Synovial Chondromatosis in the Acromioclavicular Joint: Diagnosis and Management

Jonathan R. Pire a  J. Brett Goodloe a  Anthony Emanuel b  Shane Woolf a

a Department of Orthopedics, Medical University of South Carolina, Charleston, SC, USA; b Department of Pathology, Medical University of South Carolina, Charleston, SC, USA

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Abstract
A 31-year-old male presented to clinic with 2 months of aching shoulder pain without inciting injury or recent illness. Radiographs and MRI were obtained and the leading diagnosis was synovial chondromatosis (SC) of the acromioclavicular joint. He was treated with surgical resection. This case represents a rare location for SC, a disease defined by chondral tissue growth within the synovium most commonly affecting the knee and hip. We present this case report and consolidate information published in previous reports to provide guidance and discuss management for a rare and difficult location of this disease.

Introduction
Synovial chondromatosis (SC) is a relatively rare arthropathy defined by chondral tissue growth within the synovium of a joint. These nodules of chondral tissue ultimately become pedunculated and can form loose bodies within the joint space. With progression of the disease, degenerative changes occur within the joint. It was originally thought to be a metaplastic change of the synovium into chondral tissue with a self-limiting, self-resolving disease course [1]. However, its clinical and histologic similarity to synovial chondrosarcoma has led to genetic research revealing a connection to chromosome 6 aberrations and gene fusion products, which suggests SC may represent a benign neoplastic process [2–7]. Individuals diagnosed with SC are
most commonly in their 30s–50s, but cases have been reported in pediatric patients as well [8]. The disease most commonly affects the knee (70%) and hip (20%), followed in frequency by the glenohumeral joint, elbow, ankle, and wrist [9].

SC of the acromioclavicular joint is rare and only a small number of cases have been reported [8, 10–13]. Our paper presents the case of a 31-year-old male who was diagnosed with SC of the AC joint and was treated with surgical resection.

**Case Report/Case Presentation**

The patient was a 31-year-old male who presented to a family medicine clinic with progressive aching pain in his right shoulder 2 months prior. He denied any inciting or previous injury to the shoulder, or any repetitive strenuous activity. An ultrasound of the shoulder demonstrated a heterogeneous structure in the posterior aspect of the AC joint. He was referred to the orthopedic clinic for further management. Further questioning confirmed the superior shoulder had gradually developed a prominence before he began to experience pain. Upon examination, there was a palpable mass posterior to the AC joint. The mass was tender to palpation, and he had full but painful range of motion about the shoulder.

Radiographs revealed calcifications surrounding the acromioclavicular joint with mild superior subluxation of the distal clavicle (shown in Fig. 1). An MRI revealed a 2.7 × 6 × 4.8-cm heterogeneous mass emanating from the posterior aspect of the clavicle that was isointense with muscle on T1 and hyperintense on T2 with hypointense rings and arcs consistent with calcifications (shown in Fig. 2). A diagnosis of SC was made based on the imaging findings.

After a discussion with the patient regarding his imaging and clinical findings, the patient elected to proceed with surgical resection. After receiving an interscalene peripheral nerve block, a saber incision was made centralized on the AC joint. Skin flaps were developed and the trapezius was elevated to reveal the mass in the supraclavicular fossa (shown in Fig. 3). There was no damage or invasion of the adjacent supraspinatus or trapezius. The mass was resected en bloc and a synovectomy was performed due to evidence of synovitis. To fully assess the AC joint, 8 mm of distal clavicle was resected. With distraction of the AC joint, calcified loose bodies emerged from deep within the joint and were removed. Thorough irrigation of the surgical wound was performed prior to layered closure. Histologic analysis of the specimen revealed a nodular collection of hypercellular chondroid tissue with osseous metaplasia consistent with SC (shown in Fig. 4).

The patient’s post-operative course was uncomplicated and he completed a physical therapy course without issue. At his 2-month follow-up visit, he exhibited full range of motion and strength of the affected shoulder without any symptoms. One year after his surgery, the

![Fig. 1. AP radiograph of the patient’s right shoulder shows soft tissue mineralization surrounding the AC joint in a “rings-and-arcs” pattern. There is superior migration of the distal clavicle in relation to the acromion.](image)
patient continues to do very well with no strength or range of motion deficits and reports equivalent function to his contralateral side.

