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Combined arthroscopic and open removal of loose bodies in synovial chondromatosis: a case report with technical note

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In synovial chondromatosis, the synovial lining of the joint grows benign nodules that eventually become loose bodies within the articular space.[8] These loose nodules can migrate about the joint causing pain, decreased range of motion, and mechanical symptoms. Synovial chondromatosis most commonly presents in the knee and hip joints; however, rare reports of presentation in the glenohumeral joint are reported in the literature.[1,5] The exact etiology of this condition is unknown, and the diagnosis is often delayed. Synovial chondromatosis typically presents in the third to fourth decades of life.[7] Recurrences are reported to be 15%-25% and malignant transformation into synovial chondrosarcoma has been reported in 1%-10% of patients.[6] Reports of open, arthroscopic, and combined removal of these loose bodies exist in the literature.[8,9] The decision for arthroscopic versus open removal depends on surgeon preference, as well as the location and extent of the loose bodies within the glenohumeral joint. We present a rare case of synovial chondromatosis in a 19-year-old healthy male treated with a combined open and arthroscopic approach.

Case discussion

The patient is a 19-year-old healthy male with no significant medical history other than a right proximal humerus fracture at age 4 years who presented to the orthopedic clinic with multiple weeks of right shoulder pain. Prior to presentation at the orthopedic clinic, he was treated conservatively with anti-inflammatory medications, rest, and ice by his primary care provider. The patient did not recall any traumatic inciting event for his current shoulder pain. He had a relatively benign examination with forward flexion to 160 degrees, external rotation to 70, and internal rotation to the level of T12. He had 5 of 5 strength with external rotation and abduction. Belly press and bear hug were both negative. The patient did have tenderness along the biceps groove, anterior shoulder, and pain with Hawkins impingement test. Radiographs were obtained which were consistent synovial chondromatosis as well as early degenerative changes including an inferior humeral head osteophyte (Fig. 1 *A* and *B*). Magnetic resonance imaging was recommended to further evaluate the degree of synovial chondromatosis and to assess any other associated pathology within the joint. At this time, a discussion was held with the patient about possible operative intervention in the setting of pain and concern for possible development of glenohumeral articular damage. Patient was hesitant to pursue surgery due to starting a new and physically challenging occupation. Five months later, the patient presented again with increased pain which would often awaken him at night. His examination remained relatively stable from previous aside from increased pain with O'Brien's and Speed's test as well as pain with flexion and abduction of the shoulder. Repeat magnetic resonance imaging demonstrated multiple-round joint bodies in the glenohumeral joint reaching the subscapularis, axillary recess, and in the long head of the biceps sheath (Fig. 2 *A* and *B*). In addition, there was small glenohumeral osteophytes and low-grade chondromalacia of the humeral head. At this time, the patient elected to

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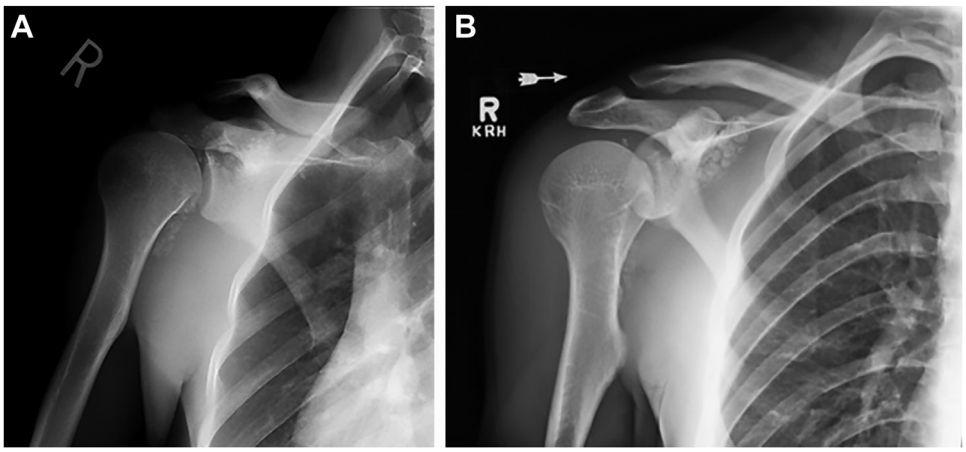

Figure 1 (**A**) Preoperative true AP X-ray of the right shoulder demonstrating loose bodies inferior to the humeral head. (**B**) Preoperative AP X-ray of the right shoulder demonstrating loose bodies medial to coracoid. *AP*, anteroposterior.

