Case Report

JHSMR Journal of Health Science and Medical Research

Interventional Pain Management Using Dextrose Prolotherapy in Treating a Partial Supraspinatus Tear: A Case Report

Theresia CT Novy, M.D., F.I.P.P., C.I.P.S.[1,2], Joudy Gessal, M.D.[2], Andrew Suwadi, M.D.[3], Ivan Christian Channel, M.D.[4], Grace Fonda, M.D.[3]

[1]Department of Physical Medicine and Rehabilitation, Bandung Pain Rehab Center, Bandung, Jawa Barat 40114, Indonesia.
[2]Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Sam Ratulangi University/Prof. Dr. R. D. Kandou General Hospital, Manado, Jakarta 14440, Indonesia.
[3]Faculty of Medicine and Health Sciences, Atma Jaya Catholic University of Indonesia, Jakarta 14440, Indonesia.
[4]Faculty of Medicine, Padjadjaran University, Bandung, Jawa Barat 40161, Indonesia.

Received 1 May 2023 ● Revised 16 June 2023 ● Accepted 29 July 2023 ● Published online 15 November 2023.

Abstract:

Shoulder pain is a medical condition that may affect the well-being and compromise the quality of life of an individual, especially in the elderly. A supraspinatus tear is the most common cause of shoulder pain. Several treatments are available for this problem, such as surgical and conservative treatment. The surgical approach is found to be more efficacious but has a high rate of recurrence. Prolotherapy is one of the novel pain treatment modalities that could provide significant pain relief in musculoskeletal diseases. In this case report, we report a 53-year-old woman, who came to the outpatient clinic complaining of pain in her right shoulder for three months. The pain had been getting worse in the previous seven days, felt continuously throughout the day, and exacerbated when she raised her arm. The physical examination revealed a limited range of motion of active abduction and flexion with a positive drop arm test of the right shoulder. An ultrasound revealed a tear-drop appearance. The patient was treated with interventional pain management using dextrose prolotherapy. After undergoing prolotherapy treatment for three sessions over two months, the patient was declared completely healed from the supraspinatus tear. In conclusion, prolotherapy coupled with an ultrasound-guided procedure appears to be beneficial in alleviating pain and completely healing supraspinatus tears.

Keywords: 10% dextrose, interventional pain management, partial supraspinatus tear, prolotherapy

Contact: Theresia CT Novy, M.D., F.I.P.P., C.I.P.S.
Department of Physical Medicine and Rehabilitation, Bandung Pain Rehab Center, Bandung, Jawa Barat 40114, Indonesia.
E-mail: theresianovymd@gmail.com

J Health Sci Med Res 2024;42(2):e20231014
doi: 10.31584/jhsmr.20231014
www.jhsmr.org

Introduction

Shoulder pain is a problem faced by physicians daily both in inpatient and outpatient clinics, especially when caused by a tear in the rotator cuff. This problem primarily occurs in the middle-aged population and can interfere with daily activities and the quality of life. The prevalence of rotator cuff tears in the general population is 22,1%[1]. Among the various possible causes, supraspinatus tears are the most common type of muscle injury, accounting for 84% of all traumatic rotator cuff tears. In people aged >60 years, supraspinatus tears usually occur in the dominant arm, which can be caused by microtrauma and impaired healing, which results in degenerative tears[2].

Supraspinatus tears can cause pain which results in limited movement, especially with severe tears. Surgical and conservative treatments are available as treatment options. The surgical approach is reported to be superior compared to the conservative approach[3]. However, surgical treatments may not provide a promising result or appear as a definitive treatment, as 13-31% of patients experience tear recurrence after surgical repair. Thus, new insights into better supraspinatus tear treatments are needed[4].

Prolotherapy is a novel pain treatment modality involving injecting irritative substances into musculoskeletal structures such as tendons, joints, and ligaments. Until now, the mechanism of prolotherapy has not been fully understood, but the current theory suggests that injected dextrose triggers the healing process by activating a local inflammatory cascade that causes the release of growth factors and collagen deposition[5]. High concentrations of dextrose are commonly utilized in prolotherapy procedures to treat pain, although other irritative substances may be used as alternatives[6].

Based on this explanation, the researchers would like to present a case report regarding interventional pain management (IPM) using dextrose prolotherapy in a patient with supraspinatus tendon tears at the Bandung Pain & Rehab Center (BPRC). We hope this paper can impart new insights to experts in any field for the advancement of IPM, particularly prolotherapy, which can accelerate the healing of tendon tears, thereby reducing the risk of complications.

