Technical Note

Arthroscopic Treatment of an Unusual Intramuscular Calcium Hydroxyapatite Crystal Deposit on the Rotator Cuff

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Abstract: Hydroxyapatite crystal deposition disease and its pathophysiology are poorly understood; however, it is known that calcific tendinitis is the most common condition related to this deposition in the upper limb. Movement of the crystals toward the myotendinous junction is rare; to the best of our knowledge, only 19 cases have been described in the literature, one of which was a case of intramuscular deposition without migration. The purpose of this technical note is to describe the technical details of the arthroscopic treatment of intramuscular calcium hydroxyapatite deposits without intratendinous migration.

Calcific tendinitis is related to 6.8% to 7.5% of all pain in shoulder disorders. It predominantly occurs in women 40 to 60 years old in the dominant limb. The most affected tendon is the supraspinatus (80%), followed by the infraspinatus (15%), subscapular (5%), and teres minor. The most common region of the affected supraspinatus is usually the "critical area," 1.5 cm medial to the insertion in the greater tuberosity, which has low vascularization.[1,2]

Hydroxyapatite crystal deposition disease and its pathophysiology are poorly understood. There are some associations with hormonal disorders and systemic disorders (e.g., idiopathic tumor calcinosis, autoimmune rheumatologic disorders, renal insufficiency, hypervitaminosis D, and other calcium disorders); however, it is known that calcareous tendinitis is the

Fig 1. Intramuscular calcification above the glenoid of the right shoulder (arrow). Anteroposterior view of the right shoulder, lateral decubitus position.

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Fig 2. Magnetic resonance imaging (T2) right shoulder. Coronal image showing intramuscular calcium deposit in the supraspinatus muscle ~3 cm in size with inflammation around the lesion (arrow).

most common related condition, and it is caused by the deposition of single or multiple calcium hydroxyapatite crystals in the upper limb.[1-5]

Calcium hydroxyapatite is the most common form of calcium in the human body. It is possible that deposits of hydroxyapatite within the tendons may migrate to adjacent tissues (e.g., bursa and bones). However, movement of the crystals toward the myotendinous junction is rare; to the best of our knowledge, only 19 cases have been described in the literature, one of which was a case of intramuscular deposition without migration.[1-5] In this Technical Note, we describe the details of an arthroscopic treatment of intramuscular calcium hydroxyapatite crystal deposits without intratendinous migration.

Surgical Technique

The patient treated with this technique was a 58-year-old right-handed woman presenting with right shoulder pain lasting for 15 months. There was no trauma, fever, or nerve/vessel dysfunction. Clinical evaluation did not show crepitus during shoulder movement or muscle atrophy but did show pain during shoulder elevation, abduction, and internal rotation. The patient presented positive Jobe, Hawkins–Kennedy, Neer, and Yocum test findings.

The radiological evaluation (Fig 1) showed a deposit of calcium above the glenoid. Magnetic resonance imaging of the right shoulder showed intramuscular calcium deposition in the supraspinatus muscle ~3 cm in size with inflammation around the lesion. The absence of tearing in the supraspinatus tendon and calcification in the layers suggested migration from the tendon to the muscle (Figs 2-4).[6] The patient underwent nonoperative management with physiotherapy for 3 months with ~20 sessions associated with Pilates and treatment with analgesics and anti-inflammatories without improvement. The arthroscopic procedure was offered after the failure of conservative treatment and persistence of functional impairment.

Glenohumeral Joint

The procedure was performed with the patient in the beach chair position under general anesthesia with a single-shot interscalene block. The joint was first accessed through the posterior portal using a 30° arthroscope (Karl Storz, Tuttlingen, Germany) with an anterior working portal. No calcification or pathology was observed in the biceps. The articular rotator cuff was carefully inspected. There was a small partial articular tear of the supraspinatus, which was debrided with a mechanical shaver (Video).

Subacromial Space

The arthroscope was directed to the subacromial space, and a lateral port was created.

Fig 3. Magnetic resonance imaging (T2) right shoulder. Coronal image showing intramuscular calcium deposit in the supraspinatus muscle, the absence of tearing in the supraspinatus tendon, and calcification in the layers.