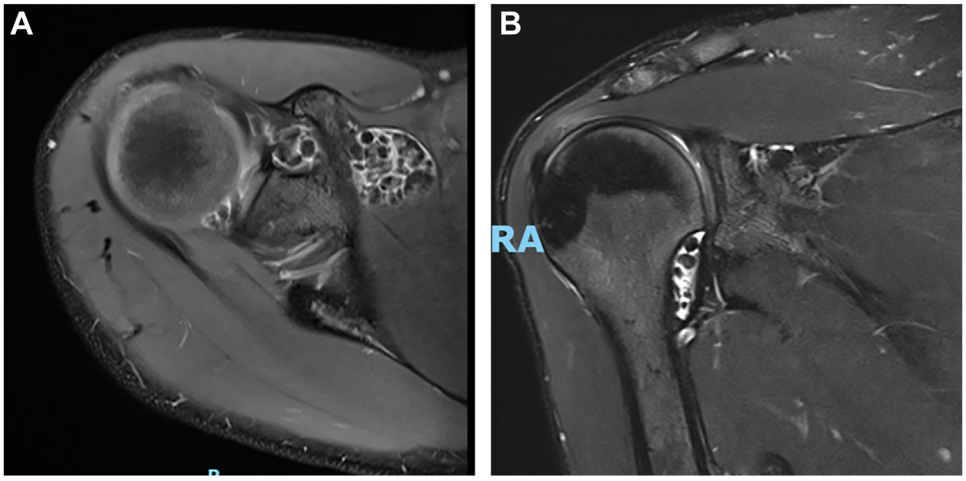

Figure 2 (**A**) Axial MRI of the right shoulder demonstrating loose bodies medial and lateral to the coracoid. (**B**) Coronal MRI of the right shoulder demonstrating loose bodies in the axillary recess. *MRI*, magnetic resonance imaging; *RA*, right arm.

proceed with surgery for removal of the loose bodies. The option of arthroscopic as well as open loose body removal was discussed with the patient given the extent of the loose bodies present as well as their location within the glenohumeral joint. The patient was ultimately indicated for a combined arthroscopic and open loose body removal from the right shoulder as well as possible biceps tenodesis given the location of the loose bodies present within the biceps tendon sheath. Consent was obtained from the patient for the publication of this case report.

Technical note

The patient was positioned in standard beach chair position. After appropriate sterile preparation and timeout, standard posterior and anterior arthroscopic portals were established, and a diagnostic arthroscopy was performed. Findings included mild grade 1 articular changes of the humeral head, intact labrum, intact long head of the biceps tendon, intact subscapularis, and superior cuff. Multiple loose bodies within the glenohumeral joint (Fig. 3) and particularly within the axillary recess were noted.

Given the extent of the loose bodies present within the biceps tendon sheath, biceps tenotomy was performed with plans for later tenodesis. Hypertrophic synovium was then débrided with combination of shaver and electrocautery wand. The procedure continued with removal of loose bodies with combination of pituitary grasper (Fig. 4) as well as kingfisher grasper. A 4-mm shaver sheath was connected directly to suction and was used for removal of loose bodies. The inner portion of the shaver was removed to allow for a large bore cannula effect to remove the loose bodies. The loose bodies within the axillary recess proved to be the most challenging to remove. With a goal to preserve the subscapularis insertion and avoid the need for open removal of the loose bodies within the axillary recess, great care was taken to remove the loose bodies in this location via arthroscopic techniques. A combination of glenohumeral distraction, traction, and pressure in the axillary region by assistant allowed for further displacement of loose bodies. This allowed access to the inferior aspect of the glenohumeral joint along the axillary recess where many of the loose bodies were located. Many nodules were observed to be removed via suction as demonstrated by presence in the suction tubing. It was estimated that more than 75 < 2 mm nodules were removed via suction tubing. Care was taken to remove each loose body within the glenohumeral joint and a thorough diagnostic evaluation, particularly along the axillary recess to ensure no remaining loose bodies were present, was performed. Loose bodies from the subcoracoid recess were removed via arthroscopic approach;

