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Case report

ATYPICAL LOCALIZATION OF ROTATOR CUFF CALCIFIC TENDONITIS: VALIDATION OF THE FIVE-STEP SHOULDER ULTRASOUND PROTOCOL IN DETECTION OF SUBSCAPULARIS TENDON CALCIFICATIONS

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ABSTRACT

Calcific tendonitis (CT) is characterized by deposition of calcium phosphate crystals in rotator cuff (RC) tendons of the shoulder. It most commonly involves the supraspinatus tendon even though the subscapularis tendon is a =rare site for calcific deposition, especially in young sportsmen.
Herein, we report the case of a 29-year-old professional tennis player with CT of the subscapularis tendon diagnosed by using the European Society of Musculoskeletal Radiology (ESSR) standardized step-by-step shoulder ultrasound (US) protocol and treated with US-guided needling of the calcification site. The aim of this report is to increase the general awareness of the atypical localization of RCCT and to highlight the importance of US imaging in early diagnose and early treatment of this disease.
Thus, sports physicians must be aware of the diagnostic and therapeutic possibilities offered by US in order to expedite rapid referral to a musculoskeletal specialist who can perform a point-of-care US examination of the shoulder and, where necessary, an US-guided interventional approach.

1. Introduction

Tennis is one of the most popular sports in the world, played by millions of athletes worldwide. Historically, it is mentioned in literature as far back as the Middle Ages. Sir Gawain, a knight of King Arthur's round table, plays tennis against a group of 17 giants in The Turke and Gowin (c. 1500) [1].
Tennis is a noncontact sport, since the players in the opposite teams are separated by a net, so the incidence of injury is relatively low.
However, it demands rapid movements to change the body position in space, in the horizontal, vertical, and rotational directions, and the arms undergo the greatest strain during repetitive movements, as they do in other overhead sports activities like baseball, volleyball, basketball, and swimming, in which degenerative diseases of the rotator cuff (RC) are also common [2, 3].
In clinical practice, RC tendon calcifications are by no means a rarity; they are, in fact, one of the most common shoulder abnormalities.

Most commonly they involve the supraspinatus tendon, followed by infraspinatus, and rarely subscapularis and teres minor. RC tendon calcifications are known to be self-limiting, running an asymptomatic course in up to 50%. However, in those patients who have associated shoulder pain, a painful restriction in range of motion and limitations in activities of daily living are reported [4].
Since it is rare, subscapularis calcific tendonitis (CT) takes place in literature mainly as case reports [5, 6]. Herein, we aimed to present a rare case of subscapularis CT occurring in a professional tennis player which was diagnosed by using the European Society of Musculoskeletal Radiology (ESSR) standardized step-by-step shoulder US protocol [7] and treated with US-guided needling of the calcification site.
The aim of this report is to increase the general awareness of the atypical localization of RCCT and to highlight the importance of US imaging in early diagnose and early treatment of this disease.

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2. Case presentation

A twenty-nine-year-old, right-handed male professional tennis player came to our hospital complaining of pain in the anterior aspect of the right shoulder. The athlete specified that the pain was aggravated with physical activity, predominantly appearing during forehand motions.

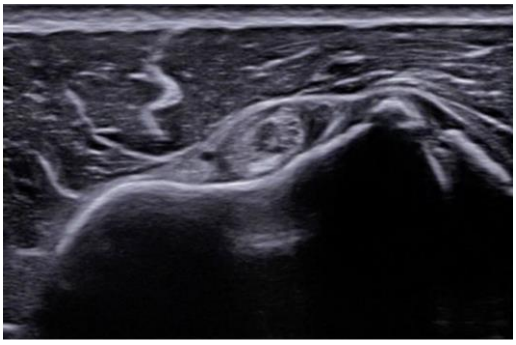
Three years before his visit, he had experienced a single episode of sudden acute pain in the right shoulder while executing a forehand stroke. Before this injury, the patient had been a competitive tennis player for approximately 15 years. He typically trained three times a week and played at least one match per week. Despite the pain, the subject continued to participate in competitive tennis and experienced the pain especially during the follow-through phase. However, the pain increased gradually, getting worse in the last three months. One month before his visit to our hospital, he was examined by his family doctor, who advised him to rest his shoulder. In recent days, the pain in his shoulder persisted even while performing daily activities and decreased sleep quality. Hence, he was referred to our hospital.

