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Osteolytic lesion of greater tuberosity in calcific tendinitis of the shoulder

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Hypothesis: This study investigated tuberosity osteolysis, an uncommon and frequently misdiagnosed form of calcific tendinitis of the shoulder, and evaluated its effects on clinical and surgical outcomes.
Materials and methods: A total of 126 patients with calcific tendinitis studied with radiographs, ultrasound, and magnetic resonance images (MRIs) were divided into groups positive and negative for tuberosity osteolysis and treated by arthroscopy. Follow-up evaluation was at 2 years, using the Constant score.
Results: Tuberosity osteolysis was associated with significantly lower Constant scores, both before and after surgical treatment. Clinical and imaging findings exhibited a significant correlation. A 100% correlation was found between arthroscopy and MRI findings of tuberosity osteolysis compared with 90% with radiographs.
Conclusion: Imaging and functional data indicate that calcific tendinitis of the rotator cuff with tuberosity osteolysis is a distinctive form of calcific tendinitis that should be considered in clinical and surgical practice.
Level of evidence: Level 2; Prospective non-randomized comparison prognosis study.

Keywords: Osteolysis; greater tuberosity; calcific tendinitis; shoulder arthroscopy; MRI

Calcific tendinitis, a condition characterized by multifocal, cell-mediated calcification of viable tissue, affects a significant number of patients with shoulder complaints.[21] Hypoxia, microtrauma, and disuse have been suggested as causative factors, but its etiology remains unclear.[10-19] It may be an incidental finding in an asymptomatic shoulder (3% to 20%), or it may be the cause of pain (7%), often bilateral (13% to 47%), with a predilection for the right shoulder.[1] Women are affected slightly more frequently than men.[1] The propensity for the supraspinatus tendon (51%), just medial to the greater tuberosity, is still unexplained; the infraspinatus (44.5%), teres minor (23.3%), and subscapularis (3%) tendons are less commonly affected.[1,7,17]

According to Uhthoff and Loehr,[20] the disease progresses through correlating pathologic and clinical stages. The initial phase of deposit formation is rarely symptomatic. The acute symptoms are usually associated with the resorptive phase, where vascular invasion, an influx of phagocytic cells, and edema raise intratendinous pressure.[22] Symptoms may become chronic.

Conservative treatment with anti-inflammatory drugs, steroids, nonsteroid drugs (NSAIDs), local injection of anesthetic, and needling is frequently successful.[6,9,13,24] Extracorporeal shock wave (ECSW) therapy is effective in selected patients and has minimal complications.[5,18,23] Radiation therapy is increasingly used less because of its potential for adverse consequences.[14] Arthroscopic

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treatment of chronically painful calcific tendinitis of the rotator cuff, resistant to conservative or semi-invasive treatment (needling), is successful in more than 90% of patients.[5,19]

Some authors have described a different disease course[3] with a longer duration of painful symptoms and a reduction in the range of motion that do not match the phases that were just outlined.[2,8,16] Osteolytic lesions of the tuberosities can affect the normal course of the disease.[2,8,16] The purpose of this study was to investigate how osteolytic lesions of the tuberosities affect the pattern of clinical symptoms and surgical outcomes.

Materials and methods

From January 2000 to December 2003, arthroscopy was used to treat 157 patients with calcific tendinitis of the shoulder. Those who had had the disease for at least 12 months and had been treated unsuccessfully with conservative methods (NSAIDs, ECSW, needling) for at least 6 months were eligible for the study. The study excluded patients who had received surgical treatment or had associated glenohumeral arthritis, greater tuberosity fracture sequelae, cuff or long head of biceps tear, type III acromion, calcium deposits types C and D,[11] acromioclavicular joint disease, or muscle atrophy. These criteria were used to recruit 126 patients (80.25%) to the study and exclude 31 (19.75%).