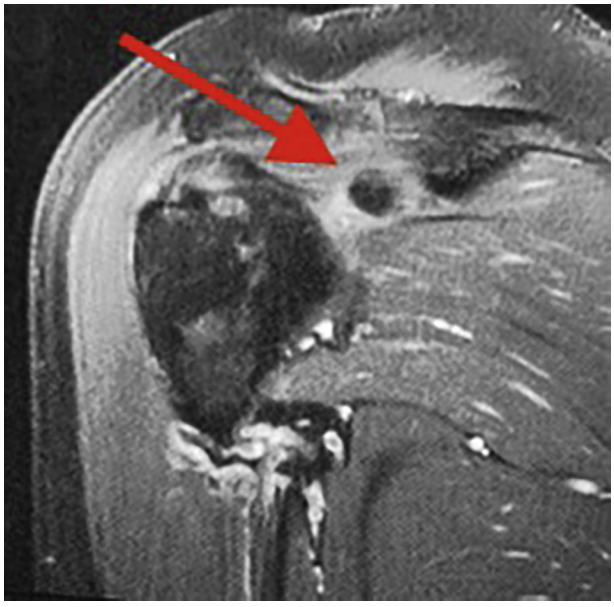

Fig 4. Magnetic resonance imaging (T2) right shoulder. Intramuscular calcification of the supraspinatus (arrow).

1. Bursectomy was performed to enhance visualization. There was no calcification under or inside the supra- or infraspinatus tendons.
2. After medial inspection of the cavity, a deposit, swelling, and neovascularization were observed in the muscular portion of the supraspinatus (Fig 5). A standard probe was used to palpate the calcium deposit.

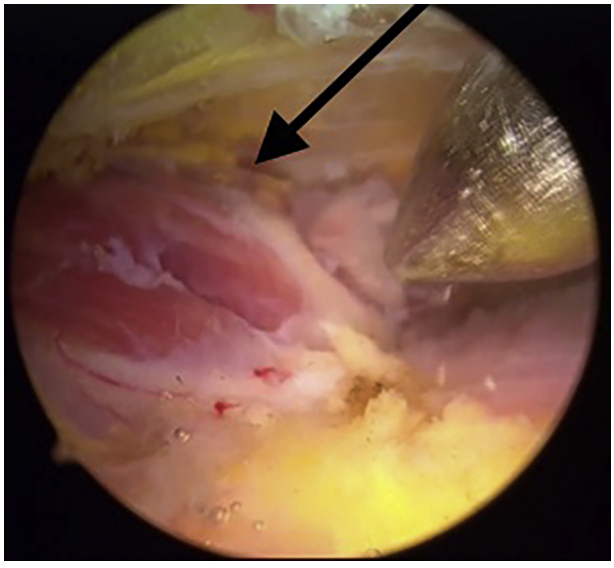

Fig 5. Arthroscopic visualization of the right shoulder from the posterior subacromial port with the patient in the beach chair position. Bursectomy was performed to enhance visualization. There was no calcification under or inside the supra- or infraspinatus tendon. Inspection of a supraspinal muscle revealed an intramuscular deposit (arrow).

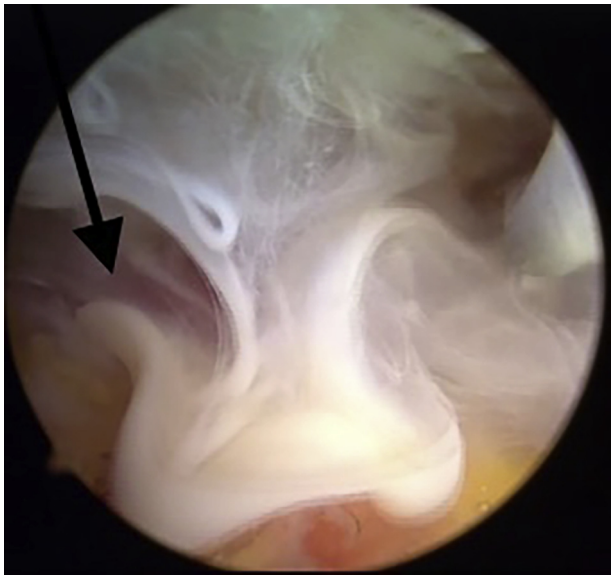

Fig 6. Arthroscopic visualization of the right shoulder from the posterior subacromial port with the patient in the beach chair position; the content was similar to that described in calcific tendinitis, i.e. a toothpaste-like deposit (arrow).

3. We introduced a trochanter and curette for stress and perforation. A large amount of white material was released, similar to the material described in calcific tendinitis (Figs 6 and 7). A shaver was used to debride the toothpaste-like deposit.
4. After drainage, we performed fluoroscopy for control (Fig 8). We continued the procedure to completely drain the deposit (Figs 9 and 10).

