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Ultrasound-guided dextrose injection treatment for chronic myofascial pain syndrome: A retrospective case series

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Abstract

Background: Due to the lack of an evidence-based consensus, managing refractory myofascial pain syndrome is challenging for clinicians. Dextrose injection (dextrose prolotherapy) emerged as a promising, cost-effective treatment. This study evaluated the efficacy of targeted ultrasound-guided dextrose injection for localized myofascial pain syndrome.

Methods: We retrospectively reviewed the clinical outcomes of 45 patients with myofascial pain syndrome refractory to alternative treatments with targeted ultrasound-guided dextrose injection. Pretreatment symptom severity and symptomatic response 1 month after treatment were statistically analyzed using a visual analog scale (VAS)-based scoring system.

Results: Of 45 patients, 8 (24.4%) reported complete resolution of symptoms at the treated site. In total, 36 (80.0%) patients reported greater than 50% improvement in their symptoms. The mean pretreatment and posttreatment VAS scores were 7.0 and 2.44 ($p < 0.001$), indicating an overall 65.0% reduction in symptom severity.

Conclusion: Targeted ultrasound-guided dextrose injection was remarkably effective for refractory localized myofascial pain syndrome, significantly reducing symptom intensities in the majority of treated patients within 1 month after a single injection.

Keywords: Glucose; Injections; Myofascial pain; Prolotherapy; Ultrasonography

1. INTRODUCTION

Decades after myofascial pain syndrome was first described, the diagnosis and management of related chronic musculoskeletal symptoms have remained challenging for clinicians.[1,2] Despite advances in the understanding of myofascial pain syndrome's underlying pathogenesis and efforts to establish practical diagnostic criteria widely accepted by clinicians,[3] a widely accepted consensus for effectively managing such chronic condition has not been established.

Various physical treatments have been proposed, including mechanical pressure, stretching, ultrasound, low-level laser therapy, transcutaneous electrical nerve stimulation, and repetitive magnetic stimulation.[4] Although they are supported by controlled studies and clinical trials, physical treatment strategies have often been limited by practitioner-dependent factors, lack of technical standardization, and availability of experienced practitioners and facilities.

Pharmacologic therapies, including nonsteroidal anti-inflammatory drugs, transdermal local anesthetic preparations, muscle relaxants, anticonvulsants, antidepressants, and botulinum type A toxin, have played major roles in the management of chronic symptoms,[5] having advantages of accessibility and providing timely symptomatic relief. However, adverse reactions to prolonged pharmacologic treatments and interactions with other medications are not uncommon in clinical practice,[6–8] especially in elderly patients with other chronic illnesses.[9] In most cases, medications achieved only temporary and partial symptomatic alleviation without reducing the frequency or intensity of relapsing symptoms.

Needle-based interventions, such as acupuncture, dry needling, and trigger point injections, were introduced and rapidly popularized. Needling treatments are inexpensive and minimally invasive, and early clinical applications have demonstrated promising efficacy.[10,11] However, the optimal regimen for needling treatment remains debated.[6–8] Dextrose injection, among a variety of regimens used, has emerged as a cost-effective option with known proliferative effects.[12–14] In this study, we examined the effectiveness of local dextrose injection for treating myofascial pain based on consecutive treatments in our department.

2. METHODS

This study was approved by the institutional review board of our hospital, and it followed the principles of the Declaration of Helsinki. We searched for ultrasound-guided injection procedures performed from August 2015 to April 2016 in our reporting database and picture archiving and communication system. Indications for treatment and treatment regimens were recorded, enabling us to refine the search for specific regimens and indications. We included patients treated with ultrasound-guided

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injection of 15% dextrose for chronic musculoskeletal symptoms that persisted for more than 1 month. Patients with known traumatic events or other potentially contributory medical conditions, such as autoimmune diseases or metastatic malignancies, were excluded.

We obtained the medical records of these patients from an electronic medical record database. We reviewed the basic profiles of patients, the initial presentation with specified site and duration, physical findings, diagnostic ultrasound findings, symptom severity as documented based on a visual analog scale (VAS), immediate response after treatment, response reported by patients on follow-up visit 1 month after treatment, major chronic medical conditions, and procedure-related adverse reactions.

If the patient was not present for a follow-up, we interviewed the patient by telephone and documented the treatment response reported by the patient or caregiver. We excluded patients who did not receive posttreatment reevaluation at the clinic or through a telephone interview.

Patients with refractory chronic pain affecting various anatomical regions were referred to a special musculoskeletal interventional clinic if they responded poorly to pharmacologic or physical therapies. They received diagnostic ultrasound analysis to exclude other possible musculoskeletal pathologies and were asked to describe their symptom intensity using the VAS. VAS scores ranged from 0 to 10, with 0 indicating the absence of pain and 10 indicating maximal pain intensity. Written informed consent was obtained for ultrasound-guided dextrose injection treatment. The treatment was performed by one radiologist specializing in musculoskeletal ultrasound-guided interventions.

