Arthroscopic Removal of Calcium Deposits of the Rotator Cuff : A 7-year Follow-up

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Arthroscopic Removal of Calcium Deposits of the Rotator Cuff

A 7-year Follow-up

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Background: Calcium deposits within the tendons of the rotator cuff are common and usually asymptomatic. Symptomatic cases that do not respond to nonoperative measures need removal of the calcium deposits.

Purpose: In this study, the results of arthroscopic removal of the calcium deposits within the rotator cuff, without rotator cuff repair, are evaluated after a minimum 7-year follow-up. This may help clarify whether rotator cuff repair in such cases is necessary for the relief of pain and good cuff function in the long run.

Study Design: Case series; Level of evidence, 4.

Methods: Fifty-six patients with calcium deposits within the rotator cuff were included in this study. Fifty-four patients were managed by arthroscopic removal of the calcium deposits without rotator cuff repair.

Results: The patients were followed up over a period of at least 7 years. At the final follow-up, all patients were able to return to their level of activity before the beginning of their complaint, with significant improvement in the University of California at Los Angeles (UCLA), American Shoulder and Elbow Surgeons (ASES), and Constant scores. The UCLA score improved from a mean (SD) of 52.8 (7.5) to 95.0 (8.2) ($P \leq .001$), whereas the ASES score improved from 57.2 (8.3) to 95.0 (8.2) ($P \leq .001$). The Constant score improved from a mean (SD) of 63.3 (9.3) to 97.8 (6.2) ($P \leq .001$). Only 3.7% of cases developed rotator cuff tears over the period of follow-up.

Conclusion: The results of this study indicate that arthroscopic removal of as much as possible of symptomatic calcium deposits of the rotator cuff is a safe and effective treatment when nonoperative methods fail.

Keywords: calcific tendinitis; arthroscopy; supraspinatus; removal

Calcium deposits within the tendons of the rotator cuff are a common shoulder disorder.[14] Two different etiological processes have been proposed. The first is degenerative calcification, in which Codman[3] proposed that degeneration within the tendon fibers precedes calcification. This was later adopted by Moseley and Goldie,[16] who defined the tendon-bone insertion area as the "critical zone."

The second cause proposed is reactive calcification within a healthy tendon.[23] Up to 50% of cases are asymptomatic and run a self-limiting course.[8,24] The stage of evolution of the disease should be judged by combining the pain history, the morphologic appearance of the deposit on plain radiographs, and the ultrasound findings. The therapeutic approach depends on the evolution of the disease. Nonoperative measures of treatment should be the first choice during the resorption phase.[23]

Patients who are not passing successfully through the resorption phase and complain of a significantly painful limitation in range of motion that interferes with their daily activity, despite receiving a trial of nonoperative treatment, should be considered for surgical intervention. This includes open or arthroscopic removal of the calcification with or without rotator cuff repair.[1,10,18,21,22]

The aim of this study is to assess the results of arthroscopic removal of as much as possible of the calcium deposits, without rotator cuff repair, in symptomatic cases that did not improve after trying the usual nonoperative measures. This may help clarify whether rotator cuff repair in such cases is necessary for the relief of pain and good cuff function in the long run.

METHODS

Fifty-six consecutive patients underwent arthroscopic calcium deposit removal with or without rotator cuff repair between March 2000 and May 2003. Two patients had a wide defect after removing the deposits and required rotator cuff repair.

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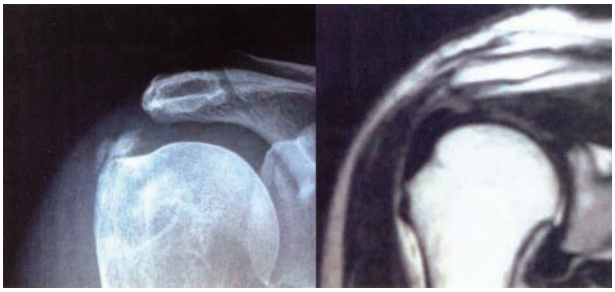

Figure 1. Calcium deposits in the supraspinatus tendon (plain radiograph and MRI).

