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Extracorporeal Shock Wave Treatment for Calcifying Tendinitis of the Shoulder: A Case Report and Literature Review

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Abstract

Background: Calcifying tendinitis of the shoulder (CTS), also known as rotator cuff calcific tendinitis, is a self-limiting shoulder disorder primarily characterized by inflammation surrounding hydroxyapatite crystal deposits in the tendons of the rotator cuff. Given the specific characteristics of the shoulder joint and the uncertainty regarding the efficacy of various treatments for CTS, no standardized treatment protocol has been established. However, numerous studies have demonstrated that extracorporeal shock wave therapy (ESWT) is effective in alleviating pain and improving joint function in patients with calcifying tendinitis of the shoulder. The therapeutic process works using high-energy shock waves to break down deposits of calcification, reduce local inflammation, and promote tissue healing. The purpose of this article is to present a case of symptomatic calcifying tendinopathy involving the rotator cuff and further demonstrate that ESWT has good efficacy in the treatment of musculoskeletal diseases.

Case Report: In this case, a 39-year-old woman with a 6-month history of shoulder pain and limited range of motion (ROM) was diagnosed with calcifying tendinitis of the shoulder. A single session of shock wave therapy resulted in the complete resolution of calcific deposits and the patient's symptoms, leading to a return to her normal ROM and improved quality of life.

Conclusion: ESWT has been shown to be a good alternative to surgery for the treatment of calcifying tendinitis of the shoulder (CTS). It can significantly alleviate pain, improve shoulder function, and reduce the average size of calcium deposits. It might be the first choice for treating shoulder tendinopathy due to its effectiveness and safety.

Keywords: Calcifying tendinitis, Shoulder pain, Extracorporeal shock wave treatment, Case report

Introduction

Rotator cuff calcific tendinitis is one of the most common causes of shoulder pain, with the vast majority of cases involving the supraspinatus tendon [1]. The supraspinatus muscle, crucial for upper arm abduction, lift initiation, and glenohumeral joint stabilization, is often the primary site of involvement. The peak onset age is typically over 30, more prevalent in individuals aged 30–50, with a higher incidence in women [2]. Calcific tendinitis is categorized as a tendinopathy, characterized by calcium salt deposition in the rotator cuff tendons, causing a periarticular inflammatory response to the disease [3]. Statistically, the prevalence of the disease is 2.7%~20%, with calcific tendinitis of the supraspinatus tendon accounting for 80%. It occurs more frequently in the right shoulder than in the left and may occur bilaterally at the same time. Patients with diabetes have a higher incidence and are prone to asymptomatic calcification [4]. The most common site of onset is 1.5–2 cm from the supraspinatus tendon at the insertion point of the greater tuberosity. As the calcified material is deposited in the paracartilaginous tissues, especially in the tendon, it can cause recurrent episodes of inflammation, which are mainly characterized by limited joint motion and severe pain [5]. Calcific tendinitis varies depending on the degree of calcification. Most patients experience moderate-to-severe pain, especially after shoulder movement; a few experiences severe pain even at rest, as well as limited joint motion, stiffness, and nighttime pain [6].

The pathogenesis is not fully understood, and it is believed that the calcification process is due to the reduction of the oxygenation capacity of the rotator cuff tendon in the aging process, which produces hypoxia, tendon thinning, tearing necrosis, and finally calcification. Second, the long-term overhead

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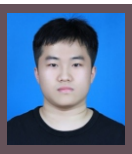
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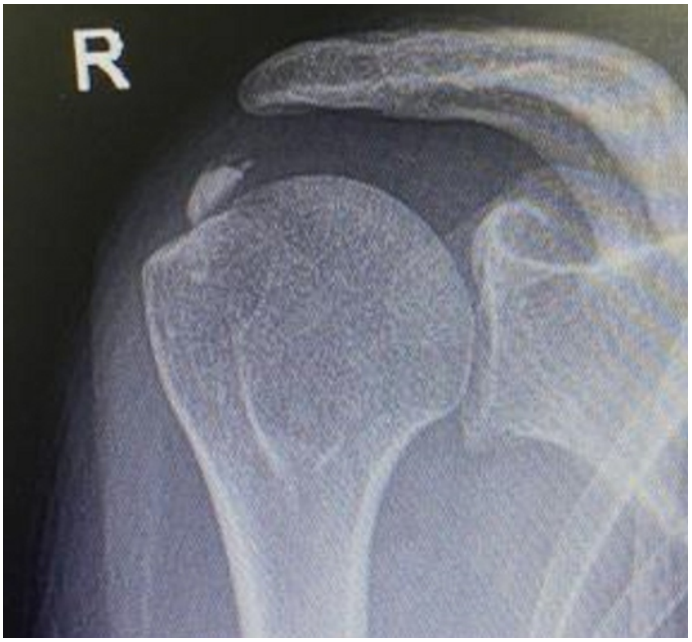