**Discussion/Conclusion**

SC of the acromioclavicular joint is a rare disease with few cases reported in the literature [8, 10–13]. Patients in these 5 case reports ranged in age from 10 to 53 and varied in terms of their presentation. Similar to our patient, none of the patients endorsed an inciting injury.
or previous trauma to the affected shoulder. Radiographs were the initial imaging study in each of these cases, with all but one showing calcifications around the AC joint. Radiographic calcifications are common in SC (70–95% of cases), predominantly in the form of "rings-and-arcs" that are classic for chondral tumors. Advanced imaging varied among the studies, but the majority ordered a follow-up CT or MRI. CT imaging is best for identifying and characterizing calcification patterns within the tumor and can show extrinsic erosion of the bone secondary to the disease. MRI best defines the architecture of the entire lesion and can help provide insight into the soft-tissue components if the diagnosis is unclear. Characteristically, SC will appear as a lobulated lesion that is isointense to muscle on T1 and hyperintense on T2 image sequences due to the high water content within the hyaline cartilage. Additionally, calcifications will appear as areas of signal void due to its magnetic susceptibility [14–16]. These typical findings on XR and MRI were consistent with the findings from the imaging in this case.

The differential diagnosis for SC includes any other benign proliferative disease of the synovium, including pigmented villonodular synovitis, lipoma aborescens, and synovial hemangioma. Malignancies such as synovial chondrosarcoma should also remain in the differential. Imaging features of each of these diseases can aid in the diagnostic process. Pigmented villonodular synovitis, the most common of these benign synovial proliferative disorders, typically appears normal on radiographs and has a distinct "blooming artifact" appearance on gradient echo MRI sequences. Lipoma aborescens, a subsynovial adipose tissue mass, will have signal intensities consistent with fat on all sequences. And although phleboliths associated with synovial hemangiomas may be mistaken for calcified chondral bodies, blood-fluid levels and vascular channels on MRI are defining features [15, 17, 18]. Synovial chondrosarcoma, a rare malignancy with radiologic and histologic similarities to SC, can be a significant diagnostic challenge as bone erosions and invasion of local tissues can be
seen in both [15, 18, 19]. It is diagnosed histologically, with distinguishing features such as myxoid changes, hypercellularity with spindling, and signs of necrosis [2].

In the present study and four of the five previous AC joint SC case reports, the treatment was open surgical excision with or without distal clavicle resection and synovectomy. In the case presented by Kudawara et al. [12], no resection was performed after incisional biopsy confirmed the diagnosis due to lack of symptoms. Given the distal clavicle degeneration found intraoperatively and residual synovitis, we performed both a distal clavicle resection and synovectomy. Definitive treatment of SC includes removal of loose bodies and/or mass, with or without synovectomy. The literature on whether or not to perform synovectomy in SC is controversial [9]. Furthermore, because SC of the AC joint is so rare, there are no studies clarifying this therapeutic question. Of the aforementioned cases, 3 of the 4 patients treated with surgical resection had a synovectomy and none of the 4 patients had a recurrence with follow-up ranging from 7 months to 4 years.

In conclusion, SC of the acromioclavicular joint, while rare, should remain on the differential in a patient presenting with shoulder pain or a mass over the AC joint with surrounding aberrant calcifications on radiograph. Definitive treatment for symptomatic cases should include resection of the tumor and loose bodies, with or without synovectomy depending on appearance of the synovium.

**Statement of Ethics**

This case study was exempt from ethics approval by the Institutional Review Board at the Medical University of South Carolina. Written informed consent was obtained from the patient for publication of the details, clinical photos, and imaging included in this case.

**Conflict of Interest Statement**

The authors have no conflicts of interest to declare.

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**Author Contributions**

Jonathan R. Pire, MD, J. Brett Goodloe, MD, Anthony Emmanuel, MD, and Shane Woolf, MD, provided substantial contribution to the material content of this study, including the conception, literature review, drafting, and final editing of the paper.

**Data Availability Statement**

No data collection was performed for this study as it was derived from a single case. All of the information provided in this study regarding the case is stored in the electronic medical record system of the Medical University of South Carolina. This information is not publicly available as it is protected by United States law under the Health Insurance Portability and Accountability Act (HIPAA) of 1996.
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