




# Intramuscular migration of calcium deposits into the deltoid muscle: two cases of a rare complication of rotator cuff calcific tendinopathy

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## Abstract

Rotator cuff calcific tendinopathy is a common non-traumatic shoulder pain condition that occurs predominantly in the supraspinatus tendon. Ultrasound-guided percutaneous irrigation of calcific tendinopathy (US-PICT) is a valid treatment in the resorptive phase. A complication of calcific tendinopathy is migration of calcium deposits outside the tendon. The most common site of migration is the subacromial-subdeltoid bursa (SASD). Another, but not frequent, type of migration is the intramuscular migration which mostly affects the supraspinatus, the infraspinatus and the biceps brachii muscles. This paper reports two cases of migration of calcification from the supraspinatus tendon to the deltoid muscle. The aforementioned site of migration has so far never been described in literature. Both patients presented calcification in the resorptive phase and therefore were treated by US-PICT.

**Keywords** Shoulder pain · Calcific tendinopathy · Ultrasound-guided percutaneous treatment · Intramuscular migration

## Introduction

Rotator cuff tendinopathy is a pathological condition characterized by hydroxyapatite crystals on the area of fibrocartilaginous metaplasia of the tenocytes [1, 2]. About 80% of shoulder calcifications involve the supraspinatus tendon [1] and only slightly more than a third of shoulder tendon calcifications become symptomatic [3, 4]. The most accredited pathogenetic theory seems to correlate a reduction in oxygen levels to the appearance of areas of fibrocartilaginous metaplasia and intratendinous necrotic areas in which calcium crystals are deposited. Uthoff et al. [5] described three stages of shoulder calcific tendinopathy. The pre-calcific phase in which the fibrocartilaginous metaplasia occurs in tendon tissue. The calcific phase is divided into two phases: the formative phase characterized by formation of calcium

deposits, and the resorptive phase in which macrophagic phagocytosis of calcium deposits occurs. Finally the post-calcific phase includes the remodeling of the tendon. The ultrasound-guided percutaneous irrigation of calcific tendinopathy (US-PICT) is a mini-invasive treatment which is suitable for the resorptive phase [6–8]. A complication of calcific tendinopathy is migration of deposits of calcium into the adjacent structures [9]. A literature review suggests the subacromial-subdeltoid bursa (SASD) as the most common site of migration. However, albeit less common, cases of intramuscular migration have been described [10]; in particular in the supraspinatus, infraspinatus [11, 12], subscapularis, in the third proximal of biceps brachii [13] and in the humeral insertion of the pectoralis major [14]. Another atypical site is intraosseous migration [15, 16] which involves three stages: the bone erosion, the subcortical migration and the intramedullary diffusion [17]. Imaging, and in particular RX, MRI and US, allows us to evaluate positioning of calcification after migration. In particular, ultrasound (US) represents the gold standard method for the identification of intrabursal and intramuscular migration [18]. The aim of this work is to describe two cases of a rare and unusual site of migration of calcium deposits from the supraspinatus tendon to the deltoid muscle in a context of calcific tendinopathy. To our knowledge analogous cases of migration have not yet been described in literature.

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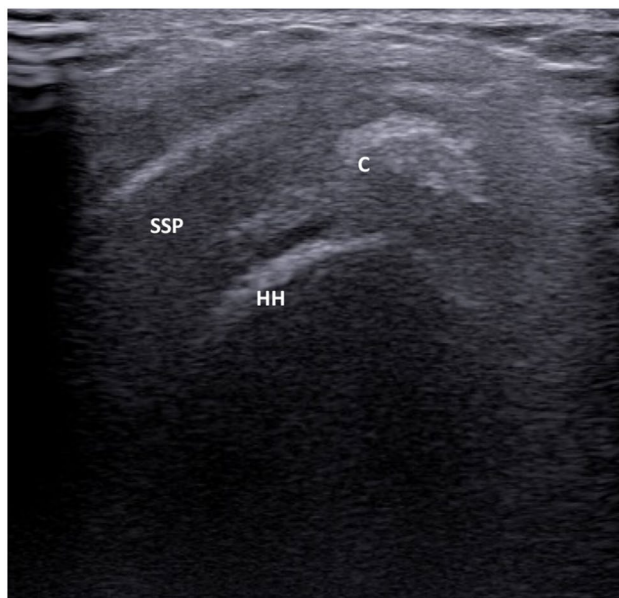
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## Case reports

