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Clinical Observation of the Efficacy of Acupotomy Combined with Ultrasound Therapy for Calcific Tendinitis under Musculoskeletal Ultrasound Guidance

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Abstract: *Objective:* To explore the clinical efficacy of acupotomy combined with ultrasound therapy for calcific tendinitis under musculoskeletal ultrasound guidance. *Methods:* A total of 72 patients with calcific tendinitis were randomly divided into two groups. The control group received acupotomy treatment under ultrasound guidance, while the observation group underwent acupotomy combined with ultrasound under ultrasound guidance. Visual analog scale (VAS) scores, joint function scores, and calcific lesion reduction rates were compared between the observation group and the control group before and after treatment, as well as at various follow-up points. *Results:* Compared with the control group, the observation group had lower VAS scores after treatment and at four weeks post-treatment, and higher joint function scores after treatment and at four weeks, three months, and six months post-treatment (all $P < 0.05$). Additionally, the observation group showed greater changes in calcific lesion reduction rates after treatment and at four weeks post-treatment compared to the control group ($P < 0.05$). *Conclusion:* Acupotomy combined with ultrasound therapy under ultrasound guidance can alleviate pain and improve joint function in patients with calcific tendinitis.

Keywords: Calcific tendinitis; Ultrasonic wave; Musculoskeletal ultrasound; Acupotomy

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1. Introduction

Calcific tendinitis is an inflammatory condition caused by calcium salt deposition in tendons or ligaments [1]. Clinically, it most commonly affects the rotator cuff, with the supraspinatus tendon being the most frequently involved, accounting for approximately 80% of cases [2]. The hip joint is also a common site, particularly at the attachment points of the gluteus medius and gluteus minimus tendons [3]. The primary clinical symptoms include severe pain at the affected site and restricted movement. Although considerable evidence suggests that calcific deposits can self-resolve over time, the process is slow, prone to recurrence, and often accompanied by severe pain during flare-ups, significantly impacting patients' quality of life. This study aims to observe the effects of ultrasound-guided acupotomy combined with ultrasound therapy on pain relief and joint function in patients with calcific tendinitis.

2. General information and methods

2.1. General information

A total of 72 patients meeting the criteria were selected from our hospital between February 1, 2023, and July 31, 2024. The patients were numbered according to their visit order and randomly divided into an observation group and a control group at a 1:1 ratio using a random number table method. Both groups had one case of hip calcific tendinitis, while the rest were cases of shoulder calcific tendinitis. During the follow-up period, three patients in the observation group and two patients in the control group were unable to complete the follow-up. After excluding these cases, 33 patients in the observation group and 34 patients in the control group completed the study. There was no statistically significant difference in general information between the two groups ($P > 0.05$), as shown in **Table 1**.

Table 1. Comparison of general information between the two groups

Group	*n*	Age (years)	Duration of disease (months)
Observation group	33	56.82 ± 9.46	5.84 ± 3.35
Control group	34	55.26 ± 10.23	6.50 ± 3.13
t		0.65	0.82
P		0.52	0.41

2.1.1. Inclusion criteria

(1) Patients aged over 18 years old; (2) Patients complaining of shoulder/hip pain or limited mobility; (3) X-ray/CT/MRI/Ultrasound indicating the presence of calcifications within the tendons of the shoulder/hip joints; (4) No adhesion of the shoulder/hip joints; (5) Able to cooperate with treatment and sign the informed consent.

2.1.2. Exclusion criteria

(1) Accompanied by tendon tears; (2) Treatment site has undergone invasive/surgical procedures; (3) Local infection, rheumatoid arthritis, tumors, etc.; (4) Accompanied by severe underlying diseases: coagulation dysfunction, multiple metastases of malignant tumors, severe heart disease, uncontrolled diabetes, etc.; (5) Received physical therapy or medications outside of this study during the treatment process; (6) Pregnant women.

2.2. Treatment plan

2.2.1. Observation group: Ultrasound-guided acupotomy combined with ultrasound therapy

Ultrasound-guided acupotomy therapy: The affected area was routinely disinfected and locally anesthetized. Calcific deposits were located using ultrasound produced by Konica Minolta Corporation, and the puncture site was marked. The needle-knife was inserted parallel to the longitudinal axis of the affected tendon, reaching the calcific deposit. Repeated puncturing was performed to fragment the calcium salts. Using the permeation separation technique, the surrounding soft tissue adhesions were carefully loosened as much as possible until the ultrasound showed that the hyperechoic shadow was dispersed or disappeared. The needle-knife was withdrawn, pressure was applied for a moment, and a sterile dressing was used to cover the site.

