The Clinical Results of Arthroscopic Treatment for Calcified Tendinitis of Rotator Cuff—— A Retrospective Study With No Less Than 2 Years Follow Up

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Abstract

Background The treatment of CT remains controversial. The aim of this study was to retrospectively evaluate the pain and functional outcomes of arthroscopic excision with or without rotator cuff repair for treating calcified tendinitis of the rotator cuff.

Methods Between Jan 2015 and Apr 2018, a total of 38 patients with 39 shoulders CT of the rotator cuff underwent arthroscopic surgery and were followed for at least two years. The clinical outcomes were evaluated at intervals of 2, 4, and 8 weeks and 3, 6、12 and 24 months after the surgery and annually thereafter. The efficacy measures included the visual analogue scale (VAS) score, University of California at Los Angeles (UCLA) score, American Shoulder and Elbow Surgeons (ASES) score and radiographic outcomes.

Results All patients underwent follow-ups, and the mean follow-up time was 45.38 months. The VAS score significantly decreased from 73.59±11.35 mm before the surgery to 26.41±10.63 mm at 6 months after surgery and continued to decrease to 5.64±5.02 mm at the end of the follow-up period (all $p < 0.01$). This result was supported by a significant increase in both the UCLA score and ASES score (all $p<0.01$) after surgery. Plain radiographs after surgery revealed complete calcification removal in all patients. No recurrence was observed during the follow-up period.

Conclusions Arthroscopic excision can relieve pain and improve shoulder joint function in patients with CT. Additional randomized controlled studies need to be conducted to confirm our findings.

Background

Calcified tendinitis (CT) of the shoulder is a very common musculoskeletal disorder [1–3]; it has an incidence rate of 2.7%-22%, and it is more common in women than in men [4, 5]. Usually, CT occurs in people between the ages of 30 and 60[6]. CT is usually characterized by pain and calcifications in the rotator cuff and synovial tissue[4, 7, 8]. Rare underlying pathologies[9] of CT include metaplastic changes and changes in the calcium phosphate level. CT occurs in the supraspinatus, infraspinatus, subscapularis and teres minor, with the supraspinatus tendon being the most commonly affected (accounting for as many as 63% of all cases)[10–12]. CT is considered to have formative, resting and resorptive phases[13]. Usually, there are no significantly symptoms in patients during the formative phases, while patients experience severe pain in the shoulder during the absorption phase[14].

Currently, because CT is a self-limiting disease, the treatment of CT remains controversial[4, 7, 15–17]. Many authors have stated that conservative treatments mainly include the use of systemic NSAIDs in the acute phase[18, 19], local infiltrations of corticosteroids and/or anaesthetics, and physical therapy that involves cold or heat and manual therapy with exercises to improve patients' range of motion[4, 20]. It has been reported that all the treatments mentioned above can relieve pain [4, 18–20], but these approaches usually require long-term treatments to achieve favourable results, and the pain is typically not relieved to a satisfactory extent. Extracorporeal shock wave therapy (ESWT)[16] and ultrasound-

guided percutaneous lavage (UGPL)[21] have also yielded good results, but might lead to complications such as vagus nerve stimulation, pain[1, 22] and even skin disinfection [23]. Many patients even experience pain and discomfort, followed by recurring symptoms of the involved shoulder[17, 21, 24, 25], and some of them require surgery finally. Nevertheless, more than 25% of patients who are resistant to conservative treatment and patients with severe symptoms persisting for more than six months need to undergo surgery [26, 27].

In comparison to open surgery, arthroscopy involving CT excisions in the rotator cuff tendons is preferred because it yields similar results[28–30], associated with rapid recovery relatively fewer complications [31]. However, there is insufficient clinical data on arthroscopic treatment for CT of the rotator cuff. In our retrospective study, we aimed to evaluate the effect arthroscopic CT excisions and rotator cuff repair in treating CT of the rotator cuff with at least two years follow up.

Methods

This study was conducted in the Department of Orthopedics at West China Hospital of Sichuan University, was approved by the Human and Ethics Committee for Medical Research at Sichuan University, and was performed in accordance with the Helsinki Declaration. All the patients provided informed consent prior to enrolment in the study.