Aside from the pain on his right shoulder, the patient reported no history of other diseases, shortness of breath, or chest pain. Laboratory blood tests revealed no abnormalities. Blood pressure was 120/70 mmHg and heart rate 85 bpm. The patient's electrocardiogram showed a normal sinus rhythm with no ST or T-wave abnormalities.

On physical examination, he had no local edema, asymmetria in skin colour, or temperature. On palpation, there was marked tenderness over the part of his anterior shoulder near the tendinous insertion of the subscapularis muscle. Internal shoulder rotation were very painful and range of motion to this direction was diminished. Internal rotation muscle power was weak and lift-off test was positive. However, the right arm was neurovascularly intact with normal motor and sensory functions of radial, median, ulnar, and axillary nerves.

On initial assessment, the sports physician considered the severe pain that the patient was experiencing and suspected a possible shoulder tendinopathy, thus, facilitated a rapid pain medication administration and an US evaluation of the patient's right shoulder.

As a result, a focused point-of-care US examination of the patient's shoulder was performed. The patient was sitting opposite to the examiner, the forearm was flexed 90° with the arm resting on the thigh, slightly internally rotated, and palm facing up. Firstly, holding the transducer in a horizontal position, the bicipital groove was localized between greater and lesser tuberosity of the humerus. This structure was used as a landmark to identify the long head of biceps brachii tendon (LHBBT), which showed a low-grade tendinosis. A small fluid expansion of the synovial sheath of LHBBT was also noted (Figure 1a and 1b).



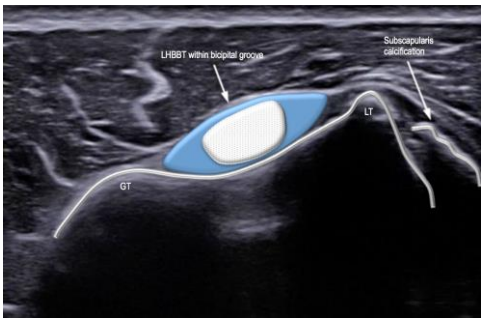


Figure 1 A and B. Short-axis scan (a) and corresponding schematic drawing (b) of LHBBT in the bicipital groove, which showed a low-grade tendinosis and a small fluid expansion of the synovial sheath. US image shows also subscapularis tendon containing a coarse calcification. GT, greater tuberosity; LT, lesser tuberosity.

Then, keeping the probe on the bicipital groove, the forearm was extrarotated to expose the subscapularis muscle-tendon unit. On long- and short-axis scans, evaluation of the patient's subscapularis tendon revealed a coarse calcification in the area of insertion anterior to the humeral head close to the lesser tuberosity (Figure 2a and 2b). Also, long-axis scans revealed cortical irregularities of lesser tuberosity (Figure 3a and Fig 3b). Subsequently, moving the patient's upper limb from the position used to evaluate the subscapularis tendon so his hand was on the posterior region of the iliac wing, i.e. on his "back pocket", the sovraspinatus tendon was identified and long- and short-axis scans revealed no tendon abnormality. Finally, the further steps of the structured approach to shoulder US included the evaluation of the acromio-clavicular joint, and the infraspinatus/teres minor tendons with the posterior glenoid labrum, which were free of disease. The verification of the subscapularis calcification and cortical irregularities of lesser tuberosity was subsequently done by plain radiographs.

Although the patient showed improvements in pain after receiving non-steroidal anti- inflammatory drug (NSAID) injections, we decided to treat the patient through an US-guided needling approach. Under local anesthesia of the subscapularis and soft-tissue adjacent to the calcification, a puncture was made using an 18 G spinal needle with the patient's upper arm in supine position and external rotation. US-guided needling of calcification site was performed towards the longitudinal axis along the subscapularis. During the procedure, the calcific material, toothpaste-like in substance, was drawn out through the needle puncture by using irrigation.

The shoulder pain was dramatically resolved after treatment and was completely resolved by the next days. Four days after the treatment, the amount of calcific material was significantly diminished, which we confirmed through plain radiological findings and range of motion of the shoulder returned to normal. Two weeks after treatment, we were able to confirm the complete removal of the calcific material.