Figure 1: Anteroposterior radiographs of a right shoulder with a calcification of the rotator cuff before shock wave treatment.

Figure 2: 3 months after treatment, showing marked changes in the appearance of the calcification that is in an advanced reabsorption process.

arm lift movement may increase the mechanical pressure load on the shoulder.

The theory of reactive calcification proposed by Uhthoff et al. [7] is generally accepted. It suggests that it is a series of processes that occur in the pre-calcification, calcification, and post-calcification phases. Among them, the calcification phase consists of a formative phase, a quiescent phase, and a resorption phase. In the pre-calcification phase, tendinocytes transform into chondrocytes, produce stromal vesicles, and express tissue non-specific alkaline phosphatase, which can lead to the formation of calcium crystals. During the formative phase of the calcification stage calcareous deposits form and increase in size. Calcium deposition stops during the quiescent stage of the calcification phase. During the resorption phase of the calcification stage the calcareous deposits are taken up by cell-mediated phagocytosis, which is done by cells such as macrophages and giant cells. In the post-calcification phase, the remaining space in the tissue where the calcareous deposits were absorbed is replaced by granular tissue and remodeling occurs. All processes produce various forms of shoulder pain [8-10].

Imaging examination is of great value for diagnosis and differential diagnosis, and X-ray examination is the preferred imaging examination of choice for CTS because of its advantages of being quick, convenient, and inexpensive [11]. In typical cases, a high signal calcified focus 1.5–2 cm from the humeral attachment of the rotator cuff tendon can be seen. Computed tomography can show calcifications more clearly, locate the exact location of calcifications, and especially identify calcifications in the subscapular tendon that are easy to miss. Ultrasonography can effectively detect calcified lesions; clarify the location of calcified lesions; observe the volume, texture, shape, and can be used for pregnant women and other people, but it is highly dependent on the experience and technology of the examiner [12]. Magnetic resonance imaging is helpful in the differential diagnosis and detection of concomitant injuries to the rotator cuff but is usually lengthy and costly.

In the 1980s, extracorporeal shock wave therapy (ESWT) was first used to treat kidney and ureteral stones, marking the emergence of a new, non-invasive treatment method that bridged the gap between medication and surgery [13]. This innovative approach revolutionized the treatment of such conditions, offering a less invasive alternative to traditional surgical procedures. In recent years, ESWT has been widely used in orthopedics, sports medicine, rehabilitation medicine, and other fields as a mechanical wave with acoustic, optical, and mechanical characteristics [14]. ESWT has the advantages of less tissue damage, fewer complications, and low cost. It helps the human body to metabolize inflammatory factors, repair damaged tissues, loosen adhesions of soft tissues and tense muscles through the cavitation effect, thermal effect, and mechanical effect. It is particularly effective in treating calcific tendinitis, whose main treatment method is conservative, especially for patients with acute pain. In most patients calcification can be successfully treated with this standardized non-surgical treatment, so as to achieve pain relief and even healing [14-17].

Case Report

A 39-year-old woman presented to the outpatient clinic with a chief complaint of persistent shoulder pain and restricted range of motion (ROM) in her right shoulder. She reported that these symptoms had been bothering her for the past 6 months. The pain was described as a dull, aching sensation that was aggravated by various movements, particularly when raising her arm and during daily activities. Over time, she noticed a gradual reduction in her shoulder's ROM, making it difficult to perform routine tasks.