Patients were included if they were symptomatic, had a poor response to conservative treatments lasting for more than 6 months prior to enrolment, had experienced night pain [8, 32, 33] with a severity of more than 60 mm on a 100-mm visual analogue pain scale (VAS; 0 mm representing no pain and 100 mm representing the worst imaginable pain) at night in the target shoulder joint, could not sleep well for more than 4 hours during the night, and had significant X-ray (Fig. 1) and magnetic resonance imaging (MRI) (Fig. 2) evidence of CT with a diameter of no less than 1 cm in the target shoulder [31, 34]. Patients with an unstable medical condition from a shoulder surgery, such as infection or abnormal vital signs, a secondary definite full rotator cuff tear, and a follow-up period of less than one year were excluded from the study.

At the time of screening, the medical history of each patient was recorded. A complete physical examination, particularly focused on the target shoulder, and laboratory assessments were performed. A radiograph of the target shoulder was also taken. Clinical diagnoses of CT of the rotator cuff were made based on the classic symptoms and radiographical evidence, and were finally confirmed by pathological diagnoses after the operation. The American Shoulder and Elbow Surgeons (ASES) scores [11], University of California at Los Angeles (UCLA) scores [2], and VAS scores were assessed preoperatively. All scores were reported by the patients themselves.

Between Jan 2015 and Apr 2018, a total of 49 patients received surgery in our department were screened. Eleven patients were excluded; 6 patients did not undergo conservative treatments for more than 6 months, 4 had definite full rotator cuff tears, and 1 had a concomitant immune disease. Finally, thirty-eight patients who underwent CT arthroscopic excision were evaluated retrospectively. The age of the

patients we included ranged from 32 years to 76 years (average 55.08 years), and 78.9% were women (8 men and 30 women). The baseline main characteristics for all 38 patients are shown in Table 1. All operations were performed by the same group of surgeons. Among the 38 patients with affected shoulders, 1 patient had previously suffered from CT in the right shoulder and underwent arthroscopic excision, and CT developed in the left shoulder 2 years later. Among the 39 affected shoulders, 3 cases involved both the supraspinatus and infraspinatus, 28 involved the supraspinatus, 5 involved the infraspinatus, and 3 involved the subscapularis tendon. Among all the patients we enrolled, 13 patients suffered from partial rotator cuff tears (Elman grade lower than II), and 9 suffered from stiff shoulders before enrolment.

Table 1
Demographic and Clinical Patient Data (n = 38)

Item		Data
Age, (mean ± SD), y		55.08 ± 8.84
Sex, n		
	Male	8
	Female	30
Side[#], n		
	Left	10
	Right	27
	Double	1
The affected tendon[#], n	Supraspinatus	28
	Infraspinatus	5
	Both two above	3
	Subscapularis	3
Concomitant PRCT[#], n	Elman grade I	13
	Elman grade II	6
	Elman grade II	0
Concomitant stiff shoulder[#], n		9
Duration of symptoms[#], (mean ± SD), m		39.69 ± 47.95*
Follow-up time[#], (mean ± SD), m		45.38 ± 16.37
PRCT, partial rotator cuff tear; SD, standard deviation;		
[#] 39 shoulders;		
[*] One patient suffered from right shoulder pain for 20 years.		

Surgical procedure

All surgical procedures were performed by the same surgeon team with the patient under general anaesthesia and in the lateral decubitus position. First, target shoulder arthroscopy with the routine posterior portal was used to evaluate the glenohumeral joint. Then, the routine anterior upper portal was established under arthroscopic guidance. Intra-articular pathologies were identified and managed, as

required. Subsequently, the scope was moved to the bursa surface for further evaluation, and subacromial decompression was performed if evidence of impingement was observed. Then, under needle guidance, the routine lateral portal was made, and the scope was moved to this portal for an outlet view.

Prior to the operation, the supraspinatus outlet view was thoroughly evaluated to locate the calcific lesion in the rotator cuff tendon. Usually, calcific materials are easily identified because calcific lesions are in a superficial location (Fig. 3a). In some cases, it was difficult to visualize any pathologies on the outer surfaces of the tendons, so exploration of the supraspinatus tendon was performed using a spinal needle to identify the calcific materials. A spinal needle was introduced into the supraspinatus tendon percutaneously to locate the calcific deposits. Once the calcific lesion was located, an additional lateral portal was normally established, and a small longitudinal incision (measuring no more than 1.5 cm) parallel to the rotator cuff tendon on the synovial side was made using a No. 11 sharp blade so that all of the calcific materials could be removed. For the three-calcific subscapularis, an additional anterolateral portal was established when we located the calcific lesion, and a small longitudinal incision (no more than 1.5 cm) parallel to the subscapularis tendon was made.

