Ultrasound-guided Placement of a Localization Wire For Arthroscopic Treatment of Calcific Tendonitis

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Abstract: Surgical decompression of calcific tendonitis of the shoulder can be difficult because identification of the lesion is problematic, as the lesion is usually within the supraspinatus and cannot be directly visualized. We demonstrate a technique to identify and mark the calcific lesion using portable 2-D ultrasound to guide the placement of a breast-biopsy localization wire into the calcific lesion, followed by arthroscopic decompression of the calcific lesion. After regional anesthesia, portable ultrasound is used to identify the calcific lesion. The introducer needle of the breast-localization wire is then advanced into the calcific lesion. The localization wire, with 2 barbs at its tip, is advanced through the introducer needle into the lesion. The barbs secure the wire into the lesion. After diagnostic arthroscopy, the arthroscope is placed into the subacromial space. The localization wire is identified and followed to the calcific lesion. The lesion is debrided with a motorized shaver, removing as much calcific material as possible. The supraspinatus tendon is then examined. If a significant defect is present, it is repaired. Early clinical results show good subjective and objective improvement.

Key Words: calcific, tendonitis, supraspinatus, arthroscopy, shoulder, ultrasound-guided, localization

Operative Technique

After a regional interscalene anesthesia, the patient is placed in the beach-chair position, and intravenous sedation is provided. At this point, portable 2-D ultrasound commences. Once the calcific lesion is identified, the skin in the region of the lateral portal is prepared with standard betadine-alcohol surgical preparatory solution. Under ultrasonographic guidance, a breast localization wire, with its introducer needle (Bard DuaLok, Bard Peripheral Vascular Inc., Tempe, AZ) is placed through the skin, into the subacromial space, and into the calcific lesion (Fig. 1). The introducer needle tip (a 20G needle) is held in the calcific lesion while the localization wire is advanced through the introducer needle. The tip of the wire has 2 barbs that deploy into the lesion as the wire is advanced. This will secure the wire into the lesion. The introducer needle is removed, leaving the localization wire anchored in the calcific lesion, and protruding from the skin.

Standard surgical preparation for the shoulder and upper limb is then performed, taking care not to dislodge the wire. Drapes are applied, followed by a clear adhesive surgical draping. At this point, portable 2-D ultrasound commences. Once the calcific lesion is identified, the skin in the region of the lateral portal is prepared with standard betadine-alcohol surgical preparatory solution. Under ultrasonographic guidance, a breast localization wire, with its introducer needle (Bard DuaLok, Bard Peripheral Vascular Inc., Tempe, AZ) is placed through the skin, into the subacromial space, and into the calcific lesion (Fig. 1). The introducer needle tip (a 20G needle) is held in the calcific lesion while the localization wire is advanced through the introducer needle. The tip of the wire has 2 barbs that deploy into the lesion as the wire is advanced. This will secure the wire into the lesion. The introducer needle is removed, leaving the localization wire anchored in the calcific lesion, and protruding from the skin.

arthroscopy commences in the usual fashion. After standard diagnostic glenohumeral joint arthroscopy through the posterior portal to evaluate intra-articular pathology, the arthroscope is placed into the subacromial space. A spinal needle is utilized to identify the best position for the lateral portal. The localizing wire is found, and followed to the calcific lesion (Fig. 3). Subacromial bursal resection may be necessary to allow for adequate visualization; this can be performed using a 4-mm arthroscopic motorized shaver or a radiofrequency wand. After examining the integrity of the rotator cuff, the calcific lesion is decompressed.

First, the biopsy wire is removed, and the lesion is trephined through the lateral portal with an 18 G spinal needle. At this point, calcific material is usually extruded, often in a “snowy” pattern or in the form of a thick, creamy substance (Fig. 4). With a small diameter (eg, 4 mm) motorized shaver, the lesion is further debrided, ensuring removal of as much calcific material as possible (Fig. 5). Once the calcific lesion has been removed, the remaining supraspinatus tendon is examined. If a small defect remains (Fig. 6), the supraspinatus does not need to be repaired; however, if a significant defect is present, it should be repaired (a video demonstration of this procedure is available on http://www.vumedi.com).10

The wounds are closed with 3-0 prolene suture; dressings and a sling are applied. Routine postoperative therapy consists

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The authors declare no conflict of interest.

