologies, with specific features including supraspinatus tendon thinning or discontinuity, and subacromial-subdeltoid (SASD) bursal fluid being highly sensitive for the presence of a supraspinatus tendon tear.<sup>3</sup> Since inflammatory markers may be falsely normal in immunocompromised patients, a MRI was vital in this case, which eventually revealed the classic "geyser sign", confirming the diagnosis of a type 2 ACJ cyst on a background of the known chronic rotator cuff tear (Figs. 2 and 3). Whilst the cyst did show rim and surrounding soft tissue enhancement, this was felt to be more in keeping with mild

superimposed cellulitis rather than a shoulder abscess given the overall clinical picture, his non-toxic clinical state and a fairly homogeneous internal cystic fluid content. Also, PVNS can present in two separate forms: localised or diffuse. Localised (or nodular) PVNS is less common, and typically affects the small joints in the hands and feet; diffuse PVNS on the other hand usually occurs in large joints like the knee or hip. The expected MRI changes in PVNS include mass-like synovial proliferation with lobulated margins and “blooming” artefact due to haemosiderin deposition. Although there were no gradient echo (GRE) sequences in this MRI scan, it would be reasonable to suspect such changes on the T2-weighted sequences as well, of which there were none (Fig. 3).

The patient received an empirical course of oral cephalexin for 1 week with improvement of the mild cellulitis. He was advised against aspiration or surgical management of the ACJ cyst due to his history of soft tissue infections, hence this was treated conservatively. Both his shoulder pain and swelling subsequently improved.

## Discussion

ACJ cyst is a unique and uncommon complication of shoulder pathology. There are 2 main types of ACJ cyst depending on aetiology and pathophysiology.<sup>2</sup> Whilst type 1 cysts are isolated and limited to the ACJ, type 2 cysts develop in the setting of a chronic full-thickness rotator cuff tear with inferior ACJ capsule degeneration due to ACJ bony spurs or a high-riding humeral head, the latter of which develops due to the loss of the stabilising compressive force from an intact rotator cuff on the humeral head, keeping it against the glenoid.<sup>4</sup> Synovial fluid escapes across the torn cuff, through the subacromial bursa and emerges superiorly through an osteoarthritic ACJ into the surrounding subcutaneous tissues.<sup>5</sup> The degenerate ACJ essentially acts like a one-way valve, allowing synovial fluid to escape from the GHJ into the cyst but otherwise prevents back-flow. This feature was originally described on fluoroscopic arthrogram of the shoulder as the “geyser sign”, due to the extravasation of contrast as a direct column of fluid