Case report

A 53-year-old woman came to the outpatient clinic complaining of pain in her right shoulder. She had felt this pain for three months. The pain had been getting worse in the previous seven days and was felt continuously throughout the day. The pain was exacerbated when the patient raised her arm. The pain felt like stabbing and there was no radiating pain. The patient also felt pain at night when she slept on the right side of her body. The pain made it difficult for her to carry out her daily activities. The pain was not accompanied by numbness or tingling. The patient was no longer working and only doing daily activities at home. Her dominant hand was the right hand. The patient had type II diabetes mellitus and she took Metformin 500 mg twice a day. She had no history of trauma. Her vital signs were within normal limits. The pain score felt by the patient based on a numeric rating scale (NRS) was seven to eight. A physical examination revealed pain with both active and passive movements of the right shoulder during flexion and abduction. She was able to make active movements of the right shoulder but they were limited due to pain. The range of motion (ROM) of active abduction and flexion of the right shoulder was limited to 60 degrees. In passive abduction and flexion movements, a ROM of 160 degrees was found. A drop arm test showed positive and negative results in the right and left arms, respectively.

An ultrasound examination of the shoulder was performed on the patient, which revealed a tear-drop appearance which indicated a fluid collection at the biceps, subscapular, and supraspinatus muscles, as well as a supraspinatus intrasubstance partial tear (Figure 1). The tests on the left shoulder were within normal limits. Based

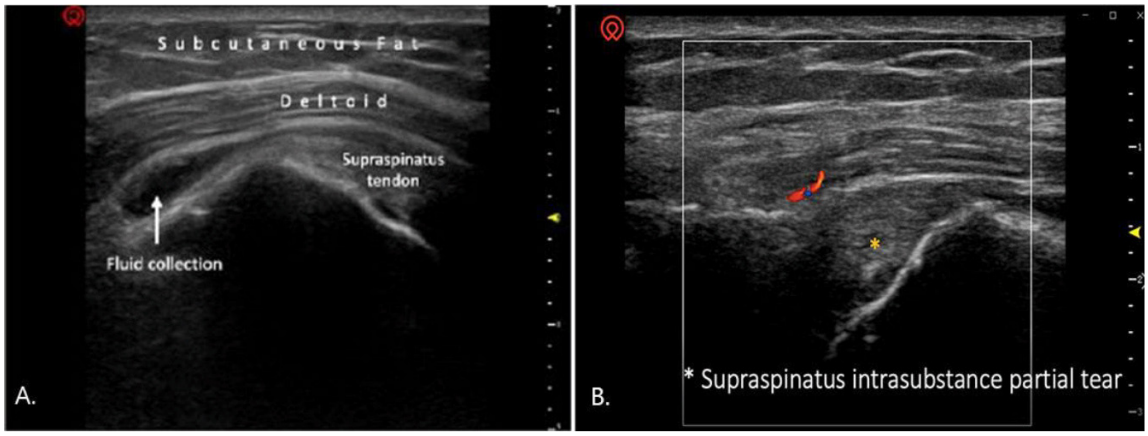

Figure 1 Ultrasound examination of the right shoulder, A. Tear-drop appearance, B. Supraspinatus intrasubstance partial tear

on the results of the physical and supporting examinations, the patient was diagnosed with a partial tear of the right supraspinatus tendon.

To determine the severity of the tear, the patient was advised to undergo a magnetic resonance imaging (MRI) examination, but due to personal reasons, the patient refused. Then, we conducted a diagnostic block examination on the supraspinatus tendon to determine the exact source of the pain. The diagnostic block was carried out by injecting 1 ml of 1% lidocaine into the right supraspinatus tendon. Following the diagnostic block, the drop arm test results were still positive. Therefore, it was confirmed that the patient had a supraspinatus intrasubstance partial tear.

An interventional pain management (IPM) technique, namely prolotherapy, was done to treat the patient by a targeted ultrasound-guided dextrose injection. First, a collection of fluid in the peritendon of the right biceps was aspirated and 4,5 ml of clear yellow liquid was obtained. Next, an injection of 1 ml of 1% lidocaine mixed with 1 ml of 10% dextrose was administered in the right peritendon of the biceps, followed by an injection of 1 ml of 1% lidocaine mixed with 2 ml of 10% dextrose in the right supraspinatus tendon (Figure 2).