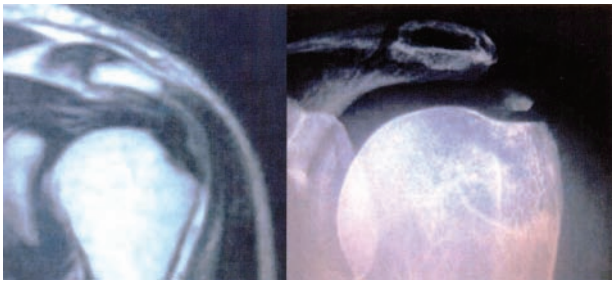

Figure 2. Calcium deposits in the supraspinatus tendon (MRI and plain radiograph).

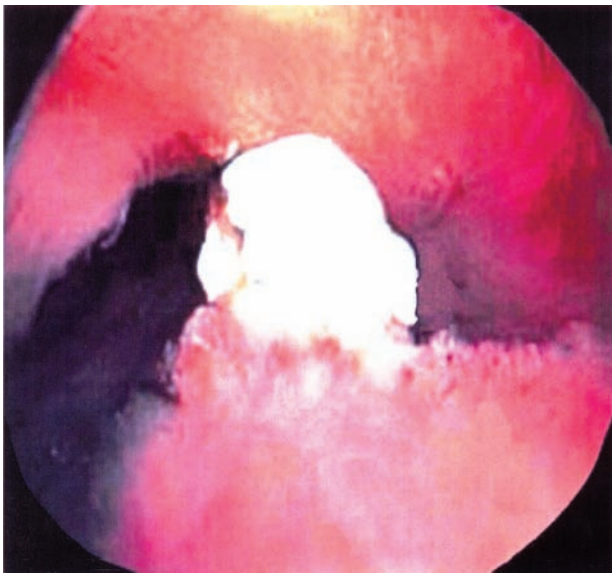

Figure 3. Calcium deposits opened up (paste).

The other 54 patients were included in this study. There were 36 men and 18 women. All patients were closely followed up for at least 7 years (range, 7-10 years). The age of patients at the time of surgery ranged between 37 and 54 years with an average of 48.6 years.

Inclusion criteria included patients with calcium deposits—as evident on plain radiographs—who complained of persistent shoulder pain with no response to nonoperative treatment for 3 consecutive months. This was in the form of rest for 1 week, followed by physical therapy of gradually increasing intensity, together with nonsteroidal anti-inflammatory drugs. None of the patients received local corticosteroid injections to avoid affecting the quality (degeneration) of the rotator cuff.

On average, the patients' complaints started 5.2 months before surgery (range, 3.5-7.1 months). All patients were passing through the resorbative phase.

All patients had tenderness over the greater tuberosity with a positive Neer/Hawkins impingement sign.[7,17]

All patients had a free passive range of motion but a painful active arc of motion between 60° and 120°. The pain was aggravated by passive external rotation. Clinical testing of the supraspinatus revealed muscle strength 4 of 5 in 6 cases and 5 of 5 in the other 48 cases.[11,12]

Preoperative plain radiographs were performed for all patients (true anteroposterior, lateral scapular, and outlet views). The radiographs, ultrasonography, and the MRI studies showed calcium deposits within the supraspinatus tendon in all patients (Figures 1 and 2).

The patients were evaluated pre- and postoperatively with the University of California at Los Angeles (UCLA), American Shoulder and Elbow Surgeons (ASES), and the Constant scores. Strength was tested using an isokinetic dynamometer (Biodex System 3 Dynamometer; Biodex, Shirley, New York).

Surgical Technique

All patients underwent shoulder arthroscopy in the beach-chair position under general anesthesia. Intra-articular diagnostic arthroscopy was performed, and synovitis on the undersurface of the cuff (articular side) was noticed in some cases. Then, the arthroscope was retrieved and reintroduced to perform subacromial arthroscopy.

Subacromial bursectomy was performed to allow better visualization of the rotator cuff. In cases with shoulder impingement, subacromial decompression (acromioplasty) was performed. Impingement was determined preoperatively by the presence of a reduced acromial-head (AH) space in the true anteroposterior and outlet views or the presence of a hooked acromion or acromioclavicular arthritis with an underlying osteophyte.