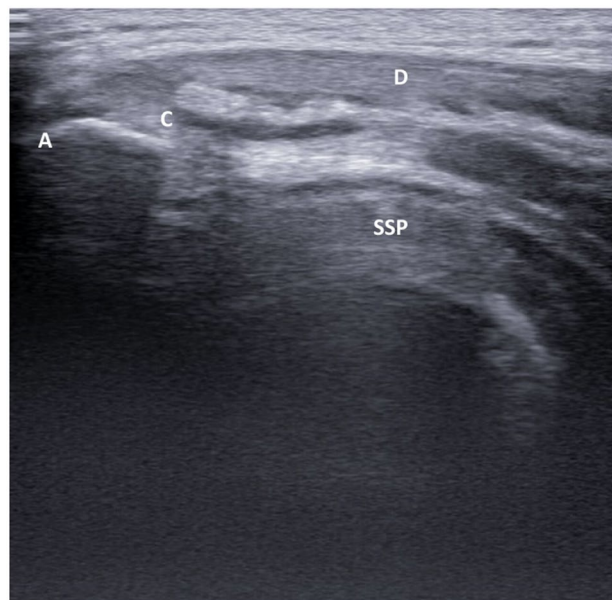
The first case refers to a 60-year-old male, amateur swimmer, non-smoker, with no cardiovascular, endocrinological or metabolic comorbidities. The patient reported a history of calcific tendinopathy affecting the supraspinatus tendon as evidenced by a muscle–tendon ultrasound examination performed 40 days earlier than our observation by another physician (Fig. 1). Upon our observation, the patient complained of right shoulder pain which irradiated to the anterior brachial and deltoid regions; despite having undergone NSAID therapy (Diclofenac 150 mg/day for 5 days) the pain was evaluated 8/10 by visual analogical scale (VAS). Clinical evaluation revealed severe functional limitation of range of motion (ROM) in passive and active mobilization.

The ultrasound examination, performed with a MyLab40 system (Esaote Biomedica, Genoa, Italy) and a 5–12 MHz linear probe, showed the absence of calcification in the previous intratendinous localization which appeared to have migrated to the deltoid muscle near the proximal acromial insertion (Fig. 2). Color Power Doppler showed an area of peri-calcific hyperemia related to phenomena of neoangiogenesis and capillary proliferation typical of the resorptive phase [19].

The second case refers to a 42-year-old female amateur tennis player, smoker with absence of endocrinological and metabolic comorbidities. The patient brought an ultrasound exam of the left shoulder performed 2 months earlier than



**Fig. 1** The ultrasound examination performed 40 days before than our observation shows the presence of calcium deposits inside the supraspinatus tendon. *C* calcification; *HH* humeral head; *SSP* = supraspinatus tendon

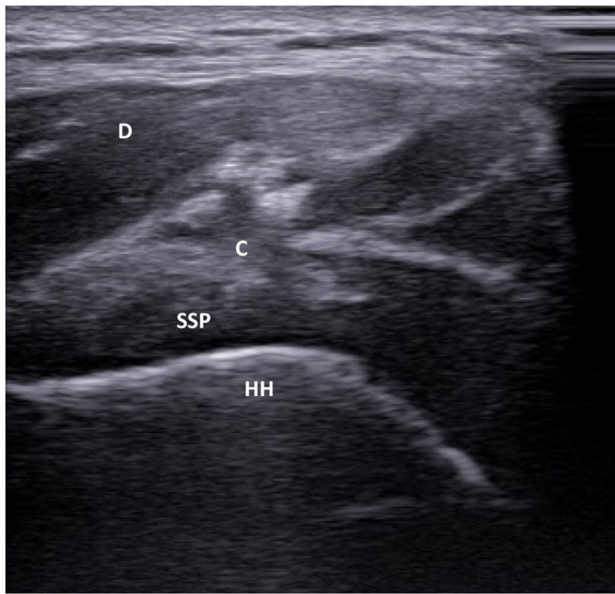


**Fig. 2** The ultrasound examination shows the presence of calcium deposits in the deltoid muscle. *A* acromion; *C* calcification; *D* deltoid; *SSP* supraspinatus tendon