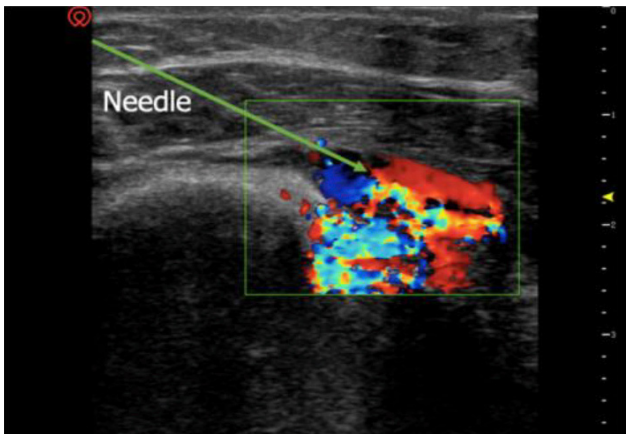

Figure 2 Injection of 1% lidocaine over the biceps tendon in a short axis view

After the IPM procedure, the patient directly underwent another physical examination to assess the effectiveness of the therapy. The examination results showed a reduction in pain of up to 100% with active ROM of abduction, while the pain with flexion of the right shoulder remained unchanged. The patient was then prescribed paracetamol 500 mg three times daily and mecobalamin 500 µg two times daily as her take-home medications. She was scheduled for a follow-up one week later.

At the follow-up, the patient had no complaints of pain in her shoulder. A physical examination showed no elicited pain in either active or passive motions, full ROM of abduction and flexion of the right shoulder in both active and passive movements, and a positive drop arm test on the right arm. A repeated ultrasound examination showed no supra-biceps fluid collection, minimal right peri-biceps fluid collection, no glenohumeral joint fluid collection, and a minimal right supraspinatus tear drop. The patient was prescribed paracetamol 500 mg to be taken as needed for pain relief, up to four times daily, and scheduled to undergo a second prolotherapy session two weeks later. At the second prolotherapy session, the patient did not complain of any pain. The physical examination revealed full ROM in both the right and left shoulders, and the drop arm test yielded negative results in both arms. An ultrasound examination conducted during the prolotherapy session showed no tear-drop appearance and effusion, but revealed a tear on the right shoulder. She was prescribed paracetamol 500 mg to be taken as needed for pain relief, up to four times daily, and a second follow-up appointment was scheduled for three days later.

During the second follow-up, the patient reported slight pain. The physical examination showed no pain during movement, full shoulder ROM, and negative results for both the drop arm test and a Hawkins-Kennedy test. An ultrasound showed no effusions or supraspinatus tears. The patient was prescribed mecobalamin 500 µg to be taken twice daily and scheduled for a third prolotherapy session one month later.

The patient did not complain of any pain at the third prolotherapy appointment. The physical examination revealed no pain during shoulder movements and full shoulder ROM. An ultrasound showed no effusions nor supraspinatus tears. The patient was scheduled for another follow-up one week later, at which there were no complaints of pain and the physical examination of the shoulder was within normal limits. An ultrasound examination of the shoulder was normal, as the supraspinatus tear resolved completely.

Discussion

A study conducted by Minagawa et al. reported that 65.3% of their supraspinatus tear patients were asymptomatic. It is known that asymptomatic patients may become symptomatic, which is related to increased tear size[1]. The possible symptoms that can occur are pain, limited range of motion, arm weakness during rotating or lifting, crepitus, clicking, and instability. Several risk factors such as male gender, smoking, diabetes, hypertension, and critical shoulder angle may promote the risk of getting a supraspinatus tear[7].

The physical examinations carried out in this study were the drop arm test and the Hawkins-Kennedy test. The drop arm test was carried out every time the patient came for treatment, while the Hawkins-Kennedy test was carried out at the second follow-up examination after the second prolotherapy as an additional examination because the patient complained of slight pain. These two examinations are among several physical examinations that can be performed to detect a supraspinatus tendon tear. Based on existing research, the drop arm test has greater specificity (sensitivity 12.07% and specificity 96.55%), while the Hawkins-Kennedy test has greater sensitivity (sensitivity 89.66% and specificity 56.03%) in diagnosing tears[8].

The best additional examination to perform for diagnosing a supraspinatus tear is magnetic resonance imaging (MRI). In addition, other examinations such as ultrasound can be carried out to detect tears. However, supporting examinations such as laboratory and histopathological tests are rarely performed. This is because laboratory examinations are not necessary for diagnosing supraspinatus tears, while a histopathological examination is invasive and is only done when surgery is required[8].