Those patients need acromioplasty underwent release of the coracoacromial ligament and flattening of the anterior-inferior surface of the acromion. This was performed with a combination of electrocautery and shaver use to remove bursal tissue and define the lateral border and under surface of the acromion. A motorized bur was then used to remove bone until the under surface of the acromion was flat when viewed from the lateral portal.

In all 38 patients with 39 affected shoulders, 14 lesions were identified directly under arthroscopy, and the other 25 were confirmed by spinal needles. All visible calcifications were removed by irrigation or debridement and were sent for further pathological assessments (Fig. 3b). After complete calcification removal and the debridement of serious degenerative changes in the surrounding tissue, a rotator cuff defect developed in most cases (Fig. 3c).

When the rotator cuff defect was considered to be a relatively large defect or the tendon was torn in full thickness, repair was performed using one or two suture anchors or side-to-side stitches, depending on defect size and shape (Fig. 3d). Suture anchor repair was performed when there were relatively large defects and partial thickness tears with an Elman grade higher than III after the removal of calcific materials, and one stitch of side-to-side repair was performed in partial tears with an Elman grade of II to prevent the progression of the rotator cuff tears. In cases with minimal damage (an Elman grade of I or lower) of the rotator cuff after the removal of the calcific deposits, only debridement was performed.

For concomitant shoulder stiffness, all patients underwent manipulation release prior to surgery and intra-articular debridement. A shaver and radiofrequency were used to remove all inflammatory synovium and release all adhesive capsules, including the capsule of the rotator cuff interval.

Postoperative management and assessment

All patients received an intramuscular injection of pethidine and/or oral NSAIDs to relieve pain after surgery. A standard protocol was designed for most of the patients included by our rehabilitation team, but an individualized rehabilitation plan was also provided as needed, depending on the outcomes and the patients' compliance at each clinical follow-up. Normally, a shoulder abduction brace was used for 4 to 6 weeks after the surgery, and then, active range of motion and strengthening exercises were started gradually, depending on the defect size, shape and repair patterns of the rotator cuff after the removal of the calcific lesions. All patients were prescribed passive range of motion exercises and rehabilitation two weeks after surgery. For calcified tendinitis of the rotator cuff accompanying stiff shoulder, passive range of motion exercises and rehabilitation were started the first day after the operation [4, 8, 35].

All patients underwent clinical follow-ups at intervals of 2, 4, and 8 weeks and 3, 6, 12 and 24 months after the surgery and annually thereafter. All radiographic and clinical efficacy measures, including the ASES scores, UCLA scores, and VAS scores at night, were determined at the outpatient clinics. The achieving pain relief and functional scores after surgery were evaluated by the patients themselves then reviewed by two surgeons (LT and XY) at each clinical visit. The radiographic data were reviewed by two physicians from our hospital imaging centre. All complications were recorded and reviewed by two senior surgeons (TX and LJ).

Statistical analysis

Statistical analyses were performed by SPSS 22.0 software (SPSS Inc., Chicago, IL, USA). Continuous data are presented as the mean ± standard deviation (SD). Changes in the VAS, ULCA and ASES scores were analysed with repeated measures analysis of variance. A p value of less than 0.05 was considered significant.

Results

All of the patients were confirmed to have CT based on the pathological examinations performed after the operation. Repair using a suture anchor was performed in 18 shoulders (46%), side-to-side repair using suture was performed in 13 (33%), and debridement was performed in only 4 (10%). 11 patients received subacromial decompression during the surgery.5 patients received acromioplasty during the surgery. No surgical complications were observed during the perioperative period.

The mean follow-up time of the 38 patients (39 shoulders) was 45.38 months (range from 28 months to 82 months). All patients were followed up for at least 2 year. Six patients (6 shoulders) were followed up by telephone and delivered the radiographic materials, and other patients completed their follow-ups in the outpatient clinics after the operation.