Skin disinfection of the puncture site was performed according to the standardized infection control protocol of our hospital. Under ultrasound guidance with an SL 15-4 linear-array transducer (S2000; Siemens-Acuson, Mountainview, CA, USA) or 14-L5 linear transducer (S3000 Siemens-Acuson), repeated needle puncture was performed with a 23G needle targeting suspicious trigger points. Meanwhile, 10-ml of 15% dextrose water was injected slowly into the triggering muscle fascicles and perimysium between them. After injection, we manually compressed the injection site to achieve hemostasis, and patients were evaluated for immediate adverse reactions within 15 min after treatment.

To evaluate the treatment response, a follow-up visit to the clinic was scheduled 1 month after treatment. All patients were instructed to avoid using topical or oral anti-inflammatory medications and performing rigorous exercise before the follow-up visit. Furthermore, they were informed of possible adverse reactions to the treatment.

We performed a descriptive and inferential statistical analysis using Matlab R2015b (MathWorks, Natick, MA, USA). Comparisons between groups and documented treatment responses were conducted using a paired sample t-test. A p value of <0.01 was considered statistically significant.

3. RESULTS

In the period from August 2015 to April 2016, 45 consecutive patients received ultrasound-guided 15% dextrose injections. The mean age of treated patients was 56.6 years. All the treated patients returned to our clinic for follow-up or repeated treatment. Of the 45 patients, 11 (24.4%) reported complete resolution of symptoms at the treated site, and 3 (6.6%) reported no response or worsening of symptoms after treatment. The mean reported VAS score was 7.0 pretreatment and 2.4 posttreatment, with an average pain severity reduction of 65.0%. We analyzed the treatment outcomes through further stratifying the patients into subgroups (as shown in Table 1) based on sex, age, and injection treatment site.

Table 1

Pain intensity before and after dextrose injection in each patient subgroup

Subgroup	Age	VAS scores before treatment	VAS scores after treatment	Change in VAS scores (percentage)	p
All subjects (N = 45)	56.6	7.00	2.44	−4.56 (65.08%)	<0.001
Gender					
Female (N = 26)	54.5	7.00	2.54	−4.46 (63.71%)	<0.001
Male (N = 19)	59.6	7.00	2.31	−4.69 (67.00%)	<0.001
Age					
Age < 60 (N = 23)	46.0	7.00	2.65	−4.35 (62.14%)	<0.001
Age > 60 (N = 22)	67.8	7.00	2.22	−4.78 (68.29%)	<0.001
Injection sites					
Shoulder muscles (N = 12)	61.3	7.08	2.66	−4.42 (62.43%)	<0.001
Upper extremities (N = 7)	54.8	6.50	1.83	−4.67 (71.85%)	0.002
Axial muscles (N = 8)	47.2	7.37	3.37	−4.00 (54.27%)	0.001
Lower extremities (N = 18)	59.0	6.89	2.06	−4.83 (70.10%)	<0.001

VAS = visual analog scale.

We treated 26 (57.8%) female patients (mean age: 54.5 years) and 19 (42.2%) male patients (mean age: 59.6 years). The average pretreatment symptom severity, quantified as VAS scores, was 7.0. The mean changes in VAS scores were –4.46 and –4.69 (63.7% and 67.0% reduction in pain severity), respectively. In both subgroups, statistical differences were observed between pretreatment and posttreatment VAS scores (p < 0.001 for both groups).

Among the included patients, 23 younger patients (age <60 years) reported a 62.1% reduction in pain severity, and 22 older patients (age >60 years) had an average 68.2% reduction in pain severity. The differences in symptom intensities before and after treatment were statistically significant for both groups (p < 0.001).

Of the 45 patients, 12 (26.7%) received dextrose injection at their rotator cuff muscles, 18 (40.0%) at muscle groups in lower extremities, 7 (15.6%) at their upper extremity muscles, and 8 (17.8%) at axial muscles, including lower neck, upper back, and lower back muscles. In all subgroups, we observed a more than 50% reduction in pain intensity at the treated site, which was statistically significant. No immediate adverse reactions or complications were reported following the intervention.

