Treatment of the calcific tendinopathy of the rotator cuff by ultrasound-guided percutaneous needle lavage. Two years prospective study

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Summary

Purpose: to evaluate the short and long term ef-
fectiveness of ultrasonography (US)-guided per-
cutaneous needle lavage in calcific tendinopathy
of the rotator cuff. To study the evolution of the
size of calcifications and pain in the two years af-
fter treatment.

Methods: a 2 year longitudinal prospective study is
carried out after applying the UGPL technique
on a number of patients diagnosed with calcific
tendinitis of the rotator cuff. Clinical, ultrasound
and radiology follow-up controls were performed,
3 months, 6 months, one year and two years after
the treatment. The Visual Analog Scale (VAS) was
used to assess the pain. The degree and point of
pain is selected on a 10cm line, arranged horizon-
tally or vertically. The “0” represents no pain and
“10” represents worst pain. The population stud-
ied was made up of 121 patients that required our
service as a result of suffering from a painful
shoulder.

Results: the pain (VAS) and the size of the calcifi-
cation significantly decreased with the applica-
tion of the technique (p< 0,001 in both cases) and
regardless of the sex (p: 0.384 for pain and p:
0.578 for the size of the calcification). This oc-
curred from the first check-up (3 months) and was
maintained for two year.

Conclusion: we consider this technique to be a
valid alternative as a first-choice treatment of cal-
cific tendinitis of the shoulder. The intervention is
simple, cost-effective, does not require hospital-
ization, involves no complications, rehabilitation
treatment is not required and it shows very few
side effects without sequelae, significantly reduc-
ing the size of the calcification and pain in the
majority of patients.

KEY WORDS: calcific tendinopathy, percutaneous lavage,
puncture, ultrasound.

Introduction

Rotator cuff tendinopathy is the most common cause
of shoulder pain, with the prevalence in the general
population found to range between 5 and 39%1,2. The
frequency of calcific tendinopathy ranges, according
to the authors, between 7.5 and 22% of all cases of
shoulder tendinopathy3-5 and the prevalence of the
condition is highest among the third and fifth decade
of life6. The etiopathogeny of calcific tendinopathy
is still not clear, although its origin may be multifactorial,
the result of a combination of extrinsic factors
(anatomical or biomechanical) and intrinsic factors
(changes related to age, vascularity, overloading, ge-
netic, hormonal factors, etc.)2,4,7-10.

There is currently no universally accepted treatment
or international protocols agreed upon by consensus
to manage the disease, with many being the tech-
niques described for this pathology, the results of
which vary from one author to another1,4,11,12. Among
the described treatments that have been most effec-
tive are shock waves13-16, ultrasound-guided percuta-
neous lavage17-23 and surgical treatment24,25.

Work is currently being carried out on the application
of safer, non-invasive techniques with fewer side ef-
facts; in this regard, ultrasound-guided percutaneous
lavage (UGPL) may be the first-choice, therapeutic
alternative in the treatment of calcific tendinopathy of
the shoulder. Initial percutaneous punctures were
performed in 1978 with fluoroscopic control26 but the
technique was dropped as a result of the radiation on
the patient during such treatment. It wasn’t until the
Nineties, with the use of ultrasound scans, that this
treatment was used again, when excellent results
were obtained in identifying and locating calcifications.
in the rotator cuff and guiding the needle to perform the vacuuming of the calcific deposits\textsuperscript{17}. Since then, a number of documented studies have been produced using UGPL with various technical modifications\textsuperscript{18-21,27,28}. However, to date, very little literature has been published on the study of the medium and long-term results of applying UGPL with a wide variety of case studies. The main objective of our study is to assess the results after applying the UGPL technique for the treatment of calcific tendinopathy of the rotator cuff with a 2-year-follow-up, assessing both the evolution of pain as well as the size of the calcification over time and the relationship between both parameters.

**Material and methods**

**Study design:** a 2-year-longitudinal prospective study is carried out after applying the UGPL technique on a number of patients diagnosed with calcific tendinitis of the rotator cuff. Clinical, ultrasound and radiology follow-up controls were performed, 3 months, 6 months, 1 year and 2 years after the treatment. The Visual Analogy Scale (VAS) was used to assess the pain. The degree and point of pain is selected on a 10 cm line, arranged horizontally or vertically. The "0" represents no pain and "10" represents worst pain\textsuperscript{29}.

**Population:** the population studied was made up of 121 patients that required our service as a result of suffering from a painful shoulder. Between 30-39 years: 16 patients; 40-49 years: 60 patients; 50-65 years: 45 patients, made up of 81 women (66.9%) and 40 men (33.1%). 78 patients (64.46%) had jobs that required low levels of physical strain (administrative, teachers, nurses…, etc.) and 43 patients (35.53%) had jobs that required moderate to high levels of physical strain (operators, firemen, policemen…, etc.).