The calcium deposits were identified as a bulge within the cuff tendon (calcific bulging sign)[19] and were localized using a spinal needle. Then, via the lateral working portal, a half-moon arthroscopy knife was used to open up the calcium deposits along the fibers of the cuff. After that, a 3.5-mm motorized shaver was used to remove as much as possible of each calcium deposit, only to stop short of causing any iatrogenic damage to the cuff. Not all of the calcium deposits were removed because total removal does not affect the final outcome, as previously revealed in the literature.[9,19,20] Sometimes the deposits were in the form of caseous material, and sometimes they were in the form of semi-solid paste (Figure 3). In some cases, very small remnants in the form of solid calcified particles were pulled out by a grasper or by using a small curette.

Then, reassessment of the cuff tendon was done with a probe to determine the tendon's need for repair. When the defect left behind after removal of the calcium deposits showed a tear involving more than 50% of the cuff thickness (in 2 cases only), cuff repair using a giant needle technique was performed.[6]

Postoperative Care

Patients used an arm sling postoperatively for 2 weeks. Passive range of motion was started the first day postoperatively and continued for 2 weeks. This was followed by active-assisted exercises that were gradually progressed to full-active exercises, taking special care not to perform excessive abduction or external rotation until the fourth week. Strengthening exercises were continued for 6 to 8 weeks.

Patients were followed up on a weekly basis for 6 weeks, then every 3 months during the first year. Henceforward, they were followed up annually.

Plain radiographs were performed on the first day postoperatively, then every 6 months for 3 years, and then on an annual basis to assess for recurrence of calcium deposits.

Statistical analysis was performed using the Wilcoxon signed ranks test.

RESULTS

Preoperatively, all patients had painful limitation of the affected shoulder's active range of motion together with dull pain that was worse by night. In 6 cases, there was some weakness in resisted forward elevation of the affected arm in contrast with the contralateral one.

None of the patients suffered from postoperative infection or wasting as noticed in the supraspinatus or infraspinatus fossa.

All but 1 patient was able to resume daily activities within 2 weeks. This patient suffered from severe incapacitating pain that extended for 2 weeks postoperatively. The MRI study performed 7 days postoperatively showed severe subacromial bursitis with fluid collection. After proper anti-inflammatory drugs and rest (no physical therapy), the bursitis resolved spontaneously within 18 days, and the patient was able to proceed with her predetermined postoperative program.

Thirteen patients who enjoyed recreational sports (2 played squash, 3 played tennis, 1 played volleyball, 1 played snooker, and 6 were swimmers) before the start of the complaint were able to return to sports at the same level.

During follow-up, 2 patients (3.7%) developed rotator cuff tears that needed arthroscopic repair. These 2 cases are different from the 2 cases that had primary rotator cuff repair while removing the calcium deposits. The tears developed 2.2 and 2.5 years postoperatively, respectively. Reviewing the intraoperative data of these patients, it was found that both of them had a notably degenerative state of the rotator cuff.

The preoperative plain radiographs showed that the deposits were present 7 to 16 mm from the supraspinatus insertion. The size of the deposits ranged between 15 and 24 mm (average 18 mm).

The postoperative plain radiographs showed complete removal of the deposits in 29 cases. Almost complete removal was achieved in the other 25 cases. During the long follow-up, 11 of these 25 cases showed complete disappearance of the deposits. The residual deposits that still persisted in the other 14 cases did not affect the final outcome.

TABLE 1
Pre- and Postoperative University of California at Los Angeles (UCLA) Score[a]

Items	Preoperative, Mean ± SD	Postoperative, Mean ± SD	*P* Value[b]
Pain (10)	3.3 ± 1.0	9.1 ± 1.0	<.001
Function (10)	7.1 ± 1.0	9.6 ± 0.8	<.001
Active FE (5)	3.7 ± 0.5	4.9 ± 0.4	<.001
Strength of FF (5)	3.4 ± 0.5	4.9 ± 0.4	<.001
Overall patient satisfaction (5)	0.0 ± 0.0	4.8 ± 1.1	<.001
Total score (35)	18.5 ± 2.6	33.2 ± 2.9	<.001
Total score (100)	52.8 ± 7.5	95.0 ± 8.2	<.001

[a]FE, forward elevation; FF, forward flexion.
[b]Wilcoxon signed ranks test.

TABLE 2
Pre- and Postoperative American Shoulder and Elbow Surgeons (ASES) Score

	Preoperative, Mean ± SD	Postoperative, Mean ± SD	*P* Value[a]
Pain (50)	27.4 ± 4.1	46.7 ± 4.8	<.001
Activity of daily living (50)	29.8 ± 6.5	48.3 ± 5.5	<.001
Total score (100)	57.2 ± 8.3	95.0 ± 8.2	<.001

[a]Wilcoxon signed ranks test.