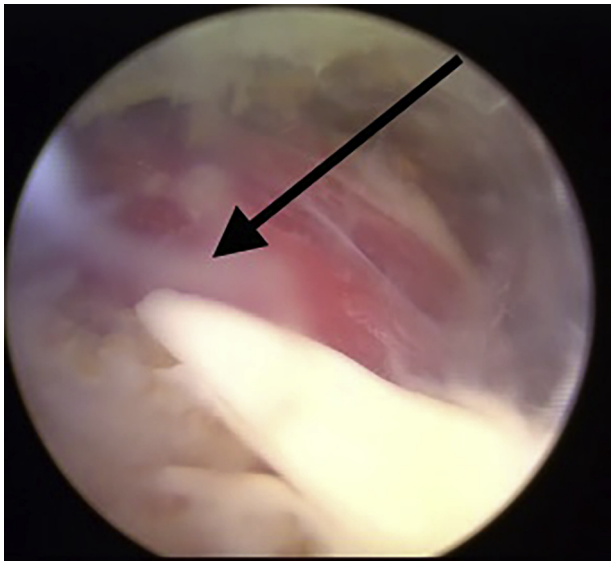

Fig 7. Arthroscopic visualization of the right shoulder from the posterior subacromial portal with the patient in the beach chair position. A large amount of white toothpaste-like material was released (arrow).

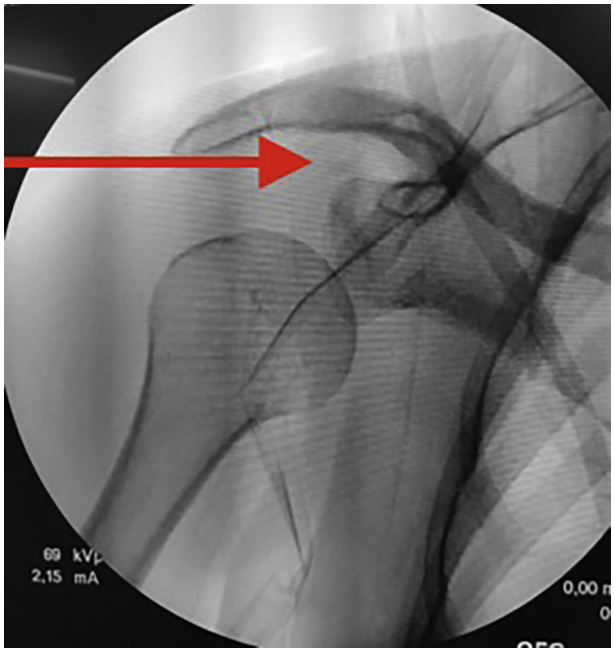

Fig 8. Intraoperative control fluoroscopy. Intramuscular calcification above the glenoid in the right shoulder (arrow). Anteroposterior view of right shoulder, beach chair position.

5. A final inspection and palpation were then performed by externally and internally rotating the humerus and palpating the rotator cuff with a probe.
6. Skin suturing, wound dressing, and joint immobilization with a sling were performed after the surgical procedure.

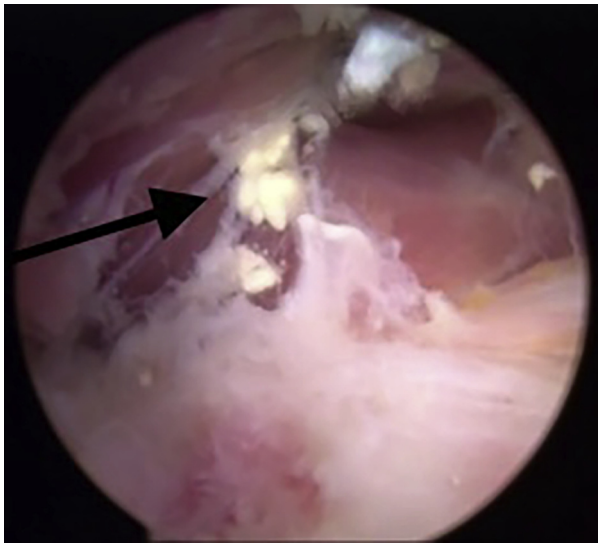

Fig 9. Arthroscopic visualization of the right shoulder from the posterior subacromial port with the patient in the beach chair position. Solid calcification remaining on the muscle supraspinal muscle (arrow).