During the follow-up, no infections, subcutaneous haematomas or other complications occurred, and no secondary operations were required for any patient. Secondary shoulder stiffness, which was present in 9 patients before enrolment, resolved after the operation with an early rehabilitation intervention. Six

patients who did not have any motion limitations prior to surgery developed stiffness, which was resolved within 6 months of surgery by intra-articular steroid injections and individualized rehabilitation.

For all of the included shoulders, the mean VAS score significantly decreased from 73.59 ± 11.35 mm before the surgery to 26.41 ± 10.63 mm at 6 months after surgery and continued to decrease to 5.64 ± 5.02 mm at the final follow-up (all $P < 0.01$). The mean ASES score improved from 34.15 ± 16.43 before the surgery to 89.49 ± 5.23 ($P < 0.01$); the mean UCLA score improved from 11.49 ± 4.97 before the surgery to 32.44 ± 1.50 ($P < 0.01$) (Table 2); and the full UCLA score data are shown in Table 3.

Table 2
Clinical Outcomes of Included Patients (n = 38)

Items	VAS	ASES	UCLA
Preoperative	73.59 ± 11.35	34.15 ± 16.43	11.49 ± 4.97
6 m postoperative	26.41 ± 10.63	60.69 ± 16.70	26.82 ± 4.63
Final follow-up	5.64 ± 5.02	89.49 ± 5.23	32.44 ± 1.50
P value	< 0.01	< 0.01	< 0.01
VAS, visual analogue score; ASES, American Shoulder Elbow Scale; UCLA, University of California and Los Angeles shoulder score			

Table 3
The UCLA parameters (mean ± SD) before and after operation

	Pain	Function	ROM	Strength	Satisfaction
Preoperative	3.13 ± 1.88	3.26 ± 1.63	2.44 ± 1.23	2.67 ± 1.11	0
6 months postoperative	7.64 ± 1.58	7.33 ± 1.40	3.95 ± 0.60	3.92 ± 0.70	3.97 ± 2.05
Final follow-up	9.03 ± 1.01	9.28 ± 0.97	4.59 ± 0.50	4.54 ± 0.51	5
P value	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
UCLA, University of California and Los Angeles; SD, standard deviation;					
ROM, range of motion					

Plain radiographs obtained one day after surgery revealed complete calcification removal in all patients (Fig. 4). At the final follow-up, the MRI (11 patients) and ultrasound (23 patients, 24 shoulders) results confirmed that all patients demonstrated complete resorption without recurrence and a good healing status of the rotator cuff tendon. The panoramic photos of the patient at 2-year follow-up showed the significantly function increased (Fig. 5).

Discussion

This study assessed the efficacy of arthroscopic excisions with or without rotator cuff repair in CT patients with the removal of the calcific deposits, and acromioplasty was performed if evidence of impingement was observed. The results showed symptomatic pain relief and an improvement in function before the final follow-up. In this study, 32 patients who underwent arthroscopic excision of calcified tissue exhibited favourable outcomes; the other six patients suffered from stiff shoulder after surgery, but all cases were resolved within 6 months with rehabilitation. No patients experienced disease recurrence. The mean VAS scores and UCLA scores at the final follow-up significantly improved in comparison to those researches or similar to the results of Marder[29] and Rubenthaler [34].

There are many ways to treat CT, and each treatment has its own advantages and disadvantages[7, 35–37]. In a recent systematic and network meta-analysis, Wu al.[38] revealed that several conservative treatments, such as ultrasound-guided needling (UGN), radial extracorporeal shockwave therapy (RSW), and high-energy focused extracorporeal shockwave therapy (H-FSW), can reduce pain and yield the complete dissolution of calcium deposition. Another review by Louwerens al.[39] indicated good to excellent clinical outcomes in high-energy ESWT and US-guided needling, but the side effects and posttreatment complications for each individual patient should be taken into account[17, 21, 24, 25]. Cho et al[27] showed that at least 28% of the patients included in their study did not fully recover after non-operative treatments, and surgical treatment may be needed for these patients.