On physical examination, the patient exhibited tenderness over the lateral aspect of her right shoulder, particularly in the region of the acromion and greater tuberosity. The right shoulder was in a passive position, with the left hand supporting the right elbow. The active and passive ROM of the shoulder joint was notably restricted, with pain reported during abduction and forward flexion. The

shoulder examination showed the following ROM: 150° in flexion and abduction, 70° of internal rotation, and 80° of external rotation. The Hawkins–Kennedy Test, Jobe–Yocum Test, and Empty Can Test were found to be positive for muscle strength (4 out of 5). Both lift-off test and the Napoleon test were negative. No signs of erythema, warmth, or swelling were observed in the affected area. Laboratory examinations showed normal values for peripheral blood counts.

The patient had no significant prior history of shoulder trauma, surgery, or any underlying systemic medical conditions that could contribute to her symptoms. She reported no known allergies and was not currently taking any medications.

Initial diagnostic evaluation included X-ray imaging of the right shoulder, which revealed calcific deposits within the supraspinatus tendon, consistent with calcifying tendinitis of the shoulder (CTS). The calcifications appeared as opaque, well-defined areas within the tendon (Fig. 1).

The patient was advised to undergo a course of shock wave therapy to manage the calcifying tendinopathy. She received one session of shock wave therapy as part of her treatment plan.

Procedure

The patient is seated, with the affected shoulder joint exposed. The upper arm is adducted and internally rotated to orient the supraspinatus tendon toward the top of the shoulder joint. Combined with the patient's X-ray examination, the tender point is located by palpation as the center of treatment, avoiding important blood vessels and nerves. Coupling agent is applied to the treatment handle, the handle is placed perpendicular to the tender point, and the energy level is gradually increased the shock energy, allowing the patient to adapt. The energy flux density should be 0.10–0.3 mJ/mm^2. Choose 2–3 treatment points, with 1000–3000 impulses. During the treatment, the patient is required to maintain the same position to prevent changes in the treatment location, which could affect the effectiveness of the therapy.

Follow-up

Following the shock wave therapy, the patient reported significant improvement in her symptoms. On a subsequent X-ray, the calcific deposits in the supraspinatus tendon were found to have markedly decreased (Fig. 2). Her shoulder pain had resolved, and her ROM had returned to normal.

Discussion

Over the past few decades since the first application of ESWT for calcific tendinitis of the shoulder, its application has expanded to various soft-tissue disorders of the shoulder joint, including calcific biceps tendinitis, supraspinatus tendinitis, supraspinatus syndrome, and subacromial pain syndrome. Increasing evidence suggests that ESWT is safe and effective for treating several musculoskeletal disorders [14]. For conditions such as calcific supraspinatus tendinitis and plantar fasciitis, ESWT has an "A" level recommendation [14]. In recent years, numerous studies have shown that ESWT has a good therapeutic effect on rotator cuff calcific tendinitis [16, 17].

A prospective study by Wang et al. [18] showed that after 2 years of follow-up, 90.9% of patients in the ESWT treatment group had improved pain and function, 57.6% of patients had complete dissolution of the calcifications, and 15.1% had partial disappearance. In the control group, 83.3% of the patients had poor recovery of function and pain, and only 16.7% of the patients had acceptable results.

Gerdesmeyer et al. [19] conducted a clinical trial in 144 patients and showed that both low- and high-energy ESWT were significantly more effective than controls. Louwerens et al. [20], through a systematic review and meta-analysis of 20 studies reporting minimally invasive methods for the treatment of chronic rotator cuff calcific tendonitis (1544 cases), concluded that high-energy ESWT is the most studied method and has been shown to be safe and effective in short- and medium-term treatment.

A retrospective study by Malliaropoulos et al. [21] showed that 12% of 67 CTS patients treated with radial pressure waves (RPW) had immediate pain relief after treatment, and a 1-year later follow-up found that 92% of patients had pain relief and a recurrence rate of only 7%. Mangone et al. [22] divided 62 cases of rotator cuff calcific tendinitis into an RPW treatment group (36 cases) and an ineffective laser treatment control group (26 cases, including 16 patients who switched to RPW treatment after short-term laser treatment), and the Constant-Murley score was performed before treatment, immediately after treatment, 1 month after treatment, and 3 months after treatment. Results showed that RPW had a good effect on functional recovery in patients with rotator cuff calcific tendinitis.