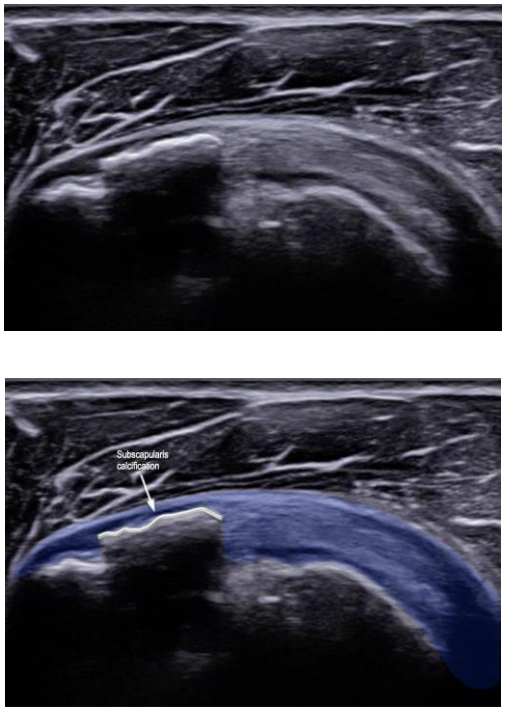


Figure 2 A and B. Long-axis scan (a) and corresponding schematic drawing (b) of subscapularis tendon obtained by transducer placement on the bicipital groove with shoulder externally rotated, reveals a coarse calcification in the area of insertion anterior to humeral head close to the lesser tuberosity.

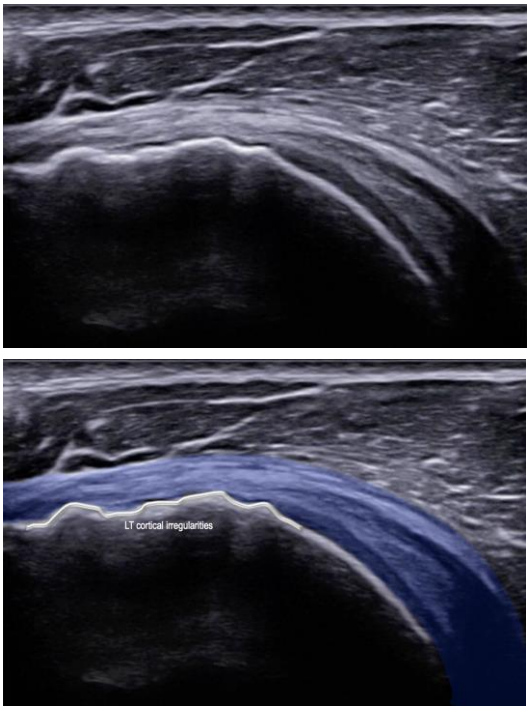


Figure 3 A and B. Long-axis scan (a) and corresponding schematic drawing (b) of subscapularis tendon (same scan of the previous figure) shows also cortical irregularities of lesser tuberosity.

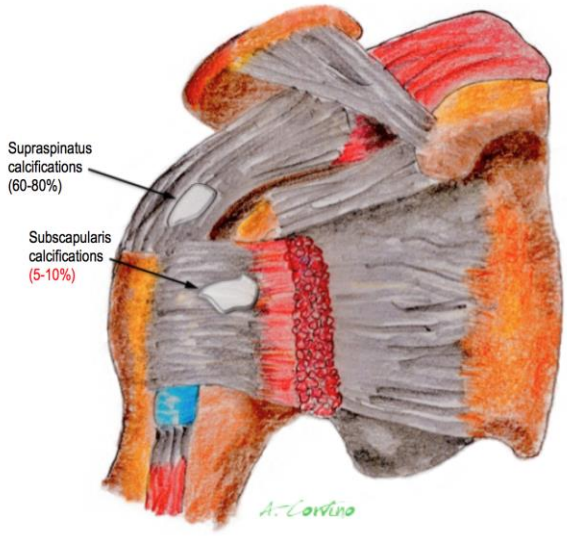


Figure 4. RCCT is a very common condition due to the presence of calcific deposits inside or around the tendons of the RC. The most commonly affected tendon is the supraspinatus tendon at its insertion on the humerus trochanter, being involved in 60-80% of cases. More rarely, calcifications are located on the infraspinatus (15-30%), the subscapularis (5-10%), or the teres minor tendons (<5%).

3. Discussion

Our RCCT is a very common condition due to the presence of calcific deposits inside or around the tendons of the RC. The most commonly affected tendon is the supraspinatus tendon at its insertion on the humerus trochanter, being involved in 60-80% of cases. More rarely, calcifications are located on the infraspinatus (15-30%), the subscapularis (5-10%), or the teres minor tendons (<5%). When symptomatic, CT can be very painful and disabling for patients, thus requiring prompt treatment [4].