Many studies recommend surgery when a patient does not respond to conservative treatment lasting for more than 6 months [30, 40, 41]. Compared to open surgery, arthroscopic excision is a safer and less invasive procedure, and the satisfying postoperative clinical results seem to not be influenced by the size or type of CT [9, 40, 42–46]. Wittenberg al.[47] investigated 100 patients who underwent conservative or operative treatment for rotator cuff calcifying tendinitis in a matched-pair analysis. They found that compared with conservative treatment, surgery not only shortened the duration of pain but also reduced the number of rotator cuff ruptures that occurred in the future, significantly improving the subjective functional outcomes.

The amount of calcification that needs to be removed during surgery remains controversial. Some surgeons have claimed that complete debridement is unnecessary for partial removal to better preserve the tendon[40], but other researchers have emphasized the importance of the complete removal of the CT region; they have even reported a negative correlation between the functional clinical outcomes and the amount of the remaining vestigial materials [41, 48–50]. However, after complete removal of the CT region, a defect of the rotator cuff usually remains. For this defect, most authors have agreed that suturing the residual tendon lesions is preferable when the remaining defect is relatively large [41, 48–50]. Suturing the tendon defect might allow patients to start rehabilitation early [41]. In our study, after all the CT areas were removed completely, 88% of patients developed a significant rotator cuff defect (tendon damage more severe than an Elman grade I) and underwent repair surgery, and our final results suggest that surgical treatment should be administered for cases that do not respond to conservative treatment.

Several limitations of our analysis should be noted. First, the lack of a randomized-controlled technique should be considered a major limitation of this study. Second, the sample size of our study is relatively small. Third, 6 patients (6 shoulders) were followed up by telephone, and their X-rays were delivered; thus, a slight discrepancy across patients in the symptom observation and functional evaluation procedures may have occurred. Nevertheless, as this is a retrospective and open study, we could not draw a definite conclusion. Additional randomized, long-term and prospective studies with a control group and more patients are recommended to confirm the findings of this study.

Conclusions

Based on the results of our research, arthroscopic calcified lesions excision can be efficacious in treating CT, with promising clinical results postoperatively. Additional studies of higher quality are needed to confirm the findings in our study.

Abbreviations

CTs, calcified tendinitis; VAS, visual analogue scale; UCLA, University of California at Los Angeles; ASES, American Shoulder and Elbow Surgeons; UGN, ultrasound-guided needling; RSW, radial extracorporeal shockwave; H-FSW, high-energy focused extracorporeal shockwave; MRI, magnetic resonance imaging; NSAIDs, non-steroidal anti-inflammatory drugs.

Declarations

Acknowledgments

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Consent for publication

The patients shown in Figs. 1, 2, 3 4 and 5 were provided written informed consent for the publication of these photos and images.

Authors' contributions

LT carried out the follow-ups of the study and prepared the draft. XY and QW contributed to the follow-ups of the study and analysis the data. LJ mainly participated in designing the study. TX secured funding and was responsible for the study set-up. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This study was approved by the Human and Ethics Committee for Medical Research at Sichuan University in accordance with the Declaration of Helsinki. Written informed consent was obtained for all patients prior to their inclusion in the study.

Competing of interests

The authors declare that they have no competing interests.