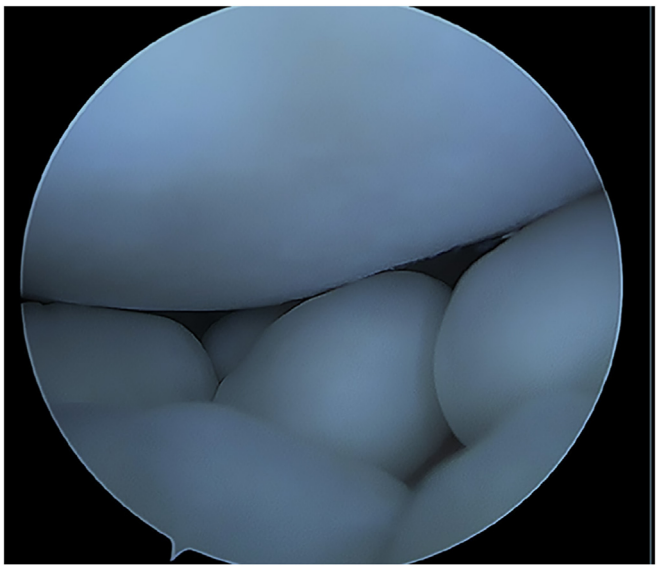

Figure 3 Arthroscopic view of loose bodies within the glenohumeral joint, viewing posterior to the humeral head.

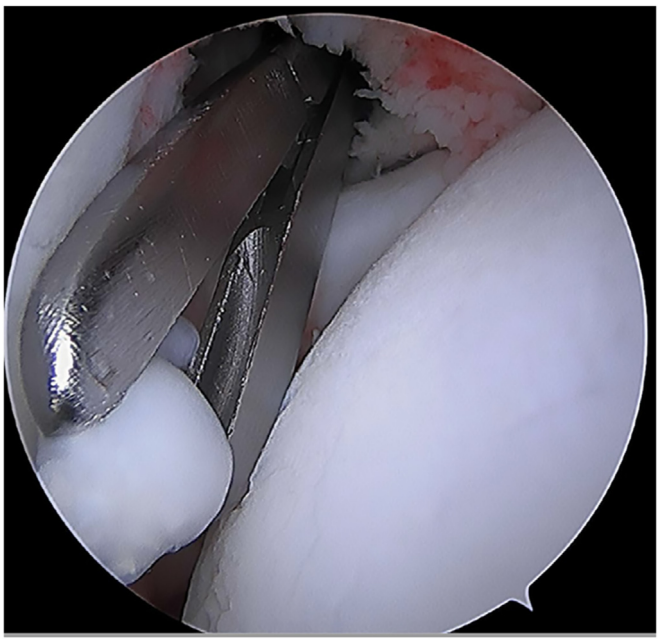

Figure 4 Arthroscopic removal of loose bodies view from posterior portal.

however, there were significant adhesions found in this area that prevented safe and adequate exposure. Thus, the decision was made at this time to proceed with an open approach to remove the remainder of the loose bodies' medial to the coracoid (Fig. 2*A*). Prior to conversion to an open approach, the subacromial space was then visualized and found to be free of loose bodies.