All the patients included in the survey were clinically diagnosed and underwent radiology and ultrasound scans to diagnose the calcific tendinopathy of the rotator cuff. 104 patients only showed calcifications in the tendon of the supraspinatus (SP) muscle, 8 patients in the SP and other tendons of the rotator cuff and 8 patients in the subscapularis (SC). Inclusion criteria were established: minimum size of calcification 5 mm, minimum value of 6 on the visual analogy scale (VAS), no known allergies to the drugs used. All the individuals were informed of the nature and characteristics of the study beforehand and they signed the informed consent, pursuant to the principles of the Declaration of Helsinki concerning medical research involving human subjects\textsuperscript{30} and study meets the ethical standards of the Muscle, Ligaments and Tendons Journal\textsuperscript{31}. Material: TOSHIBA Xario SSA-660A ultrasound, with multi-frequency probe (8-12 MHz), for the diagnosis and measurement of the size of the calcification; I-Scan 4400 (FM.Control \textregistered) portable fluoroscopic imaging system; 10 ml syringes and 18G, 20G and 21G needles for the calcification lavage.

**Description of the procedure:** for the intervention, patients do not have to fast or perform any preliminary actions other than taking an anxiolytic pill orally 30 minutes before the procedure (Bromazepam 1.5 mgr), in order to reduce the possibility of vagal syndrome. During the preliminary ultrasound scan, we establish the position of the shoulder that will make the route to the calcific deposits most accessible, through the skin. The technique is performed with the patient sitting in a chair with arm rests in front of the doctor and if possible with an internal rotation of the shoulder positioning the forearm behind the patient’s back. This position increases the pressure inside the tendon and enables the ejection of the calcium into the syringe. This area of skin is marked and the doctor explains to the patient that this position must be held throughout the procedure, approximately 30 minutes. The area shall be prepared with an aseptic technique using a povidone-iodine solution. The following shall be prepared using a sterile drape on the laboratory table, applying the aseptic technique: a 10 cc syringe containing 2% mepivacaine, various syringes containing a sterile physiological saline solution and a 5 cc syringe containing triamcinolone and 18G and 20G needles.

First the needle is inserted with the syringe containing mepivacaine and the ultrasound probe is placed on the path to be followed. We always start the procedure with the 20G needle. The anaesthesia is then administered to the area from the point of entry on the skin into the subacromial bursa. The needle is placed below the calcification and the needleling and lavage commences with the rest of the anaesthetic through the actual pressure placed on the embolus of the syringe from the outside with a pulsating or pumping mechanism (Fig. 1). These impulses continue un-

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**Figure 1.** (A) Needle point entering below the calcification. (B) The introduction of liquid produces a cavity through the pumping effect enabling the lavage.

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Results

The average size of the calcific deposits before the application of the treatment was 12.07 +/- 4.8, while the VAS was 7.46 +/- 0.92, without any significant differences between men and women in either of the two parameters (p=0.451 and p= 0.680 respectively).

In our series we found a greater percentage of calcific tendinopathy in the dominant side (54.5%) but without significant differences (p: 0.09).

The pain (VAS) and the size of the calcific deposits significantly decreased with the application of the technique (p< 0.001 in both cases) and regardless of the sex (p: 0.384 for pain and p: 0.578 for the size of the calcification). This occurred from the first check-up (3 months) and was maintained for two year (Figs. 2, 3).

The size of the initial calcification showed a wide spectrum, which is why we established four groups. Less than 6 mm, from 7-12 mm, from 13-18 mm and over 19 mm. 77.68% showed calcifications ranging between 7-18 mm. We have correlated the VAS value with the size of the initial calcific deposits and we have confirmed that the pain does not depend on the size thereof; however, we did find a positive correlation between the pain and the size of the calcific deposits after the percutaneous lavage. In other words, the pain decreases as the residual calcific deposits decreases after the treatment (p< 0.001 a year in all cases).

The decrease in pain and the size of the calcification occurred in all the cases (100%). 29.75% (36 pa-
tients) did not show any calcific deposits with the ultrasound scan after three months, 61.16% (74 patients) after six months and 83.78% (105 patients) after one year. With regard to pain, 63.64% (77 patients) were asymptomatic after three months, while after one year this percentage increased to 89.26% (108 patients). No patients suffered a relapse after two years of the procedure. During the first check-up after three months, 19 patients (15.70%) did not show any clinical or sonographic signs of improvement, with more than 5 mm calcification and VAS above 7. The intervention was repeated on these patients. Finally, a total of 13 patients (10.74%) showed no definitive improvement with the treatment one year after its application. None of these patients improved two years after the procedure. As indicated in the section on material and methods, during the application of the technique, calcium deposits can be seen to be extracted through the syringe. This occurred in 98 patients (80.99%). However, pain reduction over time was not related to whether or not calcium deposits were extracted (p:0.503). Other authors have also confirmed this fact20,21, although there is not unanimity on the issue19, however, the number of patients and the monitoring time is lower in all the cases in our survey. Six patients (5%) had a vagal reaction during the application of the procedure or as soon as it was finished which were spontaneously reverted with physical measures and in no case did it need to be interrupted or have other measures applied or subsequent medical treatments. No patients had any other complications during the intervention or during the 2 years of monitoring (rupture of the tendon, etc.).