TABLE 3
Pre- and Postoperative Constant Score

	Preoperative, Mean ± SD	Postoperative, Mean ± SD	*P* Value[a]
Pain (15)	8.3 ± 2.4	14.8 ± 1.1	<.001
Activity level (10)	4.0 ± 0.0	9.7 ± 1.3	<.001
Arm positioning (10)	7.3 ± 1.0	9.7 ± 0.7	<.001
Strength of abduction: 90° abduction or highest level patient can achieve (pounds) (25)	18.3 ± 3.4	24.6 ± 1.2	<.001
Range of motion			
Forward flexion (10)	7.3 ± 1.0	9.7 ± 0.7	<.001
Lateral elevation (10)	7.3 ± 1.0	9.9 ± 0.4	<.001
External rotation (10)	5.3 ± 1.0	9.7 ± 0.7	<.001
Internal rotation (10)	5.3 ± 1.0	9.7 ± 0.7	<.001
Total score (100)	63.3 ± 9.3	97.8 ± 6.2	<.001

[a]Wilcoxon signed ranks test.

The results according to the UCLA score[5] showed a significant improvement in the pain, function, active forward elevation, strength of forward flexion, and patient satisfaction. The mean (SD) total score improved from 52.8 (7.5) to 95.0 (8.2) ($P \leq .001$) at the final follow-up (Table 1).

The ASES score[13] showed a significant improvement in both the pain and activity level; the mean (SD) total score was 57.2 (8.3) preoperatively and 95.0 (8.2) ($P \leq .001$) at the final follow-up (Table 2).

Constant score[4] showed a significant improvement in pain, activity level, arm positioning, strength of abduction,

and range of motion (in all directions). The mean (SD) preoperative score was 63.3 (9.3), and the mean (SD) final score was 97.8 (6.2) ($P \leq .001$) (Table 3).

DISCUSSION

Rotator cuff calcium deposits occur most frequently in the supraspinatus tendon near its insertion followed by the infraspinatus, teres minor, and subscapularis in descending order, although it could also involve more than one tendon at a time.[14,24]

Nonoperative measures should always be the first choice in cases of symptomatic rotator cuff calcium deposits. They include various methods such as physical therapy, systemic nonsteroidal anti-inflammatory drugs, local corticosteroid injections, ultrasound-guided needling of the tendon, lavage, or multiple perforations of deposits using large-bore needles and extracorporal shock-wave therapy.[23]

When nonoperative treatment fails, surgery is indicated either by open or arthroscopic removal.[15]

Rupp and colleagues[19-21] found that complete intraoperative removal of the deposit did not appear to be essential as it did not significantly affect the final clinical outcome. They concluded that total removal is not necessary and sometimes not possible without substantial damage to the tendon. They also stated that often partial removal of the deposit will finally lead to total resorption. This was reinforced by other studies such as that by Hofstee et al.[9] This fact was found to be true according to the results of our study. It was unnecessary to remove the calcium deposits totally, as this did not affect the good final outcome, which showed statistically significant improvement in the UCLA, ASES, and Constant scores.

It has been stated that arthroscopic calcium deposit removal is quite effective, although occasionally it may fail to completely excise the deposit compared with open surgery, which has a higher success rate in complete removal but with more intraoperative complications.[1,18,21] As long as complete removal of the deposits is not necessary, then arthroscopic removal is clearly a better option.

Studies showed that the rate of full-thickness rotator cuff tears after calcium deposit removal is quite low (3.9% after a 9-year follow-up).[2] From that it was concluded that cuff repair after removing the deposit is not mandatory. However, the intraoperative cuff status had a significant influence on the functional results at follow-up.[2] This was evident in our results because the 2 patients (3.7%) who needed rotator cuff repair had a degenerative state of the rotator cuff as noticed intraoperatively. Accordingly, it should be recommended to repair the rotator cuff after the removal of calcium deposits, whenever the cuff appears to be noticeably degenerative.

CONCLUSION

The results of this study indicate that arthroscopic removal of as much as possible of symptomatic calcium deposits of the rotator cuff is a safe and effective treatment when nonoperative methods fail, as long as the cuff is not markedly degenerative.

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