Treatments for supraspinatus tears are available in both surgical and conservative approaches. Surgical

approaches may include minimally invasive and open surgery techniques, while conservative treatments such as physiotherapy, pain medication, and corticosteroid injections can be used to avoid surgical complications[3]. Although the surgical approach is proven to be superior to the conservative approach, the recurrence rate of supraspinatus tears is still high[4]. Another study by Ramírez *et al.* showed that the use of corticosteroids in supraspinatus tear treatment may induce apoptosis in tendons, thus prolonging the tissue healing in a supraspinatus tear[9].

The exact mechanism by which prolotherapy promotes pain alleviation and tissue healing is not well known, but according to the current theory, it resembles the natural healing process. It is hypothesized that prolotherapy induces inflammation, proliferation, and a remodeling process on the target tissue[5]. The inflammation process initiates the recruitment of cells such as macrophages, mast cells, and platelets into the injury site. These cells release cytokines that attract other cells such as phagocytes which alter the vascular and tissue homeostasis at the injury site. Once the environment around the tissues is suitable for tissue healing, a proliferation process is initiated, and cells such as fibroblasts, endothelial cells, and myofibroblasts induce angiogenesis, increasing the growth of collagen-based tissues such as ligaments and tendons. After the proliferation process, the remodeling process begins and the tissue healing process will be completed[10].

Prolotherapy has been used to treat pain in some musculoskeletal pathologies such as knee osteoarthritis, low back pain, and other musculoskeletal disorders. Irritative substances such as glycerin, phenol, morrhuate sodium, polidocanol, manganese, zinc, human growth hormone, pumice, ozone, and dextrose solution have been used to treat pain[5]. Imaging techniques such as ultrasound and fluoroscopy may be used as guiding techniques in a prolotherapy procedure. The use of an ultrasound-guided approach may be preferable compared to fluoroscopy imaging due to its low intensity of radiation, as one study reported no differences in efficacy between ultrasound and fluoroscopy approaches[11].

In our study, we treated the patient using 2 ml of 10% dextrose combined with 1 ml of 1% lidocaine. We used 1 ml of 1% lidocaine to block the supraspinatus nerve before injecting the medication. We approached the target using ultrasonography. Similar to our study, Eroglu et al. compared dextrose prolotherapy, corticosteroid injections, and physical therapy combined with home exercise in patients with partial-thickness supraspinatus tears. It was found that the use of corticosteroids could relieve pain and improve movement function quickly, but these effects could decrease over time. The use of prolotherapy has shown greater and longer-lasting effectiveness. However, this study was conducted on a limited sample and was not randomized after surgery[12].

Another study by Akpancar et al. used an ultrasound-guided approach to identify supraspinatus tendon tears in patients whose surgical treatment had failed. This study used dextrose prolotherapy with concentrations ranging from 15% to 25% with an added injection payload such as lidocaine. It was found that the use of prolotherapy showed high effectiveness in treating patients with supraspinatus tendon tears, with significantly improved shoulder function and reduced pain[13].

In this study, the patient was declared completely healed from the supraspinatus tear after undergoing three sessions of prolotherapy treatment over two months. Similarly, a study conducted by Seven *et al.* showed a good healing rate of up to 92.9% using prolotherapy compared to controls[14]. Another study by Lin et al. showed the same thing, where the use of hypertonic dextrose with ultrasound guidance in supraspinatus tendinopathy patients could relieve pain and disabilities, and improve the shoulder's active range of motion[15].

Although our study gave a satisfactory result, it had several limitations. Our study was limited to a case report study, and higher evidence-level studies such as

randomized controlled trial studies with larger samples are required. Prolotherapy's underlying mechanism of action is still not well understood, and studies that explore the possible adverse effects of prolotherapy on the musculoskeletal tissues are still lacking. Therefore, further research is needed regarding prolotherapy in order to determine its detailed mechanism and effectiveness as a therapy for supraspinatus tears.

Conclusion

Prolotherapy combined with ultrasound-guided techniques seemed to provide benefits in alleviating pain in our patient with a supraspinatus tear. Although several pieces of evidence support the results of our study, further higher evidence-level studies are required to verify the benefits and elucidate the drawbacks, if any, of prolotherapy treatment in patients with supraspinatus tears.

Ethical approval

The Ethics Committee of the Faculty of Medicine, Padjadjaran University, Bandung gave approval for this research (number 732/UN6.KEP/EC/2022). Written informed consent was obtained from the patient for publication.

Authors' contributions

All authors contributed to this study, including data collection, literature research, data analysis, and manuscript preparation.

Conflict of interest

There are no conflicts of interest in this study.

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