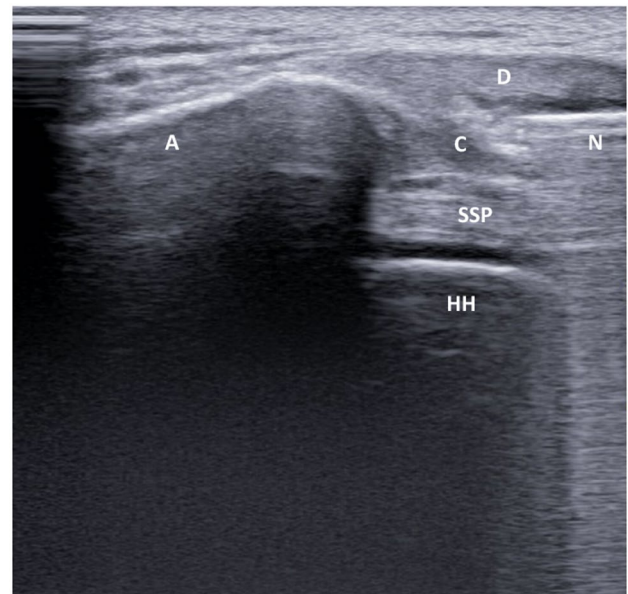
our observation which showed the presence of a calcification in the tendon of the supraspinatus muscle. During medical examination the patient reported an increase of symptoms, despite taking Ibuprofen 600 mg/day for 4 days. The symptoms were associated to reduction of free ROM in abduction and external rotation and pain intensity 7/10 by VAS. The ultrasound examination showed the calcific deposits in between the SASD bursa and the deltoid muscle (Fig. 3).

Despite absence of guidelines regarding the treatment of intramuscular migration of calcification, based on the experience gained in the treatment of tendon calcifications and the ultrasound staging of the pathology, both patients were treated whit US-PICT [20]. The patient described in the second case returned after 7 days for treatment. The ultrasound re-evaluation illustrated the complete migration of the calcification to the deltoid muscle (Fig. 4).

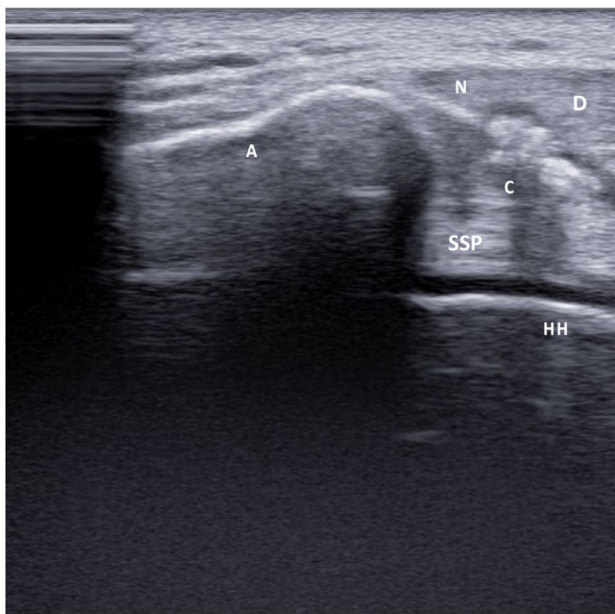
The following procedure was adopted to treat the calcic formation: the first phase was an accurate two-step skin disinfection with povidone-iodine and chlorhexidine. The double color disinfection allows us to "center" the area of treatment; secondly through ultrasound guide and a 21G needle, 5 ml of lidocaine 2% was injected into the SASD bursa. Two minutes later the needle was introduced into the calcification using ultrasound guide to aspire calcium deposits by means of compression and release of the syringe plunger (Fig. 4). The procedure was performed by the same needle but changing syringes, until all the amorphous material of the calcification aspirated. Without removing the needle, 1 mL of triamcinolone acetonide 40 mg/ml was injected into the SASD bursa



**Fig. 3** The ultrasound examination shows the presence of calcium deposits between the deltoid muscle and the supraspinatus tendon. *C* calcification; *D* deltoid; *HH*=humeral head; *SSP*=supraspinatus tendon



**Fig. 5** The image shows the treatment of the calcification of the second patient where the introduction of a separate needle from the other side of the calcification to complete the procedure was necessary. *A* acromion; *C* calcification; *N* needle; *HH* humeral



**Fig. 4** The image illustrates the ultrasound-guided percutaneous irrigation of migrated calcification inside the deltoid muscle. The ultrasound examination shows the needle inside the calcification during the treatment. *A* acromion; *C* calcification; *D* deltoid

to avoid reactive bursitis. In the second patient the introduction of a separate needle from the other side of the calcification to complete the irrigation of the calcific deposits was necessary (Fig. 5). The last phase was a post-procedural ultrasound check