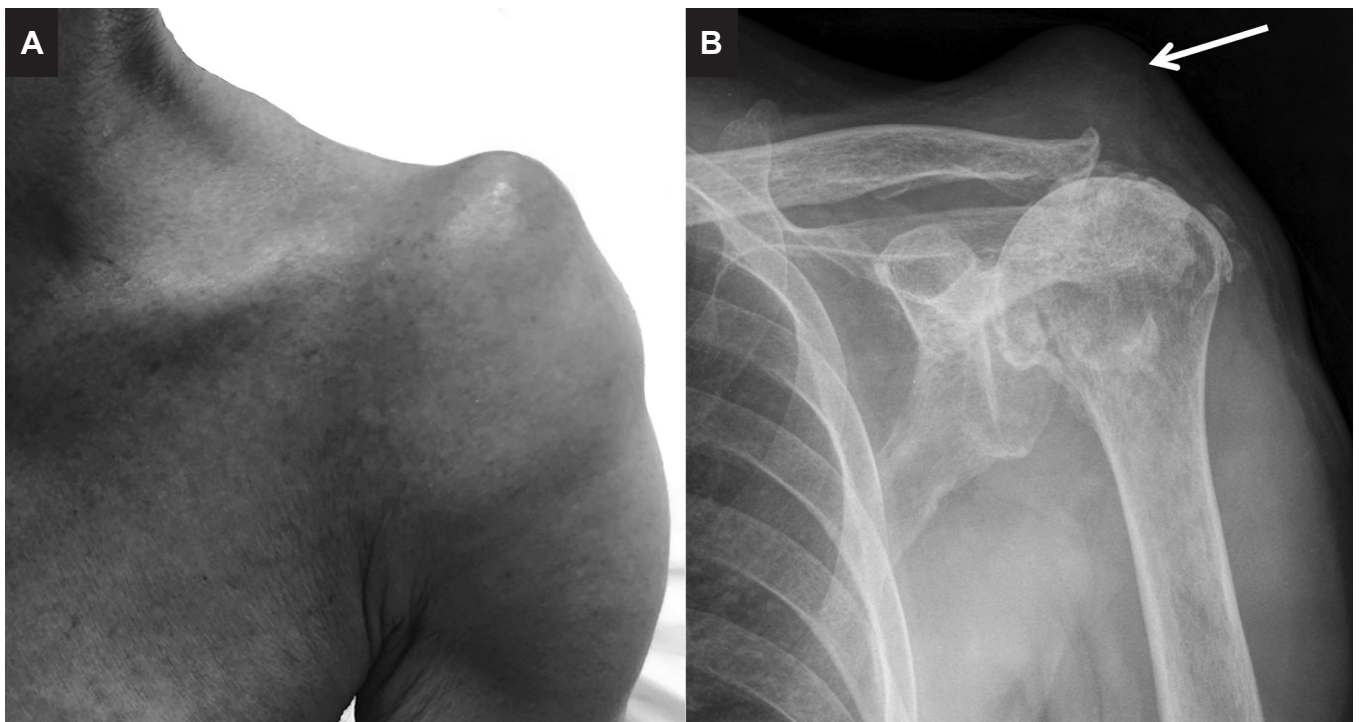


Figure 1. (A) Picture of a large, fluctuant, erythematous swelling over the left acromioclavicular joint (ACJ). (B) Left shoulder X-ray showing superior soft tissue swelling (arrow) and marked degenerative changes of the glenohumeral joint (GHJ) and ACJ. There is superior migration of the humeral head and loss of the acromiohumeral distance compatible with long-standing supraspinatus tendon tearing.

from the GHJ, across the ACJ, and into the cyst.<sup>6</sup> However, the same diagnostic features can be appreciated by non-invasive means like MRI or real-time ultrasonography.<sup>7</sup> But whilst ultrasound is useful in detecting rotator cuff tears and evaluating the cystic nature of a soft tissue mass by demonstrating posterior acoustic enhancement and absence of internal Doppler signal, it is limited in its assessment of the subacromial region due to the bony anatomy. MRI, on the other hand, provides a more detailed evaluation of the rotator cuff tearing, bony anatomy including the ACJ and subacromial regions, whilst also providing a better roadmap for surgical intervention.

There is no universal consensus with respect to the management of type 2 ACJ cysts. Many authors advocate surgical management,<sup>2,5</sup> although conservative management has been reported to be successful as well.<sup>2</sup> Surgery is indicated for symptoms or for cosmesis, with surgical options including: excision of the cyst and base of the cyst, excision arthroplasty of the distal clavicle (also known as Mumford

procedure) or ACJ excision, with or without a rotator cuff repair and GHJ arthroplasty options, including a reverse total shoulder arthroplasty or shoulder hemiarthroplasty. Arthroscopic decompression and debridement has been performed before, but due to concerns of excess skin and underlying soft tissues in the setting of an enlarging recurrent cyst, surgeons may favour an open excisional approach instead.<sup>5</sup> Whilst cyst aspiration can be done under aseptic technique, a high recurrence rate has been reported, and over time, repeated aspirations are also associated with an increased risk of fistula formation.<sup>8</sup>