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Figures

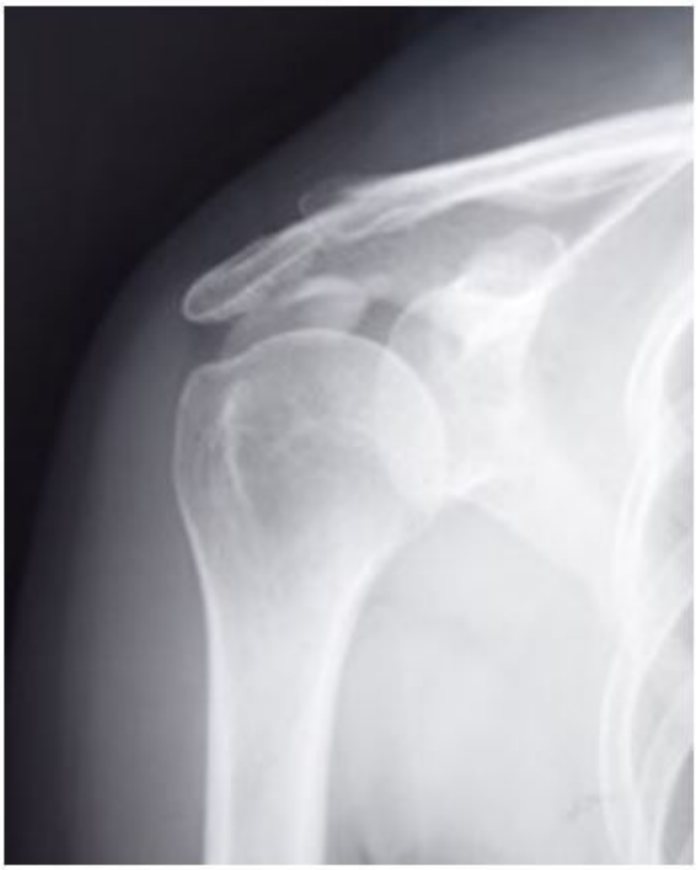

Figure 1

X-ray (front and posterior) clearly showing CT in the target shoulder.

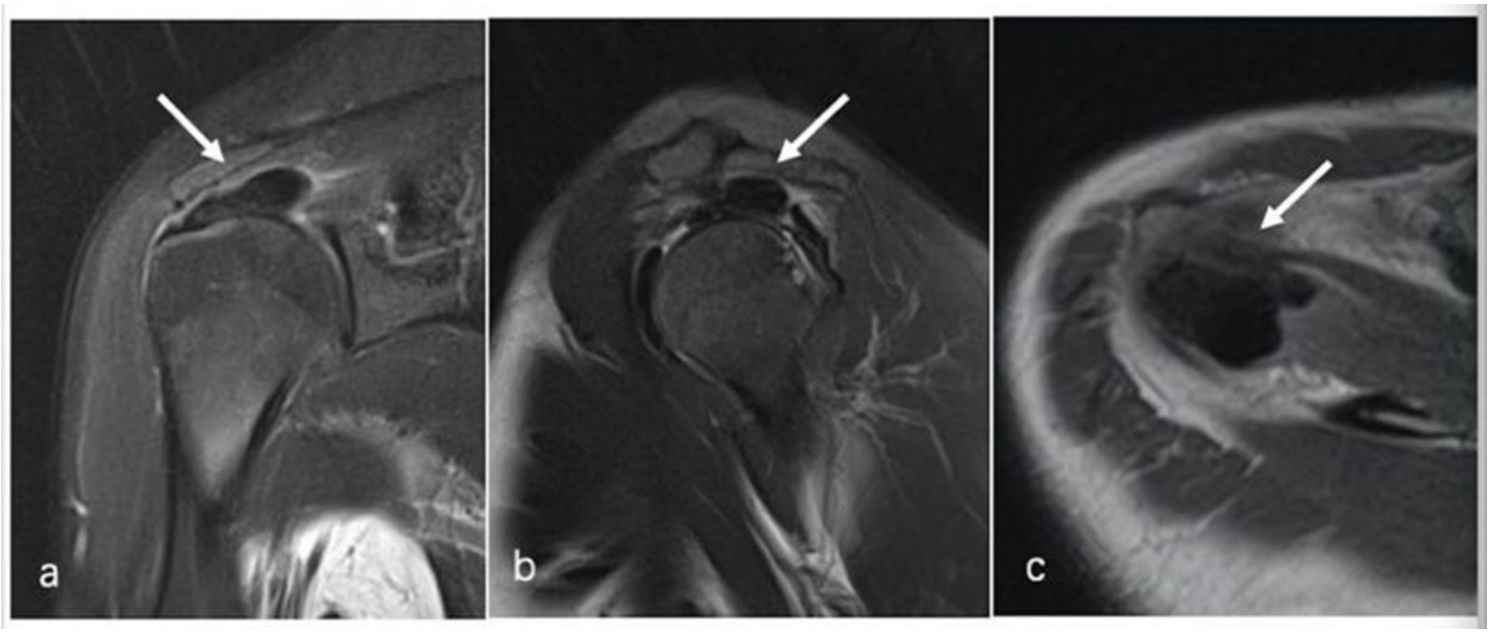

Figure 2

MRI scan showing CT in the target shoulder in the sagittal (a) and coronal (b) planes.

