



## Calcifying tendinitis of the rotator cuff : Functional outcome after arthroscopic treatment

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**In this study, we assessed the functional results after arthroscopic excision of rotator cuff calcifications. Sixty-one shoulders in 57 patients with chronic calcifying tendinitis of the rotator cuff were treated with arthroscopic excision, subacromial bursa debridement and shaving. In patients with fraying or roughness of the coracoacromial ligament, an acromioplasty was also performed. Patients were evaluated after a mean follow-up of 15 months. The modified Constant score and DASH score significantly improved from 33.4 to 66.8 and from 49.7 to 17.3 respectively. Performing an acromioplasty did not influence the final outcome. Frozen shoulder was a frequent complication (18%) without significant effect on the final DASH or Constant score. The presence of residual calcifications after arthroscopic needling did not influence the final outcome. We therefore believe that the presence of residual calcifications can be accepted if this is deemed necessary to preserve the integrity of the tendon.**

**Keywords :** rotator cuff ; tendonitis ; calcifications ; arthroscopic treatment.

debate. Hydroxyapatite is formed by fibrocartilage cells in the tendon following an unknown stimulus. Subsequently, depending on the disease phase, pain and limitation of motion can occur.

Uthoff and Loehr (17) believe that calcifying tendinitis progresses through correlating pathological and clinical stages. During the formative phase, a portion of the tendon undergoes fibrocartilaginous transformation, and calcification occurs in this transformed tissue. The calcific deposit resembles chalk. Once formed, the calcific deposit enters a resting period (resting phase). The calcific deposit may or may not be painful. If large enough, it may cause mechanical symptoms.

After a variable period, an inflammatory reaction may ensue. Vascular tissue develops at the periphery of the deposit. Macrophages and multinuclear giant cells absorb the deposit during this resorptive phase. At this stage, the calcific deposit resembles toothpaste. Occasionally, it leaks into the subacromial bursa. This stage may be very painful.

### INTRODUCTION

Calcifying tendinitis of the rotator cuff is a common condition in middle aged individuals. This condition affects 2.7% to 20% of the population, mostly aged between 30 and 50 years. Women are more frequently affected than men (1, 3, 9, 13). Only a few of them have clinical symptoms. The aetiology of these calcifications is still a matter for

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Once the calcific deposit has been resorbed, fibroblasts reconstitute the collagen pattern of the tendon in the postcalcific phase.

Several authors have tried to classify these calcifications. Bosworth (1) distinguished three subtypes depending on the size of the calcium deposit. De Palma and Kruper (3) described three types depending on the severity and duration of symptoms. In this study, we used the classification described by Gärtner and Simons (4, 5). They distinguished three types of calcifications. A clearly circumscribed and dense calcification on radiographs is a type I. When the calcium deposit undergoes spontaneous resolution and radiographs show a cloudy and translucent appearance without clear circumscription, it is called a type III calcification. In Gärtner's type II calcifications the deposit has no specific morphology.

The initial treatment of choice for patients with severe pain and dysfunction is conservative. The chronic subacute phases are managed easily with anti-inflammatory medication and local application of ice (11). Injection of a local anaesthetic agent or a corticosteroid is often an effective adjunct in these patients. Extracorporeal shock wave therapy has shown good results (7, 8, 15). Surgical treatment is reserved for patients in which prolonged conservative therapy has failed and the deposit does not show signs of spontaneous resolution on radiographs. Surgical treatment may include open or arthroscopic removal of the calcification, combined with bursectomy and/or acromioplasty.

The purpose of this retrospective study was to evaluate the functional results of arthroscopic excision and shaving of symptomatic calcifications.