Autoimmune connective tissue diseases, including polymyositis, have been associated with an increased risk of rotator cuff tears and eventual surgical repair.<sup>9</sup> This is likely related to chronic periarticular soft tissue inflammation leading to tendon weakening and hence subsequent rupture. This inflammation can persist subclinically, even with adequate control of their underlying disease manifestations.<sup>9</sup> However, to the best of our knowledge, the “geyser sign” has never

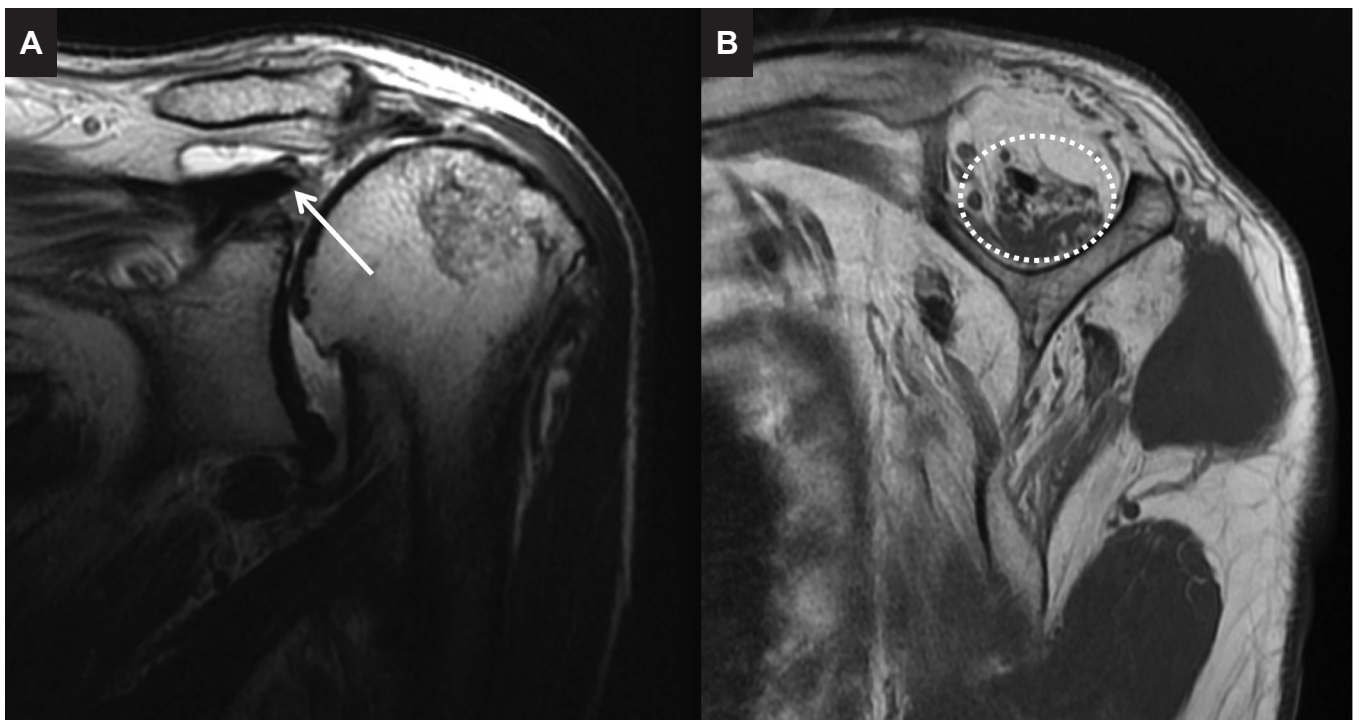


Figure 2. MRI of the left shoulder 4 years before presentation in 2016. A coronal T2-weighted image (A) shows a complete tear of the supraspinatus tendon (arrow) with retraction up to the level of the glenoid. There is superior migration of the humeral head with loss of the acromiohumeral interval and degeneration at the ACJ and GHJ. The sagittal T1-weighted image (B) shows moderate to severe fatty atrophy of the rotator cuff tendons including the supraspinatus (dashed oval) compatible with chronic, long-standing rotator cuff tearing