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Techniques in Shoulder & Elbow Surgery • Volume 13, Number 3, September 2012

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of range-of-motion exercises and routine use of the arm as tolerated.

Clinical Outcomes
Consecutive patients who underwent arthroscopic surgery for debridement of a calcific tendonitis lesion from March 2008 to December 2009 were included. Patients undergoing revision surgery were excluded.

At each office visit, patients completed a questionnaire regarding their subjective shoulder status. Patients answered multiple questions regarding their shoulder; they were asked about the frequency of pain with activity and sleep, how often the shoulder was extremely painful, and their frequency of pain at rest, with activities overhead, and with sleep. Patients were also asked about the degree of their shoulder stiffness, the severity of pain reaching behind, and pain with overhead activities. They were also asked to rate their shoulder overall, and about their level of activity at work and with sport.

Objective evaluation was also completed at each office visit. This consisted of passive range-of-motion analysis, as well as strength assessment with a hand-held dynamometer. This evaluation was carried out at the preoperative, 6-week postoperative, 12-week postoperative, and 6-month postoperative visits.

The results of this group were compared. However, to add another dimension to the evaluation, additional comparison was performed with a larger group of patients; this previous cohort (historical control) of patients had a single-row arthroscopic rotator cuff repair, but without calcific tendonitis. These historical patients were part of a prior study comparing partial versus full-thickness rotator cuff repairs with a single-row technique; only the patients who required a full-thickness repair were utilized for this comparison. For this previous study, consecutive rotator cuff repair patients from 2005 to 2007 were included, and exclusion criteria included previous rotator cuff repair, greater tuberosity fracture, osteoarthritis, concomitant instability surgery, adhesive capsulitis, calcific tendonitis, and isolated subscapularis tears.

Statistical Analysis
Parametric data were evaluated with Student t test, and nonparametric data were evaluated with the Mann-Whitney U test.

RESULTS
The short-term results of ultrasound-guided arthroscopic removal of calcific tendonitis in 12 patients (13 shoulders) were evaluated. There were 6 female and 6 male patients; 1 male patient had bilateral involvement. The average age at the time of surgery was 49 years (range, 32 to 70 y). Average follow-up time was 4.6 months (range, 1.6 to 8.5 mo). Seven of the shoulders required a rotator cuff repair following the calcific lesion debridement. The only complication was 1 wound infection noted at the 1-week follow up. This patient was treated with arthroscopy of the subacromial space and incision.

FIGURE 1. Localization wire entering the calcific lesion with ultrasound guidance; ultrasound image on the left, illustration on the right.

FIGURE 2. Right shoulder, surgically prepared and with an adhesive drape covering the flexible localization wire.

FIGURE 3. Arthroscopic image (view from posterior portal) of the subacromial space. The motorized shaver follows the localization wire to the calcium lesion. Deltoid fascia is on the upper right, supraspinatus is on the lower left.
and debridement of the wounds. The patient was also treated with oral antibiotics, and went on to heal uneventfully.

Subjective shoulder status assessments improved for all criteria, except the “level of sport,” which was largely unchanged. Significant improvements (from preoperative to the 6-mo visit) were seen with patient-ranked frequency of pain with activity, improving from “always” to “weekly” ($P < 0.02$), and pain during sleep, improving from “always” to “monthly” ($P < 0.002$). Significant improvements were seen with patient-ranked shoulder stiffness, improving from “quite” to “a little” ($P < 0.02$) and with pain reaching behind the back, improving from “severe” to “mild” ($P < 0.05$). Patient-ranked overall shoulder assessment improved from “bad” to “fair” ($P < 0.05$).

Objectively, improvements were seen in passive range of motion and in strength, but the only improvements that were significant were an increase in supraspinatus strength from 5 (9) N (mean, SEM) to 59 (12) N ($P < 0.05$), and in adduction strength from 52 (9) N to 72 (11) N ($P < 0.05$).

Seven patients (8 shoulders) had a follow-up ultrasound 6 months postoperatively. All had intact supraspinatus tendons; 4 of these had undergone rotator cuff repair at the time of calcific lesion debridement. Three shoulders had residual small calcifications, 2 of which were in the same patient.