In 1907, Painter was the first to describe the radiographic findings in patients with CT. Codman, in the 1930s, proposed that degeneration of tendon fibers preceded calcifications. In 1902, Harrington and Codman performed the first reported operative removal of a calcific deposits. In 1987, Ellman first described the arthroscopic removal of calcific deposits. More recently, Uhthoff and Loehr proposed a progressive reactive calcification process to describe the disease [8].

Although the exact cause of RCCT remains unclear, some intrinsic and extrinsic factors related to genetics, ageing, endocrinological status, vascularity, overloading, and local degenerative or proliferative processes are thought to have contributions to etiopathogenesis.

According to mechanical theory, tendinopathies occur as a result of repetitive load stress exceeding normal physiological limits of the shoulders, thus involving athletes who engage in repetitive overuse activities, as in our case. Chronic overuse-related microtrauma and tendon degeneration may, in fact, play an important role in predisposing athletes to subscapularis injuries. Several investigators have hypothesized that the tendon may be chronically injured by a mechanical compression between the lesser tuberosity and coracoid process, the so-called “roller wringer effect”, of particular significance in high-demand overhead athletes.

Another contributory mechanism of injury is antero-superior impingement, in which articular-sided abrasion may occur at the lesser tuberosity and glenoid rim interface, especially in the resisted flexed and internally rotated positions (e.g., the tennis follow-through). Such chronic, repetitive stress applied to the subscapularis musculotendinous junction could lead to microtrauma and eventually macroscopic tendon compromise. The inflammation would then be structured as calcium crystals [8, 9].

Whether sport-specific activities predispose to such chronic overuse is not yet clear, although several studies have demonstrated a subscapularis stress during certain sports such as tennis. More specifically, a study investigation has shown tremendous subscapularis demands during the tennis serve and forehand stroke, with a high frequency of US confirmed subscapularis tendon calcifications in the dominant shoulder of veteran (age, 35–77 years) tennis players [9].

Another widely used theory is the hypoxic degeneration. The disease might be related to hypoxia and necrosis within the tendon with subsequent degeneration, although this has been questioned by Bosworth. However, the development of the CT occurs when hydroxyapatite salt of calcium starts depositing in the RC tendons, one of which is subscapularis. The disease has four phases according to histological findings: precalcific, calcific, resorptive and repair phases. Uthoff et al. reported that the affected tendon is transformed to fibrocartilage, and it may be a predilection to calcification. It is followed by formative and resorptive phases. There is a natural cycle in which the tendon has the capacity to repair itself; in chronic calcific tendonitis this cycle can be blocked at any stage [10].

US examination is a fundamental tool in diagnosis and treatment of CT. Use of high-resolution US shows the presence of deposits and defines their locations in the tendons, including their size and texture. This technique enables staging of the deposits by correlation of shadow cones and shows RC tears in detail. More recently, US has also changed from having a purely diagnostic role to become an important therapeutic tool, especially for carrying out bursal lavage and tendon needling [9, 10]. Radiologists have developed a full step-by-step US shoulder protocol that includes evaluation of the following structures: the long head of the biceps brachii tendon, the subscapularis tendon, the supraspinatus tendon and rotator interval with both static and dynamic evaluation for impingement, the acromio-clavicular joint, and the infraspinatus and teres minor tendons with the posterior glenoid labrum. In this setting, US has proved to be 79% sensitive and 88% specific for diagnosing shoulder tendon calcifications using dynamic maneuvers [7].

In our patient, a focused point-of-care US examination of the shoulder was performed according to the above-mentioned protocol, and this revealed a coarse subscapularis calcification and cortical irregularities of lesser tuberosity. Thus, our case is a further confirmation that shoulder US examination can help in preventing missed or delayed diagnosis of RC tendon calcifications, especially when the diagnosis is not always clear clinically or when physical examination maneuvers are limited by pain and soft tissue swelling.

4. Conclusions

In literature, there are only a few cases reporting a subscapularis CT. Here we represent a case of US confirmed subscapularis CT of the right shoulder in a rarely seen localization of RC tendinitis, which responded dramatically to the US-guided needling of calcification site.

Sports physicians must be aware of the diagnostic and therapeutic possibilities offered by US in order to expedite rapid referral to a musculoskeletal specialist who can perform a point-of-care US examination of the shoulder. This approach to sports pathology potentially improves patient outcomes.

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