A 58-year-old Female Patient with Severe Right Shoulder Pain

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Section 2 – Answer

Case description

A 58-year-old woman presented with right shoulder pain, ongoing for several months but becoming severe over the past 2 weeks. There was no recent change in activity or associated injury. On physical examination, the patient was found to have limited abduction and internal rotation of the shoulder.

A radiograph of the right shoulder appeared normal [Figure 1]. There was no fracture or dislocation. No soft tissue calcification was present. There was also no periosteal reaction or suspicious osseous lesion.

Musculoskeletal ultrasound (US) demonstrated an enlarged, heterogeneous appearance of the supraspinatus tendon [Figure 2]. In addition, multiple nonshadowing amorphous slightly echogenic to isoechoic foci were identified within the supraspinatus tendon with partial extension into the adjacent thickened subacromial-subdeltoid bursa. This resulted in an ill-defined junction of the tendon bursal surface and the bursa itself. There was no significant adjacent subcutaneous edema and no associated hyperemia by power Doppler.

Figure 1: Anteroposterior (Grashey) radiograph of the right shoulder demonstrates no fracture or dislocation. No calcific foci are seen adjacent to the greater tuberosity (arrowhead) of the proximal humerus to correspond to the supraspinatus tendon

Interpretation

The findings were consistent with right supraspinatus calcific tendinopathy (CaT) within the resorptive phase with an associated subacromial-subdeltoid calcific bursitis. The US demonstrated an intact supraspinatus tendon with migration of the calcium hydroxyapatite deposits from the supraspinatus tendon into the adjacent bursa. The radiographs were normal, indicating this is radiographically occult and emphasizing the benefits of the use of US for this diagnosis

An US-guided needling and lavage (barbotage) were suggested for treatment. The patient subsequently received a glenohumeral joint injection by sports medicine and was sent to physical therapy. Upon a 2-month follow-up clinical visit, there had been significant improvement in pain and increased range of motion

Discussion

CaT is a common condition in which calcium hydroxyapatite deposits in tendons. It most commonly affects the rotator cuff (RC) tendons and 80% of time involves the supraspinatus tendon. Middle-aged to elderly women are most commonly affected.[1-5] The exact cause and pathogenesis remain unclear but hypotheses include metabolic and endocrine diseases, genetic predisposition, and hormonal factors.[1-5] One theory suggests that decreased oxygen tension within the tendon results in fibrocartilaginous metaplasia with secondary mineralization and resultant calcific deposition.[4-6]

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Given that the use of musculoskeletal US has continued to increase over the past few decades, CaT is frequently diagnosed using US.[5,7] Multiple studies have shown that US is more sensitive than MRI in the evaluation of CaT, due to its superior ability to clearly delineate the calcific deposits.[2,5,8] Furthermore, contrary to traditional teaching, when compared to MRI, US can also better delineate the specific stages and phases of CaT, especially the painful resorptive phase [Figure 2].[2,5,9,10]

There are three distinct stages of CaT: the precalcific, calcific, and postcalcific stages.[1,2,5,10] The calcific stage is further subdivided into the formative, resting, and resorptive phases [Table 1]. US demonstrates CaT as variably shadowing or nonshadowing echogenic foci depending on the stage and phase.[1,2,5] In the formative and resting phases of the calcific stage, RC CaT presents on US as shadowing hyperechoic foci within the tendon [Figures 3 and 4].

As shown in this case, US is particularly advantageous in identifying calcific deposits in the painful resorptive phase of the calcific stage. Patients most commonly seek medical attention during this painful resorptive phase which is typically self-limiting with pain gradually improving over the course of 2–3 weeks.[1,2,5] During the resorptive phase, the calcium hydroxyapatite deposits migrate into the surrounding peritendinous tissues, in this case, the subacromial-subdeltoid bursa of the shoulder [Figures 2 and 3], causing pain and decreased range of motion.[1,2,5,10] The deposits in this phase appear as amorphous, fragmenting, and faintly shadowing to nonshadowing echogenic foci migrating outside the RC tendons into the overlying bursa, often initiating a painful subacromial-subdeltoid calcific bursitis [Figures 2 and 3].[1,2,5,10]