Patients were evaluated preoperatively and postoperatively using the Constant score's activities of daily living (ADL), range of motion (ROM), and pain and strength subscores.[4] Follow-up was at 24 months or longer (range, 24-60; mean, 36 months). All diagnostic scans were evaluated independently by each of the 3 surgeons on the team. Using an identical procedure, they also separately conducted a preoperative and postoperative clinical assessment of function. Scores and subscores were expressed as mean $\pm$ standard deviation. To ensure reliability of the final outcome scores, the preoperative and postoperative scores calculated by the 3 examiners and their diagnostic evaluations were analyzed for interobserver variability using the Pearson correlation coefficient (PCC). Age, sex, occupation, and time from symptom onset to arthroscopic surgery were recorded and analyzed using SPSS software (SPSS Inc, Chicago, IL). The level of significance was set at $P < .05$.

Contact between calcium deposits and cortical bone was first assessed on ultrasound, plain x-ray images, and then on magnetic resonance imaging (MRI). X-ray imaging performed on standard anteroposterior (AP) views, in neutral, internal, and external rotation, and lateral scapular and axillary views were analyzed for any space between deposit and cortical bone. The imaging findings were used to divide patients into groups positive for tuberosity osteolysis (TO), when the deposit appeared to be in contact with bone even on a single radiographic view, and negative for TO.

Surgery was performed under combined scalene block and general anesthesia, with the patient in the lateral decubitus position and 5-kg traction applied to the arm. The same arthroscopic technique was used in all cases. It consisted of an articular and a subacromial stage. The former facilitates joint evaluation and enables associated articular lesions to be visualized. In this phase, no suture markers were placed. In the subacromial stage, we first operated from the posterior and then from a lateral portal. After bursal débridement, deposits were located by percutaneous needling, using preoperative radiographs, and carefully excised with a 4.2-mm full radius resector (ConMed Linvatec, Largo, FL) and curettes. Minor tendon tears due to calcium excision (longitudinal partial tears < 1 cm in length) were not sutured; in some cases, a considerable portion of the cuff and bone had to be resected to avoid residual deposits that would be responsible for poor clinical outcomes.[16] Longer longitudinal lesions (partial tears > 1 cm and complete tears to the articular surface) were repaired using side-to-side PDS II suture (Ethicon Inc, Johnson & Johnson, Somerville, NJ), whereas crescent-shaped tears of the tendon insertion were sutured with Super Revo Screws (ConMed Linvatec). Acromioplasty was performed only when the coracoacromial ligament was fibrillated or rough or when the acromion was exposed.

All patients followed the same rehabilitation program. Passive mobilization was begun immediately after the operation; special care was taken to reestablish all passive ranges of joint motion immediately. Active motion was recovered in a pool at 3 weeks; strengthening exercises were allowed at 6 weeks.

This study did not undergo Institutional Review Board approval.

Results

A total of 126 patients matched the inclusion criteria. None were lost to follow-up.

Radiographic findings

Preoperative radiographs showed tuberosity lesions in 56 of 126 patients (44.4%), of whom only 3 (7%) had lesser TO. In these 56 patients, the supraspinatus was involved in 33 (76.8%) and the infraspinatus in 7 (16.2%). The teres minor was never involved. In 13 of 126 patients (10.3%), radiographic findings of TO were not confirmed on arthroscopy; these patients, accounting for 23.2% of TO-positive patients on x-ray imaging, were considered as false-positives (Figure 1). The lower TO rate found on arthroscopy (34.1% of enrolled patients) exactly matched the MRI findings. For all these data, the interobserver reliability was high (PCC $>$ 0.90; $P < .001$).

Osteolytic lesions

Calcium deposits in contact with the tuberosities consistently caused cortical lesions that varied in shape, extension, and bone involvement (Figure 2). The shape and size of the deposit (Figure 2) and sex, age, and occupation were unrelated to the presence of osteolysis.

Clinical findings

The mean Constant score of the 126 patients was 51 $\pm$ 21.36. Interobserver reliability was high (PCC > 0.9; $P <$ .001). The mean score of women was slightly lower than