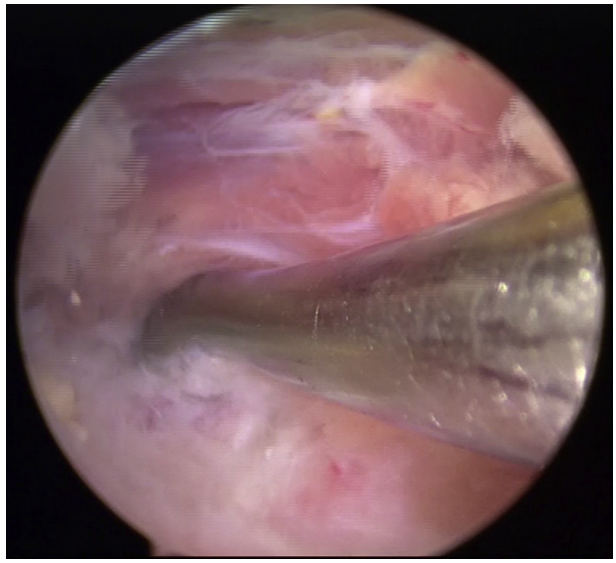

Fig 10. Arthroscopic visualization of the right shoulder from the posterior subacromial port with the patient in the beach chair position. We continued the drainage procedure until no calcification remained.

7. A summary of the advantages and disadvantages of this procedure is listed in Table 1.

Rehabilitation

The patient returned to the outpatient clinic in 14 days without pain or complaints. The surgical stitches and the sling were removed. Physical therapy was performed in the institution, starting with passive movements and isometric exercises of the rotator cuff until the second week, followed by global isotonic exercises and strengthening of the scapula stabilizers.

Discussion

We describe the treatment of intramuscular calcium hydroxyapatite crystal deposition. After analyzing the current literature, we observed that among the 19 reported cases of calcium hydroxyapatite crystal deposition, only 1 case did not involve intratendinous to intramuscular migration. Many authors have proposed different theories regarding the pathogenesis of calcium hydroxyapatite crystal deposition, such as decreased

Table 1. Indications and Preparations for the Technique

Clinical evaluation yields results similar to those of acute subacromial bursitis, rotator cuff tendinitis, or impact syndrome.
Radiological evaluation shows a deposit of calcium above the glenoid.
Magnetic resonance imaging shows intramuscular calcium deposition in the supraspinatus muscle, with inflammation around the lesion.
Locating the deposit can be a challenge.
Fluoroscopy may be useful to help visualize the intramuscular deposit.
A trochanter/probe can be used to expose the deposit and avoid making deep cuts in the rotator cuff (nerve/muscle damage).
A small residual deposit will not impair the clinical outcomes.

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
• Simple procedure	• Deposit cannot be viewed intra-articularly
• No sutures required	• Wide bursectomy is necessary
• Fluoroscopy may be useful to help visualization	• Locating the deposit can be a challenge
• Trochanter and curette can be used for deposit stress and perforation	• It is difficult to completely remove the deposit
• Accelerated postoperative rehabilitation	

local vascularization, failure of the repair response and erroneous stem cell differentiation; however, Vinantia et al.[2] posited that the formation of intramuscular calcium deposits differs because of the formation of hematomas after trauma and microtrauma.[5] In cases with intramuscular to intramuscular migration, Hsu et al.,[7] Jim et al.,[8] and Gotoh et al.[3] suggested an association with rotator cuff tears and the need for crystals to create an intrasubstantial lesion for migration to occur, which are conditions that were not observed by magnetic resonance imaging in our patient.[3,7,8]

Arthroscopic techniques require additional training but offer the advantage of minimally invasive approaches with reduced postoperative pain and early mobilization (Table 2). However, it is necessary to avoid the risk of neurovascular injury during deposit stress and perforation in the supraspinatus muscle. The suprascapular nerve courses through the suprascapular notch an average of 3.42 cm from the superior end of the glenoid fossa.[9] Another risk with this technique is damage to the supraspinatus muscle during withdrawal of the calcium deposit.

In many patients, calcific tendinitis is a self-limiting condition and can be treated successfully with conservative measures. Conservative treatment should be indicated at baseline; this includes physiotherapy, analgesic drugs, nonsteroidal anti-inflammatory drugs, steroid infiltration, and shock wave therapy. Once conservative treatment has been tried without success, arthroscopic treatment is indicated. In our case, with intramuscular deposition, we could not determine whether surgical treatment offered better results than conservative treatment. However, we believe that the deposit of intramuscular calcium hydroxyapatite was not responsive to conservative treatment, and the clinical outcomes of improved pain and function with surgical treatment were evident in the patient in question.

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