4. DISCUSSION

For refractory chronic myofascial pain, as therapeutic alternatives to invasive treatments, increasing attention has been given to the clinical application of ultrasound-guided needle injection of bioactive agents. Dextrose injections, commonly used in prolotherapy by clinicians for decades, have been evaluated in numerous retrospective series and randomized controlled trials. Theoretically, dextrose injection leads to local inflammation, mimicking the condition of tissue injury, and stimulates the proliferation cascade, as observed in experimental animal models. Tissue repair and remodeling follow the transient inflammatory state and have been associated with short- and long-term relief for patients with chronic musculoskeletal symptoms.[15–17]

In a case series of 67 patients with chronic myofascial pain treated with repeated 15% dextrose injection, the average pain score decreased from 7.0 to 2.55, reaching statistical significance.[18] In another series of 20 patients treated with a single 12.5% dextrose injection, significant improvements were demonstrated in musculoskeletal symptoms.[19] In a recent literature

review investigating evidence for prolotherapy efficacy, Hauser et al. reviewed 11 studies involving 709 patients treated with an injection of 12.5% dextrose for chronic myofascial pain at a single clinic. Follow-up of patients for an average of 19 months showed that the treatment response was statistically significant, with average VAS score of 6.3 before treatment and 2.2 after treatment.[20] Two retrospective series of 127 and 177 patients treated with 20% dextrose injections demonstrated drastic relief of chronic myofascial pain and functional disabilities, which contributed to restoration of daily activities in more than 80% of patients.[21,22] These results were not site-specific but universally positive. However, the dextrose concentrations used in these studies were inconsistent because currently, no consensus exists in terms of optimal regimen. Nevertheless, all regimens of the dextrose solution resulted in remarkable positive outcomes.

With notable results of dextrose injections shown in many case series, investigations comparing dextrose with other treatment modalities have also emerged to determine their efficacy over placebo or other injection regimens. In a Korean prospective, randomized controlled study, 23 patients received trigger point injections with 5% dextrose, 20 received normal saline, and 21 received 0.5% lidocaine. Posttreatment symptomatic improvements, as measured by the average decrease in VAS score, were significantly different between the groups, with the dextrose group having the greatest difference in VAS score ($p < 0.01$).[23] From a clinical perspective, it is evident that dextrose injection has intrinsic, advantageous biologic properties compared with other agents used for treating chronic localized musculoskeletal conditions.

In this retrospective study, we reviewed a series of dextrose injection treatments that followed the same regimen and procedure. The quality, characteristics, and duration of pain can often be nonspecific; hence, all diagnostic studies are inconclusive. Therefore, we relied on exclusion rather than inclusion criteria for patient selection in our practice, considering onsite diagnostic ultrasound performed by an experienced musculoskeletal radiologist. However, all patients presented with chronic, disabling symptoms that were refractory to pharmacologic, physical, or other treatment modalities. We could identify the trigger points and administer the injections with excellent accuracy through ultrasound guidance. After treatment, we followed all the patients, mostly when the patients returned to our clinic, thus eliminating the influence of missing cases. In our statistical analysis, we revealed a consistent reduction in pain severity by more than 50% following the treatment regardless of sex, age groups, and injection site. Our experience of the remarkable efficacy of dextrose injection in Taiwan is consistent with published case series.

This study has certain limitations. The retrospective and uncontrolled study design and the method of referring patients to our clinic may have resulted in a biased selection of patients. Several factors were not controlled in our study, and so, the included patient population is heterogeneous. The impact of several confounding factors was difficult to minimize. Concurrent pharmacological treatment, especially use of anti-inflammatory and analgesic medications, may influence symptom intensity reported by the patient. This study lacks specific inclusion criteria based on objective findings, owing in part to the absence of use of specific radiological or laboratory diagnostic tools for most of the chronic myofascial pain symptoms reported. We might have treated patients with completely different etiologies although they had similar presentations. We used the VAS, the most convenient tool used in clinical settings to evaluate pain severity, as the sole outcome measure for treatment response. Subjective rating is frequently questioned for its reliability and validity. The long-term effect of dextrose injection was not evaluated in this study, owing to the relatively short interval between treatment and outcome measurement. In our experience; however, injections were frequently repeated when symptoms relapsed shortly after remission. It remains unclear whether dextrose injection achieves long-term effects beyond temporary symptomatic relief.

In future studies, we will investigate the biological properties of dextrose in vivo with objective outcome measures, especially through diagnostic imaging or histological sampling, which may clarify the exact mechanism of clinical responses to dextrose injection. Moreover, in the current multidisciplinary care of patients with chronic myofascial pain, we aim to compare dextrose injection with other therapies, such as physical therapy or pharmacologic treatment, through controlled prospective trials. A comparison between our current injection regimens and other commonly used agents, conducted through randomization and a rigorous study protocol, could help determine the optimal regimen for injection. Furthermore, evaluation of long-term outcomes of dextrose injection may help analyze its efficacy in long-term symptomatic control and improvement in patients' functional and social disabilities.

In conclusion, ultrasound-guided targeted dextrose injection for treating refractory localized myofascial pain syndrome showed remarkable effectiveness, significantly reducing symptom intensities in the majority of the treated patients 1 month after a single injection. Our experience is consistent with available scientific evidence that dextrose injection is a safe, inexpensive, and efficient treatment.

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