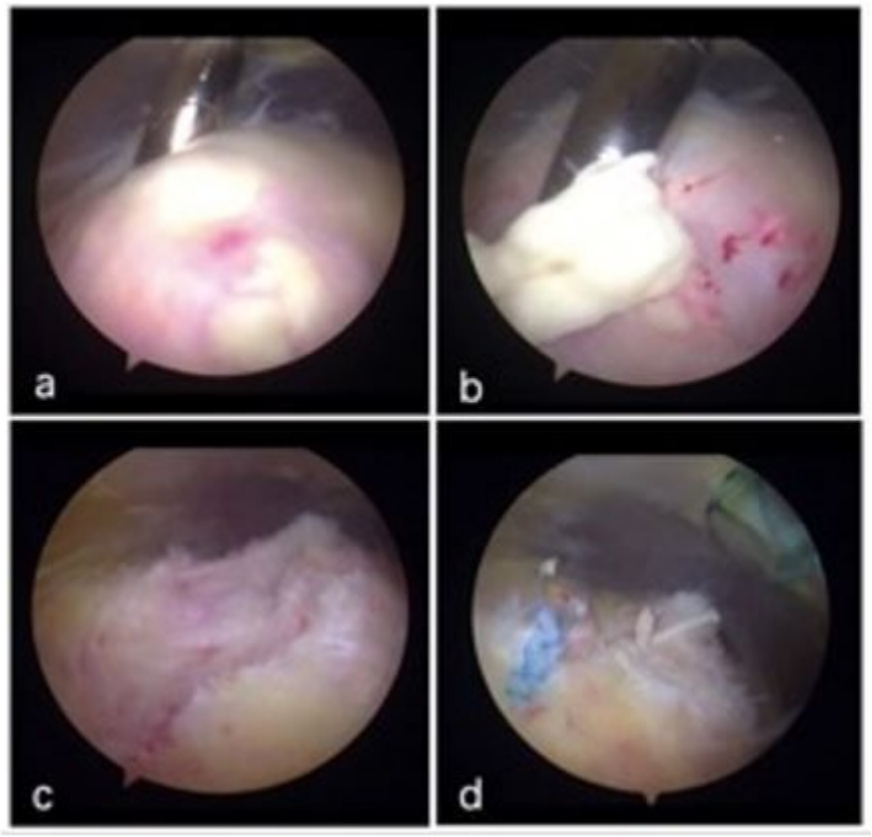

Figure 3

The calcific materials were found in a superficial location (a) and were removed (b). A rotator cuff defect developed after calcification removal (c). The rotator cuff defect was repaired using one double loaded anchor (d).

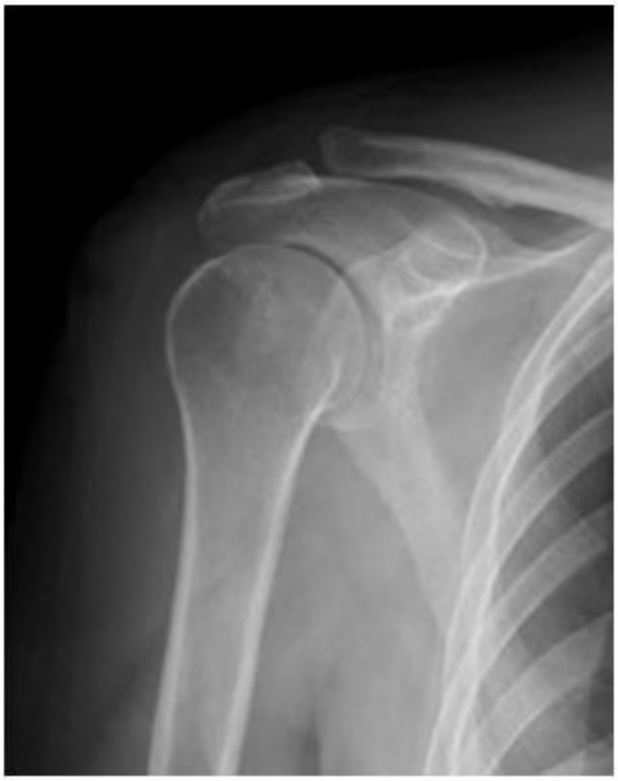

Figure 4

X-ray (front and posterior) taken postoperatively showing complete calcification removal.

Figure 5

Functional image after the surgery