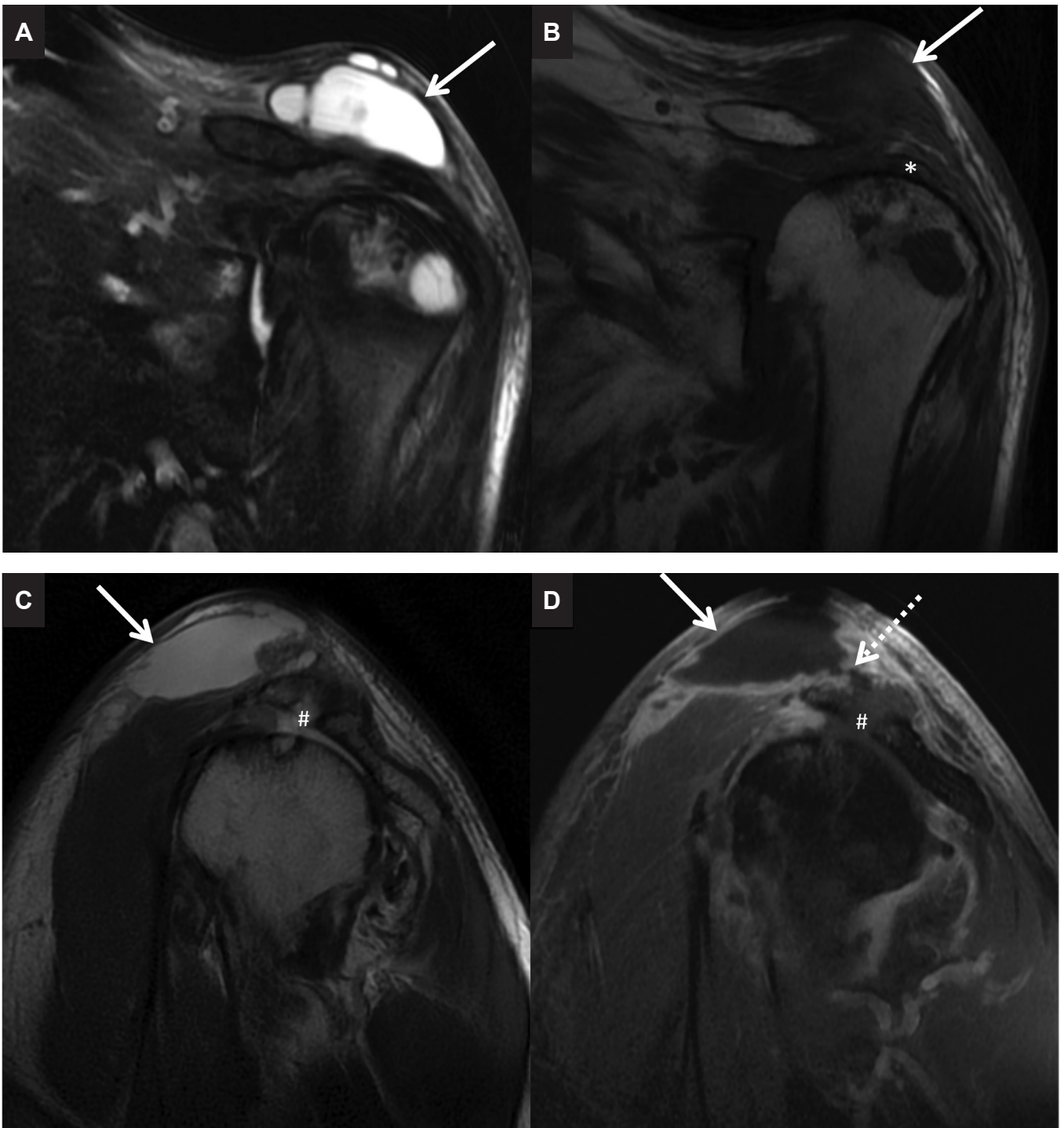


Figure 3. MRI images of the left shoulder at presentation. Coronal T2-weighted with fat suppression (A) and T1-weighted (B) images show a large T2-weighted hyperintense and T1-weighted iso-to-hypointense lesion superior to the ACJ likely due to a cyst (arrows). As seen on the prior MRI there is narrowing of the acromiohumeral interval (\*) due to the known chronic supraspinatus tendon tear. Degenerative changes and cysts are also seen at the greater tuberosity of the humeral head. Sagittal T2-weighted image (C) and T1-weighted image with fat suppression after intravenous contrast medium administration (D) show T2-weighted hyperintense, non-enhancing fluid in the subacromial-subdeltoid (SASD) bursa extending into the ACJ (#). The fluid then extends from the ACJ to the subcutaneous tissues through a superior capsular defect (dashed arrow) forming a geysler cyst (arrow). The cyst shows rim enhancement with surrounding cellulitis, and close clinical follow-up with consideration of aspiration would be prudent.

been documented in polymyositis patients before. Besides his advanced age, we also hypothesise that chronic inflammation from the underlying polymyositis and glucocorticoid-induced tendon degeneration from long term prednisolone use all contributed towards this patient's rotator cuff tendinopathy and hence eventually resulted in the development of an ACJ cyst and "geyser sign". Treatment-wise, given the increased post-operative risk of infections and poor wound healing in such immunocompromised patients, we propose that conservative management should be considered as a viable treatment option even if symptomatic, as in our patient's case.