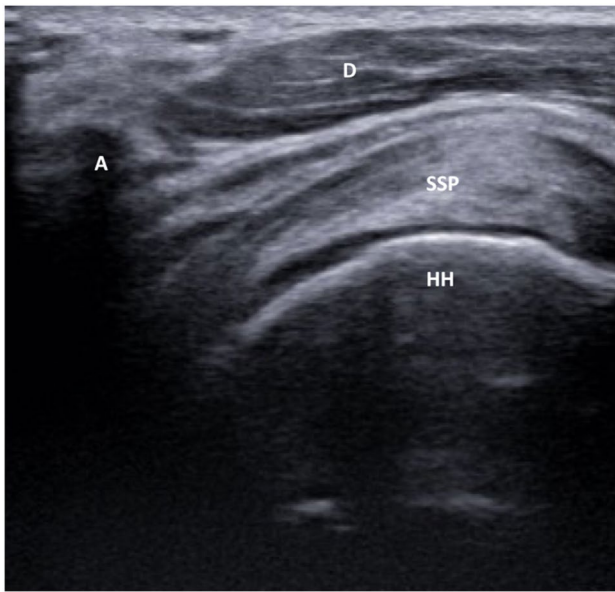
to exclude periprocedural complications. After the procedure the needle entry site was covered with sterile gauze and dry ice was applied for 15 min.

The patients were instructed to rest for 3 days from treatment and subsequently for 15 days avoiding elevation and abduction movements. The clinical and ultrasound evaluations were performed after 3 weeks from procedure after which physiotherapy was initiated. At the first check at 3 weeks from the procedure the patient of the first case reported a complete remission of the symptoms while the second patient reported the persistence of minimal pain (VAS 2/10). Ultrasound examination showed in both patients the disappearance of hyper-echoic area in the deltoid muscle referable to the migrated calcification and the absence of the previously described inflammatory phenomena. The final clinical and ultrasound evaluation was performed at 60 days from the procedure; both patients reported the remission of the pain symptoms with complete recovery of the joint ROM in all movement; the ultrasound examination showed the absence of calcific deposits in the deltoid muscle and the supraspinatus tendon, and the absence of inflammatory reactions affecting the SASD bursa (Fig. 6). Both patients resumed regular sport activity.

## Discussion

Migration of intratendinous hydroxyapatite crystal deposits into adjacent structures is a rare complication which mainly concerns the SASD bursa. Cases of intramuscular migration,





**Fig. 6** The ultrasound examination performed 60 days after the procedure shows the absence of calcific deposits inside the deltoid muscle. *A* acromion; *D* deltoid; *HH* humeral head; *SSP* supraspinatus tendon

mainly in the supraspinatus and infraspinatus muscles, are reported, as evidenced by Pereira et al. [21] in a multicenter retrospective study. Other cases of intramuscular migration in the subscapularis muscle and proximal third of the biceps brachii have also been described. Another atypical migration is intraosseous, in which MRI becomes fundamental in addition to the ultrasound examination that allows to highlight the erosion of the humeral head related to the passage of calcification. In fact, as demonstrated by the literature, MRI is fundamental to identify the correct phase of intraosseous migration of calcification (the bone erosion phase, the subcortical migration or the intramedullary diffusion) and to make the differential diagnosis with other bone pathologies [22]. From our analysis of literature, cases of migration of rotator cuff calcifications in the deltoid have not been described.

The ultrasound examination allows us to identify the correct phase of the calcification and the migration into the adjacent structures. Bianchi et al. [23] describe three different types of calcification visualized on ultrasound in the calcific phase: type I which appear as hyperechoic structures with a well-defined acoustic shadow; type II are hyperechoic but with a mild acoustic shadow and type III which appears as isoechoic without an acoustic shadow. Types II and III generally correspond to the resorptive phase. The passage of calcifications to adjacent tissues occurs mainly during the resorptive phase. In this phase, due to the softer consistency of the calcification, the US-PICT is indicated and in our experience it allows a rapid regression of pain symptoms

[24]. Ultrasound exam allows the correct diagnosis of the position of the calcification inside the tendon, the staging of the calcification and the identification of the reactive phlogosis, detectable as edema surrounding the calcium deposits. The presence in both cases of a previous ultrasound evaluation (respectively 40 and 60 days before our observation) with relative diagnosis of calcific tendinopathy of the supraspinatus tendon, combined with the identification of calcification only in the intramuscular site allowed the correct diagnosis of migration inside the deltoid muscle.

## Conclusion

This paper demonstrates that the deltoid localization can be considered a possible, although rare, site of atypical migration of rotator cuff calcifications. Moreover ultrasound-guided percutaneous treatment has proven to be a valid option for pain relief and recovery of the shoulder in cases with intramuscular migration of calcification.

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**Data availability** All data relating to the two case reports are available in the manuscript.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical standards** All procedures performed in studies involving human participants were in accordance with the ethical standards of Helsinki Declaration.

**Informed consent** IRB approval and informed consent from the patients included in the cases report was obtained.

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