## MATERIALS AND METHODS

Between January 2002 and June 2004, 95 patients with calcifying rotator cuff tendinitis were treated with arthroscopic excision of the deposits and shaving. Patients with concomitant instability, rotator cuff tears or acromioclavicular joint pathology were excluded from this study. The remaining 69 patients were invited for a clinical and radiological follow-up. Twelve patients did not react or were not interested. So finally, the follow-up examination was performed on a total of 61 shoulders in 57 patients (40 women and 17 men). There were 29 left shoulders and 32 right shoulders. The

dominant side was involved in 35 patients. The mean age was 47.2 years in women and 49.5 years in men. All patients had chronic shoulder pain for more than 6 months (mean : 25.6 months). Intensive nonoperative treatment failed in all patients before surgical treatment. Nonoperative treatment included physical therapy, non-steroidal anti-inflammatory drugs, steroid injections or acupuncture. Thirty-eight patients (62.3%) were treated with extracorporeal shock wave therapy.

We classified the calcium deposits on the preoperative radiographs according to Gärtner *et al* (4, 5). Radiographs were taken in three positions : antero-posterior-view in internal and external rotation and an outlet view. Preoperative ultrasound examination was performed to exclude rotator cuff tears. We also divided our patients in three groups, depending on the size of the deposit. Group A were calcifications less than 10 mm, group B were calcifications between 10 mm and 20 mm and group C were calcifications larger than 20 mm. Preoperatively the DASH-score (6), Constant score (2) and the body mass index (BMI) were measured. Since we did not have a power assessment instrument for the preoperative evaluation, only the Constant subscores for pain, activities of daily living (ADL) and function were evaluated preoperatively (modified Constant score).

Surgery was carried out under combined interscalene block and general anaesthesia with the patients in lateral decubitus. The arthroscopic technique consisted of an intra-articular stage and a subacromial stage. The glenohumeral joint was evaluated and any abnormalities were noted. Subsequently, after bursal debridement, the calcium deposits were located by percutaneous needling and carefully excised by use of a motorised shaver. This occasionally resulted in the creation of tendon tears but these were left untreated. An arthroscopic acromioplasty was only performed when there were signs of impingement (fraying or roughness) on the coracoacromial ligament. Postoperatively the shoulder was supported for 2 days in a sling till all the swelling was gone. Gentle range of motion exercises were allowed immediately after surgery.

All patients were reviewed after a mean period of 15 months (range : 3 to 53). Patients were evaluated postoperatively by use of the DASH and the Constant score. Standard radiographs were taken to evaluate the presence of residual calcifications. The statistical analysis was done with the SAS software, using Wilcoxon paired tests to test pre-postoperative evolution while unpaired tests were used for comparing constructed groups. Frequencies were analysed by chi-square tests. The significance level was set at 5%.

Table I. — Pre- and postoperative pain, range of motion, modified Constant score (without strength measurements), and DASH score

	Pain*	Flexion	Abduction	External rotation*	Internal rotation*	Modified Constant score	Total DASH score
preop	3.9+/-2.3	134.7°+/-32	126.4°+/-36	7.5+/-2	6.8+/-3	41.4	44.7
postop	10.5+/-3.7	170.3°+/-14	168.8°+/-18	9.1+/-2	8.5+/-2	63.7	22.8

\* points on Constant score.

Table II. — Functional outcome of shaving versus shaving with acromioplasty

	DASH preop	DASH postop	Modified Constant preop	Modified Constant postop
shaving	42.6+/-14	24.5+/-19	42.8+/-11	62.8+/-10
shaving with acromioplasty	49.7+/-15	17.3+/-18	33.4+/-6	66.8+/-9

## RESULTS

No major complications were noted after the arthroscopic treatment. The average DASH score significantly improved from 44.7 to 22.8 ( $p = 0.00001$ ). The modified Constant score (without subscore for strength) improved from 41.4 to 63.7 ( $p = 0.00001$ ). The mean postoperative Constant score including strength assessment was 75.8 +/- 14.7 points. Arthroscopic excision and shaving of the calcifications resulted in significant postoperative pain relief: the pain score improved with an average of 6.6 points from 3.9 +/- 2.3 to 10.5 +/- 3.7 points ( $p = 0.00001$ ). We also noted a significant improvement of the postoperative mobility ( $p = 0.00001$ ) (table I).