Radiographs are typically obtained as the first-line imaging modality for shoulder pain. However, as in this case, radiographs are limited in the detection of less dense RC calcific deposits which can be radiographically occult [Figure 1]. This is typical of the precalcific stage, while deposits are still forming, and of the resorptive phase of the calcific stage, when deposits are fragmenting, dissolving, and migrating [Figure 2]. US has been shown to be more sensitive than radiographs for

Table 1: Summary of the stages and phases of calcific tendinopathy

Stages	Pathophysiologic changes	Symptomatology
Stage I		
Precalcific stage	Cellular changes begin that eventually result in the development of calcifications, resulting in the calcific stage	Traditionally asymptomatic
Stage II		
Calcific stage (3 phases)		
Formative phase	Phase 1 – Formative phase: Calcium hydroxyapatite crystals coalesce to form calcific deposits, resulting in the resting phase	Traditionally asymptomatic
Resting phase	Phase 2 - Resting phase: Calcific deposits are formed, maturing and enlarging	Asymptomatic or dull pain secondary to large deposits causing impingement during motion
Resorptive phase	Phase 3 - Resorptive phase: Calcium deposits migrate into the surrounding tissues, initiating a painful inflammatory response (for example, calcific bursitis)	Classically, the most painful or symptomatic phase. This phase is self-limiting and gradually improves over 2-3 weeks
Stage III		
Postcalcific stage	Begins approximately 2-3 weeks following the resorptive phase. Calcific deposits resolve. Healing and remodeling changes in the affected tendon(s) result in the formation of granulation tissue with fibroblasts and collagen	Symptoms improve and can be asymptomatic

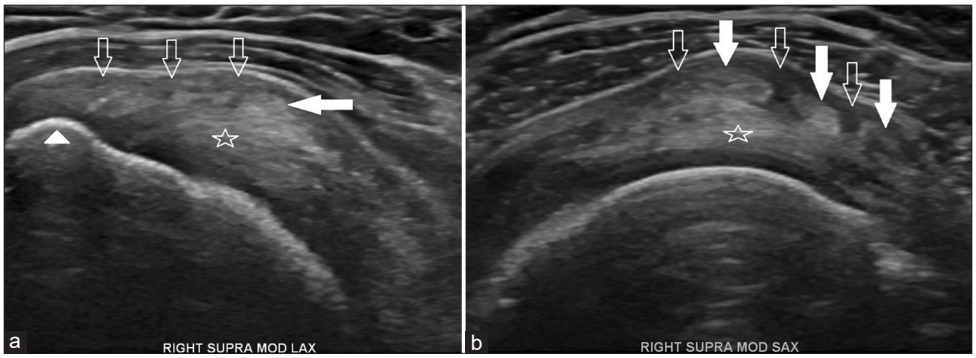

Figure 2: Ultrasound images of the right shoulder. (a) Long-axis and (b) short-axis sonographic images of the same right shoulder, demonstrating heterogeneity and enlargement of the supraspinatus (SUPRA) tendon (stars) with multiple nonshadowing amorphous slightly echogenic to isoechoic foci (solid arrows) within the supraspinatus tendon with partial extension into the adjacent thickened subacromial-subdeltoid bursa (open arrows). The junction between the tendon bursal surface and the bursa itself is ill-defined. The arrowhead points to the greater tuberosity and MOD indicates modified (Crass position)