In summary, ACJ cysts are an uncommon and under-recognised clinical entity that deserve more attention. We present the first case of a large type 2 ACJ cyst complicated by superficial cellulitis in the setting of polymyositis with secondary Sjögren's syndrome on immunosuppression, who improved after conservative management alone. Typically, surgical management is advocated for the treatment of such cysts if symptomatic; however, in the case of rheumatic patients on immunosuppression, it may be prudent to adopt a conservative line of therapy first, given their increased risks of poor wound healing and post-operative infections.

#### REFERENCES

1. Vogel DW, Steinbach LS, Hertel R, Bernhard J, Stauffer E, Anderson SE. Acromioclavicular joint cyst: Nine cases of a pseudotumor of the shoulder. *Skeletal Radiol* 2005;34:260–5.
2. Singh RA, Hay BA, Hay SM. Management of a Massive Acromioclavicular Joint Cyst: The Geysers Sign Revisited. *Shoulder & Elbow* 2013;5:62–4.
3. Tan RK. A Review of the Role of Magnetic Resonance Imaging in the Evaluation of Shoulder Impingement Syndrome and Rotator Cuff Tendon Tears. *Ann Acad Med Singapore* 1998;27:243–7.
4. Kumar VP. Biomechanics of the Shoulder. *Ann Acad Med Singapore* 2002;31:590–2.
5. Cooper HJ, Milillo R, Klein DA, DiFelice G. The MRI geysers sign: acromioclavicular joint cysts in the setting of a chronic rotator cuff tear. *Am J Orthop (Belle Mead NJ)* 2011;40:E118–21.
6. Craig EV. The geysers sign and torn rotator cuff: clinical significance and pathomechanics. *Clin Orthop Relat Res* 1984;191:213–5.
7. Gilani SA, Mehboob R, Bacha R, Gilani A, Manzoor I. Sonographic Presentation of the Geysers Sign. *Case Rep Med* 2019;2019:1–3.
8. Murena L, D'angelo F, Falvo DA, Vulcano E. Surgical treatment of an aseptic fistulized acromioclavicular joint cyst: a case report and review of the literature. *Cases J* 2009;2:1–4.
9. Huang SW, Lin CL, Lin LF, Huang CC, Liou TH, Lin HW. Autoimmune Connective Tissue Diseases and the Risk of Rotator Cuff Repair Surgery: A Population-Based Retrospective Cohort Study. *BMJ Open* 2019;9:1–8.

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