Arthroscopic excision and shaving alone also resulted in an improvement of the DASH score from 42.6 to 24.5 ( $p < 0.001$ ). In these patients, the modified Constant score (strength score not included) improved from 42.8 to 62.8 ( $p = 0.00001$ ). A combined acromioplasty did not significantly influence the outcome (table II). An arthroscopic acromioplasty was performed in 14 shoulders (22.9%). An improvement of the DASH score was observed from 49.7 to 17.3 ( $p < 0.05$ ). The modified Constant score improved from 33.4 to 66.8 ( $p < 0.01$ ).

Preoperative radiographic examination revealed 53 shoulders (86.8%) with a Gärtner type I calcification, 7 shoulders (11.5%) with a type II calcification and 1 shoulder (1.6%) with a type III calci-

fication. The deposits were located in the supraspinatus tendon in 55 (90.1%) shoulders, in the infraspinatus tendon in 4 (6.6%) shoulders and in both tendons in 2 (3.3%) shoulders. In 12 patients the calcifications measured less than 10 mm (Group A), 29 calcifications were between 10 mm and 20 mm (Group B), and calcifications larger than 20 mm (Group C) were observed in 20 shoulders. We did not notice a significant difference in pre- or postoperative DASH and Constant scores with respect to the preoperative size of the calcifications (table III).

Postoperative radiographic examination showed absence of calcifications in 56 (91.8%) patients. Three (4.9%) patients had a residual type II calcification and 2 (3.3%) had a type III calcification. All residual calcifications were less than 10 mm in size. The presence of residual calcifications did not significantly influence the DASH, or Constant score as shown in table IV.

In the postoperative period a frozen shoulder (persistent pain and marked limitation of motion, especially external rotation) was observed in 11 (18%) patients. Patients with a frozen shoulder were all treated with physiotherapy (intensive active and passive mobilisation exercises, including stretching) and in all but two we performed a distension arthrography. This conservative treatment protocol resulted in restoration of the mobility in all cases. At follow-up, there was no significant difference in improvement of the Constant score and DASH score between patients with and those

Table III. — Pre- and postoperative function, according to the preoperative size of the calcification

Calcification size	DASH preop	DASH postop	Modified Constant preop	Modified Constant postop
< 10 mm	34.4+/-12	25+/-19	40.8+/-9	61.3+/-4
10-20 mm	50.1+/-10	25+/-20	41.6+/-9	63+/-13
> 20 mm	43.4+/-22	20,5+/-16	42.7+/-12	65.7+/-8

Table IV. — Postoperative Constant scores and subscores in patients according to the presence of residual calcifications

Postoperative residual calcifications	Pain	ADL	Function	Strength	Total Constant	DASH
No calcifications (n = 56)	10.3+/-3.8	26.6+/-6.9	36.8+/-4.2	12.1+/-6.8	75.5+/-15	24+/-9.1
Calcifications < 10 mm (n = 5)	13+/-2.7	30.6+/-5.2	37.2+/-3.3	11.7+/-4.7	79.5+/-1.3	9+/-6.8

without a frozen shoulder postoperatively. Of the 11 patients with a frozen shoulder, 2 had non insulin dependent diabetes mellitus (NIDDM) and 3 had documented hypercholesterolemia.

Finally, we found no correlation between the final outcome and the age or sex of the patients, the involvement of the dominant side, the duration of preoperative symptoms, the kind of preoperative treatment and the BMI (data not shown).