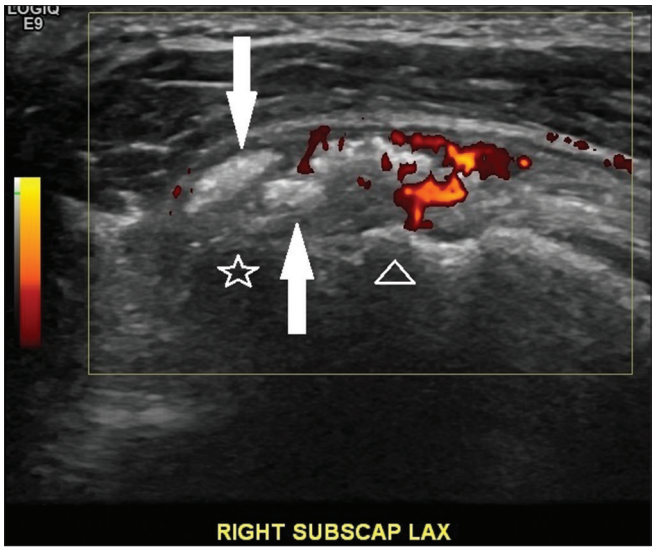

Figure 3: Long-axis power Doppler sonographic image of the right subscapularis (SUBSCAP) tendon in a separate 44-year-old woman with shoulder pain. Image at the level of an irregular lesser tuberosity (arrowhead) shows multiple shadowing echogenic foci (arrows) with associated acoustic shadowing (star) and hyperemia consistent with subscapularis calcific tendinopathy. Notice the calcific tendinopathy is partially in the resorptive phase with hyperemia extending into the adjacent slightly distended subacromial-subdeltoid bursa

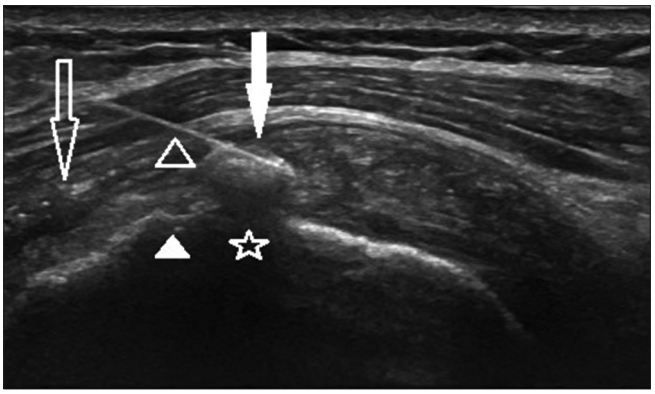

Figure 4: Long-axis sonographic image of the right supraspinatus tendon, at the level of the greater tuberosity (solid arrowhead), obtained during an ultrasound-guided needling and lavage (barbotage) performed on a different 59-year-old woman with shoulder pain related to calcific tendinopathy. The procedure is performed with the needle (open arrowhead) entering the shadowing (star) calcific deposit (solid arrow) using a lateral to medial approach with an in-plane technique. Notice the fragmented punctate echogenic debris (empty arrow) extending into the adjacent subacromial-subdeltoid bursa secondary to the needling and lavage of the calcific deposit

early detection of CaT in both the precalcific stage and the resorptive phase.[2,4,5]

US is also beneficial given its ability to easily utilize real-time Doppler interrogation to evaluate for associated hyperemia [Figure 3].[2,4,11-13] This is especially important for the detection of local hyperemia caused by calcium migration during the resorptive phase, the presence of which correlates with the severity of symptomatology.[2,4] Although a similar sonographic (and radiographically occult) appearance to this case can be seen in the typically asymptomatic precalcific stage, our patient's history of ongoing pain for several months which then became severe for 2 weeks, is most consistent with the resorptive phase of the calcific stage. This case is likely toward the end of the resorptive phase, given the lack of hyperemia and since the resorptive phase typically resolves in 2–3 weeks [Table 1]. US is also unique and advantageous for its therapeutic capabilities in the ability to perform an US-guided CaT needling and lavage (barbotage) with corticosteroid and analgesic injection into the subacromial-subdeltoid bursa and differentiating those cases which are favored to resolve with conservative management [Figure 4].[6,8,11-13]

Ethical statement

Informed consent and protocol review were exempt per our Institutional Review Board policies for this type of study and since these examinations were clinically indicated.

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Conflicts of interest

There are no conflicts of interest.

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