Ultrasound therapy: On the second day after the acupotomy procedure, treatment was administered using the WED-300 full-digital ultrasound therapy device (Weierde Medical Electronics Co., Ltd.). The treatment frequency was set to 1 MHz, intensity 1.2 W/cm^2, and a 50% pulse mode was applied for 15 minutes per session, once daily, for seven consecutive days.

2.2.2. Control group: Musculoskeletal ultrasound-guided acupotomy therapy

The method is the same as the observation group.

2.3. Observation indices

(1) VAS (Visual Analog Scale) before and after treatment, as well as at each follow-up point (four weeks, three months, and six months after treatment): A 10 cm horizontal line was used, divided into 10 equal parts, representing a scale of 0–10 points. Patients marked their perceived level of pain on the line, with higher scores indicating greater pain severity.

(2) C-MS/HHS (Constant-Murley Score/Harris Hip Score) before and after treatment, as well as at each follow-up point: For shoulder calcific tendinitis, the C-MS was used, which includes pain, impact on daily activities, shoulder range of motion, and shoulder-related muscle strength, with a total score of 100 points. Higher scores indicate better shoulder function. For hip calcific tendinitis, the HHS was used, covering pain, symptom severity, restrictions in daily activities, and limitations in physical activities, with a total score of 100 points. Higher scores indicate better hip joint function.

(3) Calcific lesion reduction rate: The maximum transverse diameter of the calcific lesion before treatment was compared to the maximum transverse diameter after treatment and at follow-up points (four weeks, three months, six months). The reduction rate was calculated as the percentage of the difference relative to the pretreatment maximum transverse diameter.

2.4. Statistical methods

SPSS27.0 statistical software was used for statistical analysis of the data. If the measurement data conforms to a normal distribution, a *t*-test was used; if not, a rank sum test was applied. For counting data, the chi-squared test or Fisher's exact test was employed, and for ordinal data, a rank sum test was used. A *P*-value less than 0.05 was considered statistically significant.

3. Results

3.1. Comparison of VAS between the two groups

There was no statistically significant difference in VAS scores between the two groups before treatment ($P > 0.05$). Compared to pre-treatment scores, VAS scores decreased in both groups after treatment and at all follow-up points ($P < 0.05$). When compared to the control group, the observation group had lower VAS scores both immediately after treatment and four weeks post-treatment ($P < 0.05$). However, there was no statistically significant difference in VAS scores between the two groups at three and six months post-treatment ($P > 0.05$). The results are presented in **Table 2**.

Table 2. Comparison of VAS scores between the two groups

Group	*n*	VAS (score)				
		Before treatment	After treatment	Four weeks post-treatment	Three months post-treatment	Six months post-treatment
Observation group	33	7.33 ± 1.31	3.12 ± 1.22	2.15 ± 1.37	2 (1.2)	1 (0, 2)
Control group	34	7.44 ± 1.19	4.21 ± 1.37	2.94 ± 1.43	2 (1.3)	1 (1, 2)
t/z	-	-0.35	-3.43	-2.30	-0.046	-1.38
P	-	0.73	0.01	0.03	0.963	0.169

3.2. Comparison of C-MS/HHS between the two groups

There was no statistically significant difference in C-MS/HHS between the two groups before treatment ($P > 0.05$). Compared with before treatment, the C-MS/HHS of both groups increased after treatment and at each follow-up point ($P < 0.05$). Compared with the control group, the observation group had higher C-MS/HHS scores after treatment and at each follow-up point ($P < 0.05$). **Table 3** shows the scores of the two groups of patients.

Table 3. Comparison of C-MS/HHS between the two groups of patients

Group	*n*	C-MS/HHS (score)				
		Before treatment	After treatment	Four weeks post-treatment	Three months post-treatment	Six months post-treatment
Observation group	33	39.85 ± 5.53	72.36 ± 10.25	85.52 ± 8.70	91.76 ± 5.93	94.30 ± 4.28
Control group	34	39.44 ± 5.37	66.59 ± 12.54	75.06 ± 12.57	86.47 ± 9.71	90.53 ± 6.93
t	-	0.31	2.06	3.95	2.70	2.69
P	-	0.76	0.04	0.00	0.09	0.09

3.3. Comparison of calcific lesion reduction rate

There was no statistically significant difference in calcific lesions between the two groups before treatment ($P > 0.05$). Compared with the control group, the observation group had a higher calcific lesion reduction rate both immediately after treatment and four weeks after treatment ($P < 0.05$). However, there was no statistically significant difference in the calcific lesion reduction rate between the two groups at three and six months after treatment ($P > 0.05$), as presented in **Table 4**.