## DISCUSSION

The purpose of this study was to evaluate the functional and subjective outcome after arthroscopic needling in patients with calcifying rotator cuff tendinitis. We noted a significant improvement in DASH and modified Constant score after arthroscopic excision and shaving of calcium deposits. The overall DASH score of our patients improved from 44.6 preoperatively to 22.8 postoperatively. The mean postoperative Constant score reported in this study was 75.8 +/- 14.7 and this is comparable to studies performed by others. Tillander *et al* (16) reported a mean postoperative Constant score of 79 after arthroscopic subacromial decompression in shoulders with calcifying tendinitis. Rubenthaler *et al* (13) reported a postoperative Constant score of 97.6 points in their arthroscopically treated group with a follow-up of 17 months. Recently, Porcellini *et al* (9) reported a mean postoperative Constant

score of 86.4 +/- 7.2 after a mean follow-up of 36 months. The mean postoperative subscore for strength in our series was 12.1, where the expected strength in the normal shoulder according to Yian *et al* (18) in a comparable patient group is 13.4. The expected subscore for function is 40 points in that study ; in our study we found a postoperative subscore for function of 36.8 points. Although we were unable to determine the preoperative strength in our study, our findings indicate that in general a (nearly) normal shoulder function can be expected after arthroscopic excision and shaving of calcifications. The follow-up period in this study varied from 3 to 53 months. The great variability of this period is a weakness of this study. However, we found no significant difference in outcome when comparing patients with a follow-up less than one year with others with a follow-up longer than one year (data not shown).

Some studies favour arthroscopic acromioplasty as a routine treatment for calcifications in the rotator cuff (13, 16). We only perform acromioplasty when we see definite signs of impingement on the coraco-acromial ligament during the arthroscopy. These signs consist of fraying or roughness of the coraco-acromial ligament. There is no indication for acromioplasty in cases with inflammatory changes around the calcium deposits and in patients with large deposits bulging into the subacromial space (10, 12, 14). The final outcome in this

study was not influenced by performing an acromioplasty. Similar findings were reported by Porcellini *et al* (9).

In this study, we also looked at the morphology and size of the calcifications and their effect on the postoperative outcome. Porcellini *et al* (9) noted that patients with preoperative calcifications greater than 20 mm in size had the lowest preoperative Constant score. At two years follow-up, the Constant score in all groups increased irrespective of the preoperative size of the calcifications. In this study, the preoperative size of the calcifications did not influence the pre- or postoperative Constant score.

It is still a matter for debate whether calcium deposits should be removed entirely to achieve a good functional result. During arthroscopic needling, the surgeon is often confronted with the following dilemma : removal of the entire deposit may result in the creation of a full thickness rotator cuff defect which might become symptomatic, while the presence of residual calcifications might result in persisting symptoms. We found no difference in outcome in patients with residual calcium deposits compared with those without residual calcium deposits. This is in concordance with the study performed by Tillander *et al* (16). These authors found no difference in outcome when comparing patients with or without residual calcifications seen on standard radiographs. Porcellini *et al* (9) on the other hand concluded that the outcome after arthroscopic needling of calcifications in the rotator cuff in 63 patients after an average of 36 months strongly correlated with the persistence of residual calcium deposits in the tendon. In their study a postoperative ultrasound was used to determine the presence of residual calcifications. We only used a radiographic evaluation to determine the presence of residual calcifications. This is a potential disadvantage of this study : microcalcifications are often only seen on ultrasound.

Frozen shoulder was a frequent complication of arthroscopic excision and shaving of calcifications (18% of the patients). A frozen shoulder was defined as persistent pain combined with marked limitation of motion, especially external rotation. After conservative treatment of the frozen shoulder,

we found no significant differences in final Constant score and DASH score. We believe that residual calcium debris in the subacromial space and in the glenohumeral joint may result in irritation of the glenohumeral capsule. Therefore, we recommend a thorough lavage of the shoulder during the arthroscopic treatment with removal of as much debris as possible.

In conclusion, arthroscopic shaving and excision is a safe and reliable procedure for calcifying rotator cuff tendinitis. Good to excellent results and a nearly normal functioning shoulder can be expected. An additional acromioplasty is only needed in the presence of impingement signs (fraying or roughness) on the coracoacromial ligament. In this study, residual calcifications did not significantly influence the postoperative outcome. We believe that the presence of residual calcifications can be accepted if this is necessary to preserve the integrity of the tendon. The occurrence of a frozen shoulder in the postoperative period was a frequent complication in this study, but we noted no differences in final outcome as compared to patients who did not develop this complication.

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