Hsu et al. [23] reported the results of a prospective study in which they included 46 consecutive patients. They were randomly divided into two groups. All 33 patients in the treatment group received high-energy-focused waves. The 13 patients in the control group received sham treatment. Results were good to excellent in 87.9% of shoulders in the active group, and in the control group, they were fair in 69.2% and poor in 30.1%.

There is a growing number of studies comparing ESWT with other treatments, as well as studies combining ESWT with other therapies for better outcomes. However, the best conservative treatment for calcific tendinitis of the rotator cuff is currently inconclusive [21].

Studies have shown that ultrasound-guided, precise positioning of shock waves in the treatment of calcific tendinitis is superior to pain point localization in long-term shoulder function recovery, calcification size change, and absorption. Kim et al. [24] showed that ultrasound-guided supraspinatus tendon puncture, subacromial corticosteroid injection, and ESWT for calcific tendonitis improved clinical symptoms and eliminated calcium deposition. However, ultrasound-guided puncture with subacromial steroid hormone injections is, according to these authors, more effective in the short term in terms of shoulder function recovery and pain relief [24]. However, other authors have criticized the methodology of this study [25].

Abo Al-Khair et al. [16] proposed that the combination of focused shock wave and RPW in the treatment of calcific supraspinatus tendinitis can significantly improve the clinical symptoms, joint mobility, and eliminate the calcification, they found that the combination of methods was more effective than their use alone.

Common complications after shock wave therapy are local pain, skin erythema, soft-tissue swelling, hematoma formation, syncope, etc. The occurrence of complications is usually related to energy flow density, and high-energy ESWT is more likely to lead to local complications than low-

energy ESWT [26].

There have also been isolated cases of more serious side effects of shock wave therapy, with two cases reported as osteonecrosis [27, 28]. In 2002, it was reported that a patient with calcific tendinitis who had undergone ESWT developed recurrent shoulder pain 3 years later and was diagnosed with stage 4 osteonecrosis of the humeral head [27]. The study suggested that ESWT may be harmful to the blood supply to the epiphysis of the humerus, especially when the sediment is located near the ascending branch of the anterior circumflex humeral artery, and the shock wave may damage the anterior circumflex humeral artery, and it is recommended that attention should be paid to avoiding the intertubercular sulcus when performing shock wave therapy for calcium deposition. Liu et al. [28] reported another case of osteonecrosis after receiving high-energy (0.78 mJ/mm2) shock wave therapy for rotator cuff lesions, suggesting that this may be related to the vascular destructive effect of shockwaves. Although the possibility of serious complications in the treatment of CTS with ESWT is very small, it still needs to be taken seriously in clinical practice to avoid the occurrence of similar serious complications [29].

There are many non-surgical treatments for rotator cuff calcific tendonitis, but the relative effects of these treatments are not fully supported by evidence-based medicine due to the lack of large-scale randomized controlled trials. Therefore, there is a need for more high-quality studies to assess the differences in efficacy between different treatments [20]. Among them, ESWT shows promise for pain relief and functional restoration of calcific tendinitis with negligible complications, but its specific mechanism of action is not fully understood and needs to be further explored. The advantage of this therapy is that the therapeutic effect can be achieved by accurately locating and selecting the appropriate energy density and frequency. However, there is controversy about the optimal frequency of treatment, and more research is needed. Although fewer complications have been reported, strict protocols need to be followed to prevent potential complications in clinical applications.

In addition, the efficacy of shockwave therapy may be affected by individual patient differences, such as the duration of the disease, the size and location of calcifications, and other factors [30]. Therefore, in the actual treatment, an individualized therapy plan is particularly important. Meanwhile, to improve the effectiveness and safety of the treatment, it is recommended to carry out appropriate rehabilitation and functional training before and after treatment to strengthen the stability and flexibility of the shoulder muscles. For the conservative treatment of rotator cuff calcific tendinitis, it is necessary to require comprehensive consideration of a variety of treatment methods and individualized therapeutic plans according to the specific conditions of the patient.

Conclusion

A single session of shock wave therapy resulted in the resolution of calcific deposits and patient's symptoms in a 39-year-old woman diagnosed with calcifying tendinitis of the shoulder. ESWT has been shown to be a good alternative to surgery for the treatment of calcifying tendinitis of the shoulder. It might be the first choice for treating shoulder tendinopathy due to its effectiveness and safety.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflicts of Interest: Nil. **Source of Support:** None.

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