Table 4. Comparison of calcific lesion reduction rate between two groups of patients

Group	*n*	Calcific lesion reduction rate (%)			
		After treatment	Four weeks post-treatment	Three months post-treatment	Six months post-treatment
Observation group	33	20.67 ± 3.03	29.43 ± 3.30	52.32 ± 7.05	81.51 ± 5.41
Control group	34	18.41 ± 3.06	25.63 ± 3.89	48.70 ± 11.04	78.12 ± 8.90
t	-	3.05	4.30	1.61	1.87
P	-	0.00	0.00	0.11	0.06

4. Discussion

Calcific tendinitis is a common clinical condition characterized by localized pain and restricted movement, frequently occurring in individuals aged 30–50 years [4]. The pathophysiological mechanism remains unclear but may be related to degeneration, genetic predisposition, and local metabolic abnormalities [5]. Modern medicine suggests that poor blood supply in the hypovascular zones of tendons, termed "danger zones," makes them prone to degeneration and necrosis. During the tendon repair process, when an acidic environment develops, free calcium ions precipitate into calcium salts, which gradually deposit within the diseased tendon, resulting in calcific tendinitis [6]. Conservative treatments for calcific tendinitis include anti-inflammatory and analgesic medications and local corticosteroid injections. Although corticosteroids can provide rapid pain relief, the long-term outcomes are unsatisfactory, with a high recurrence rate [7]. Over time, persistent pain may lead to adhesive arthritis, further impairing joint function. For cases unresponsive to conservative management, surgical treatments are available, such as open surgery, which has a high success rate for removing calcifications but involves greater trauma, infection risk, and postoperative complications [8]. Alternatively, arthroscopic debridement offers faster recovery and fewer complications compared to open surgery, but precise localization and complete removal of calcifications remain challenging, and excessive debridement increases the risk of tendon rupture [9,10]. Therefore, effective methods to alleviate pain, minimize trauma, and reduce recurrence rates have become the focus of this study.

With advancements in imaging techniques and the growing popularity of minimally invasive procedures, ultrasound-guided minimally invasive treatments have gained increasing attention. The acupotomy technique targets calcific lesions to perform separation and cutting, releasing adhesions, improving local blood flow, and reducing inflammation, ultimately relieving pain and improving mobility [11]. However, in the past, blind acupotomy procedures carried risks of nerve or vascular injury. In contrast, musculoskeletal ultrasound clearly visualizes tendons and surrounding bursa structures and dynamically monitors the morphology of tendons in motion [12]. Ultrasound-guided acupotomy treatment for calcific tendinitis directly targets calcifications, fragmenting the lesion, restoring function, and avoiding blood vessels and nerves. Wang and Liu [13] demonstrated that ultrasound-guided acupotomy treatment effectively improves symptoms and signs in patients with rotator cuff calcific tendinitis, making it a safe and effective minimally invasive therapy. Beyond calcific lesions, joint inflammation also plays a significant role in pain and functional impairment in calcific tendinitis patients [14]. Ultrasound therapy [15] employs sound waves with a frequency greater than 20 KHz to stimulate endothelial cell activity and facilitate macrophage phagocytosis of calcifications, while also directly decomposing hydroxyapatite crystals. Ultrasound therapy is non-invasive, convenient, efficient, and cost-effective with minimal side effects and short treatment duration. However, current research on its use for calcific tendinitis remains limited, and clinical promotion is lacking. This study investigated the combination of ultrasound-guided acupotomy and ultrasound therapy for calcific tendinitis. Results showed that the VAS scores in the combined treatment group were lower than in the control group after treatment and at four weeks, indicating better early pain relief compared to acupotomy treatment alone. Additionally, the calcific lesion reduction rate in the combined group was higher at four weeks, suggesting that ultrasound therapy promotes early resorption of calcifications. Combined treatment also yielded higher C-MS/HHS scores at all time points, indicating that timely pain relief and effective management of calcific lesions contribute to better restoration of joint function, both in the early and long term.

5. Conclusion

In summary, ultrasound-guided acupotomy combined with ultrasound therapy effectively reduces pain and improves joint function in patients with calcific tendinitis. However, this study has limitations, including a small sample size, particularly for hip calcific tendinitis, and the lack of efficacy evaluations for calcific tendinitis in various tendons. Future studies will include multicenter, large-sample trials to provide more robust clinical evidence.

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Disclosure statement

The authors declare no conflict of interest.

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