Discussion

In our survey including 121 patients, with the application of the UGLP, we found that pain disappeared in 89.26% and the calcification disappeared in 86.78% of the patients, with low levels of complications (5% vagal reaction). More than 50% of the patients were asymptomatic 3 months later, with the largest percentage reached one year after the application of the UGLP and with the results remaining after two years. Therefore this technique may be effective in the medium and long term. Similar results to those published after arthroscopic treatment33,34 and higher, medium and long-term, to other minimally invasive treatments such as infiltrations with corticoids35, shock-waves16 and iontophoresis using acetic acid36. The etiopathogenicity of calcific tendinopathy of the rotator cuff is still unknown and may be caused by a number of factors. The epidemiological analysis of our series could advance some of these factors. In our series, as with other authors, the majority of the calcific deposits were in the supraspinatus tendon21,37, which could be related to the critical or ischemic area, located in the distal area of this tendon38,39. Also, in our survey, it mainly affects women in the fourth decade of life18,20,23,37, with no relation to prior illnesses or traumas, with a greater presence in professions or activities that require low levels of physical exertion and with no significant differences between the dominant and non-dominant side18,20,40; this information could suggest a greater influence of intrinsic factors (genetic or hormonal) rather than extrinsic factors (traumas). Physiotherapy is classically recommended as a first option for treating calcific tendinitis and surgical treatment is considered after an average period of six months if clear clinical results are not obtained22,41. Surgical treatment has seen better results in the treatment of this pathology that the conservative treatment25,33. However, there is a number of reasons for not prescribing surgical treatment as a first option. On the one hand, although surgery would appear to reduce the percentage of tendon ruptures26, it is not riskless, given that if the calcification is bulky, the surgical resection of it could leave to a defect in the tendon and even rupture it, with it possibly having to be repaired42,43. On the other hand, after surgical treatment, rehabilitating treatment is normally required in the majority of cases44. Finally, it has the inconvenience of having to stay in hospital, entailing greater health costs18,45.

As we described in the procedure, we used a single 20G needle, a smaller needle could cause an obstruction in the needle if calcium is extracted and a large one could damage the tendon. Various intervention techniques have been described, some authors use two needles18,22 and others puncture the calcification and aspirate the content19. No differences have been found between aspirating the calcium content21, therefore some authors do not recommend this aspiration technique as it could increase the risk of damaging the tendon20,21. In our study, the calcification was not punctured, a needle was introduced below it and we pressure-cleaned it with the saline solution, this is distributed throughout the calcification and the diluted calcium is repulsed into the syringe, without using the aspiration technique and therefore reducing the risk of tendon damage and the possibility of the needle being obstructed by the calcific deposit. A significant reduction of the size of the calcification has been seen, regardless of whether calcium is extracted, therefore we do not believe that the aspiration technique is required, or the introduction of two needles as a single operator can perform the technique. With our procedure we have obtained similar results or even better results to those communicated by other authors using different techniques18,20,23. With a two-year follow-up in our series. Calcification classification by Gärtner46 is based on morphology and density of these as they are shown in X-ray studies. Different phases of the illness are described based on the evolution of symptoms and images, and for the lack of response suggests a simple infiltration puncture. Classically, papers about calcifying tendinopathy mentioned Gartner’s Classification, but not data is found about long-term evolution of the calcification size and its relation with symptoms release. That is the main reason why we improved...
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our investigations in order to know how these calcifications evolve post UGPL. Our study is mainly a clinical trial, and we do not find other studies, which consider same stats such as size before and after treatment in such sample, comparing this evolution with clinical improving after treatment. Limitations of our study are the lack of randomisation and control cohort. The sample is made up of all the individuals that attended our department diagnosed with calcific tendinitis of the shoulder. The positive results obtained in our experience with the application of the two stats, considering two years free-of-pain period and regular work activity, as success in the treatment of these patients. Non measuring functional scales or quality life scores could be considered as a limitation of our study. To conclude, we consider this technique to be a valid alternative as a first-choice treatment of calcific tendinitis of the shoulder. The intervention is simple, cost-effective, does not require hospitalization, involves no complications, rehabilitation treatment is not required and it shows very few side effects without sequel, significantly reducing the size of the calcification and pain in the majority of patients.

References