Attention was turned to the biceps tendon sheath and subcoracoid space via an open approach. The anterior portal incision was extended distally for a standard deltopectoral incision. Standard deltopectoral approach was taken to the level of the biceps sheath where further loose bodies were removed, and a longitudinal tear in the long head of the biceps tendon was noted. The biceps tendon was tensioned appropriately and then a tenodesis in standard fashion with a unicortical endobutton technique was performed. Attention was turned to the subcoracoid recess. The rotator interval was released medially. It was possible then to palpate and remove the remainder of the loose bodies within the subcoracoid space with a combination of Cobb elevator and blunt dissection.

After confirmation that all loose bodies have been removed, the wound was irrigated (Fig. 5). The incision was closed in standard fashion.

Postoperatively, the patient was provided with a sling for comfort. Physical therapy was initiated at 2 weeks postoperatively for early range of motion. For the first 6 weeks postoperatively, physical therapy focused on progressive range of motion. Six weeks following surgery, the patient was advanced to progressive strengthening. The patient returned for his final follow-up visit 3 months postoperatively. His Visual Analog Scale pain score was 0. His American Shoulder and Elbow Surgeons score at final follow-up was 100. He had forward elevation to 160 degrees, external rotation to 70 degrees, internal rotation to T12, and 5/5 strength with abduction, external rotation, and full strength with resisted belly-press. He reported minimal pain at final follow-up and was back to work in construction.

Discussion

Synovial chondromatosis is a rare condition that presents with multiple nodules in a synovial space. This most commonly being the knee and hip joints.[8] It is uncommon for this disorder to present in the shoulder and especially rare to present in a young adult.[7] The presence of loose bodies within the articular space further damages within the joint space, and therefore many cases of synovial chondromatosis are commonly treated with surgical removal.[8,9]

In a 2016 case report and literature review, Ravel et al[8] discuss the debate on open versus arthroscopic approaches. They cite Covall et al[2] indicating no clear advantage with open procedure. In our case, the arthroscopic approach was particularly helpful in removing the loose bodies from the inferior aspect of the glenohumeral joint in the axillary recess. Access to the axillary recess is further described by Memon et al[5] in a similar case report of a 23-year-old male with similar presentation. Removing these loose bodies via an open approach would have likely required a subscapularis tenotomy which would have led to the need to protect the subscapularis postoperatively and resulted in much slower rehabilitation process. However, in our case it would have been extremely difficult, if not impossible, to reach the loose bodies in the biceps sheath more distally through an arthroscopic approach. Although the difficulty gaining access to the biceps sheath in cases of arthroscopic removal of loose bodies has been noted by Lunn and Walch in 2007,[4] other authors might consider arthroscopic methods sufficient to access the subscapularis recess and biceps tendon sheath.[3] Furthermore, removal of the numerous loose bodies within the subcoracoid space medial to the coracoid would have been quite challenging via an arthroscopic approach, especially given the proximity to surrounding neurovascular structures. In this particular case, the open approach also allowed for safe access to subcoracoid recess where many loose bodies were located.

The combined arthroscopic and open approach has been previously documented by Buess and Friedrich[1] in a very similar case to ours involving a 22-year-old male. They report access to more than 50 nodules to be impossible by sole use of the arthroscope alone. Because of this, they also opt for a combined deltopectoral approach. However, the technical aspects of this surgery are not described.

Figure 5 Loose bodies on surgical towel.

Given the reported transformation into synovial chondrosarcoma in 1%-10%[6] of patients and our patient's young age on presentation, the decision was made to send sample nodules to pathology. The results from pathology were as follows: well-circumscribed, nodular, firm soft-tissue fragments ranging from 0.7 to 1.3 cm in greatest dimension, sectioning each of the fragments reveals white-tan, solid, slightly pearly tissue with no areas of necrosis or cystic change identified. A systemic review by Vincent et al in 2017 revealed only 48 cases of secondary synovial chondrosarcoma in 27 reports since 1957. In these cases, they report symptoms such as intramedullary infiltration, muscle infiltration, and aggressive progression of symptoms which were not present in our patient. It could be debated whether pathology specimens were necessary in our patient.

Conclusion

This is a rare case of synovial chondromatosis with a unique technical note describing the combined arthroscopic and open removal of loose bodies in an otherwise healthy 19-year-old male.

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