When the subjective and objective data were compared with the historical cohort of full-thickness rotator cuff repair patients ($n = 101$), there were mixed results. At the 6- and 12-week time points, the calcific tendonitis cohort had significantly improved values for many subjective and objective measures compared with the rotator cuff repair group. The exception was patient-ranked overall shoulder status. This value was significantly better in the rotator cuff repair cohort at the 6- and 12-week time points when compared with the calcific tendonitis group. By the 6-month time point the calcific tendonitis group results were not significantly different than the rotator cuff repair group, except that patient-ranked overall shoulder status was still significantly better in the rotator cuff repair cohort.

**DISCUSSION**

Our study found that ultrasound-guided placement of a localization wire followed by arthroscopic debridement of the calcific lesion is an effective operative treatment of calcific tendonitis. The data show that this technique results in subjective and objective clinical improvements. There were significant improvements in several patient-determined criteria: pain with activity, pain during sleep, subjective shoulder stiffness, pain reaching behind, and overall shoulder status. There were also examiner-determined improvements: supraspinatus and adduction strength showed significant improvement. In addition, when compared with a historical control group of rotator cuff repair patients (without calcific tendonitis), our current group of patients had significant improvements at the 6- and 12-week time points, but these differences were not significant at 6 months. However, overall shoulder status was significantly improved in the rotator cuff cohort.

Difficulty with identifying the calcific lesion makes arthroscopic debridement difficult. Ellman reported that in 16% to 18% of arthroscopic cases, no calcific deposit could be found, and Jerosch et al reported that the calcific lesion was identified by needling in 40 of 48 patients. In an effort to overcome this problem, Weber described intraoperative fluoroscopy to help localize the lesion. He reported complete relief of pain in 16 of 20 patients.

Rupp et al and Kayser et al describe the preoperative mapping of the calcific lesion using ultrasound. Rupp and colleagues measured the distance from the biceps tendon and the greater tuberosity to the calcific lesion using ultrasound, and used those measurements arthroscopically to locate the lesion. Kayser and colleagues utilized ultrasound to draw skin markings on the patient: the intersection of the lines drawn from the longitudinal

**FIGURE 4.** Calcium material (arrow) is “milked” from the supraspinatus with the motorized shaver (view from lateral portal).

**FIGURE 5.** The motorized shaver is seen decompressing the calcific lesion; arthroscopic image (view from lateral portal) on the left, illustration on the right.
and transverse ultrasound images represented the point of maximal echogenicity. This point was the entry site of the needle during arthroscopy, and the needle could then be followed to the calcific lesion to perform the debridement.

In a technical note, Sorensen et al.8 described the use of a sterile ultrasound probe to place a breast localization needle, similar to our description. However, no clinical data were reported. Sabeti-Aschraf et al.17 in a technical description, utilized intraoperative ultrasound during arthroscopy to assist in the identification of the lesion, in addition to assessing the completeness of the debridement. Bethune et al.18 describe a case report using an intraarticular ultrasound probe to define the lesion during arthroscopy. Again, no clinical follow-up was reported for these reports.

Our technique uses preoperative ultrasound to guide the placement of a breast localization wire, which is then used to identify the calcific lesion during subacromial arthroscopy. Identification of the calcific lesion is important, because the lesion must be adequately visualized to be debrided. Jerosch et al.19 have shown that the degree of surgical resection of the calcific lesion directly affects the clinical results. In their series, patients with lesions that were not detectable postoperatively had significantly improved Constant scores compared with the group whose calcific lesion had merely decreased in size postoperatively, but was still identifiable radiographically. This group, in turn, had significantly improved Constant scores compared with the group whose calcific lesion remained unchanged or had increased in size. Thus, it is important to debride as much of the calcium as possible and preoperative needle localization with ultrasound guidance allows for identification of the calcific lesion. After identification, a thorough debridement can be completed.

CONCLUSIONS

Ultrasound-guided placement of a breast-lesion localization wire can aid with arthroscopic identification of calcific tendonitis lesions. This can ensure a more reproducible and more thorough debridement of the calcific lesion, which has been correlated with improved patient outcomes.

REFERENCES