Original Article

Ultrasound-Guided Physiological Saline Injection for Patients with Myofascial Pain

Sussaya Kongsagul[1], Timporn Vitoonpong[1,2], Wasuwat Kitisomprayoonkul[1], Natthiya Tantisiriwat[1,2]*

[1]Department of Rehabilitation Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand,
[2]Department of Rehabilitation Medicin, King Chulalongkorn Memorial Hospital, Thai Red Cross Society, Bangkok, Thailand

Abstract

Background: Based on the histological confirmation of the presence of nerve structure in the fascia, hence, myofascial pain was treated by the mechanism referred to as interfascial block. To date, the studies of physiological saline for treating patients with myofascial pain has been limited. Ultrasound (US) guided with physiological saline injection (PSI) technique has been routinely practiced among patients with myofascial pain in outpatient service at the Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital. The main objective of this present study is to find the overview data including the percentage of patients responding, acceptable pain period, and adverse events. **Materials and Methods:** Electronic medical reports among 142 patients receiving US-guided PSI from August 1, 2016, to November 20, 2017, at the Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital, were retrospectively reviewed by the first author. Procedures were performed by the last author. The analysis was independently performed by the first author. **Results:** One hundred and forty-two patients with complete medical records were compatible with analysis. The average age of patients was 55 years. Most of the patients were female (68.3%). Most of the patients (76.8%) had chronic suffering from myofascial pain. Approximately half of the patients (56.4%) are currently received pain-relieving medications. Upper trapezius muscle (19.5%) was the most common muscle receiving the procedure, followed by multifidus (10.0%) and quadratus lumborum (9.5%). Most of the patients (86.8%) received the procedure one muscle. Approximately 30% of the patients were able to stop pain-relieving medications after the procedure. The median of acceptable pain period was 63 days. The percentage of patients having an acceptable pain period >3 months was 43.9%. No major adverse events were demonstrated. **Conclusion:** US-guided PSI technique demonstrated pain reduction in 72.8% of the analyzed patients, with an acceptable pain period of 63 days. No major adverse events were demonstrated among all the patients. This technique should be considered as another invasive procedure for eradication myofascial trigger point.

Keyword: Invasive procedure, myofascial pain, physiological saline injection, ultrasound-guided intervention

Introduction

Musculoskeletal ultrasound (MSK US) for pain management attracts physiatrists' attention to improve their patients' care and to develop new researches.[1,2] Based on the histological confirmation of the presence of nerve structure in the fascia, myofascial pain is treated by a mechanism called interfascial block.[3]

The US-guided interfascial block was published as the case report in a patient with myofascial pain recently. Piraccini reported that the solution of levobupivacaine 45 mg and triamcinolone 40 mg within 15 mL normal saline was injected on the deep fascia of the erector spinae muscle for pain relieving.[4] The same author reported one case with right postthoracotomy pain syndrome received the hydrodissection of fascial planes in the internal mammary region with triamcinolone and ropivacaine together with a nerve block.[5] Ueshima reported that using local anesthetic into the fascial plane between the multifidus and longissimus muscles among two patients who underwent spinal surgery can improve patients' recovery.[6] Ueshima also recently reported

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Address for correspondence: Dr. Natthiya Tantisiriwat, Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital, Thai Red Cross Society.
Department of Rehabilitation Medicine, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand.
E-mail: natthiyamd@gmail.com

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that normal saline 10 mL between the fascia of the internal and external intercostal muscles can successfully relieve pain; however, Ueshima proposed that interfascial adhesion is the cause of pain.[7] Hence, this technique has limited evidence for pain relief among patients with myofascial pain. A comparative study revealed that physiological saline could immediately relieve pain, similar to mepivacaine.[8] To date, studies regarding the use of physiological saline for treating patients with myofascial pain are limited.

Invasive procedures were frequently used among many patients suffering from myofascial pain failed for conservative treatment to eradicate the myofascial trigger point (MTrP). These procedures include dry needling, deep dry needling, local anesthetic injection, and local anesthetic plus steroid injection.[9-11] The latest agents used for injection are ozone and botulinum toxin.[12-14] However, serious adverse events such as pneumothorax have been found among patients receiving dry needling and deep dry needling and trigger point injection due to blinded technique.[9-11] Cost-effectiveness is questioned for botulinum toxin using among these patients.[13,14]

The US-guided with physiological saline injection (US-guided PSI) technique has been routinely practiced in our outpatient service at the MSK US clinic, Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital, since August 2016. Immediate pain relief and improving range of motion were demonstrated by clinical observation. Some patients remained symptom free during the follow-up visit. The main objective of this present study was to identify overview information before having the approval to perform the future randomized controlled trial. This information included the percentage of patients responding, acceptable pain period, and adverse events.

Materials and Methods

Study design, setting, statistical analysis, and ethical considerations

Electronic medical reports among 142 patients receiving US-guided PSI at the Department of Rehabilitation Medicine, King Chulalongkorn Memorial Hospital, were retrospectively reviewed by the first author from August 1, 2016, to November 20, 2017. Patient data regarding demographics, details of the procedure, current pain-relieving medications, and adverse events were independently analyzed by the first author.

These procedures were performed and recorded by the last author who has 5 years of experience in MSK US screening and interventions. All the patients have initially informed the procedure details, use of sterile saline at the physiological concentration for injection, and possible adverse events. Acetaminophen and cryotherapy were prescribed after intervention for 3 days.

Protocol for the present study was approved by the Institutional Review Board (IRB) of the Faculty of Medicine, Chulalongkorn University (IRB. No 1055/2017). Data were analyzed using SPSS Statistics version 22.0 (SPSS Inc., Chicago, IL, USA). Categorized data are reported as percentage or number. For continuous data, parametric data are reported as mean and standard deviation, whereas nonparametric data were reported as the median and interquartile range (IQR; Q3-Q1). Subgroup analysis was performed among patients who had the electronic medical record of the Numeric Rating Scale (NRS) at the date of intervention and during follow-up visits.

Inclusion criteria

1. Patients were diagnosed with myofascial pain syndrome that had MTrP causing pain and/or referred pain or autonomic symptoms during compression at MTrP. The symptoms were relieved after compression for 5–10 s[15]
2. Patients demonstrated a limited range of motion around the pain region[15]
3. Patients complained that pain was the moderate degree to the severe degree determined by NRS at least 4.

Exclusion criteria

1. Patients firstly receiving pain-relieving medications on the same day of the intervention.
2. Patients aged under 18 years old.

Operational definitions

These following operational definitions were used by the first author to retrieve appropriate data. These operational definitions are categorized into three dimensions:

1. Efficacy reported as the percentage of patients having pain reduction
    - Two criterions were used for retrieving medical records identified patient response to this technique including NRS criteria was analyzed as subgroup analysis.
        - NRS criteria were defined as the medical records demonstrating that patients have NRS reduction as 2 or greater point at the follow-up visit. Subgroup analysis was performed among these patients having a record of NRS at first and follow-up visit
        - Clinical record criteria were defined as the medical records demonstrating that patients have pain reduction >50% during the follow-up visits and/or improving range of motion after the intervention and during the follow-up visits.

For patients receiving the procedure more than one muscle in the same visit, the pain reduction is evaluated at the muscle having the highest pain.

- Percentage of patient response to US-guided PSI was defined as the percentage of patients reported that they could discontinue pain-relieved medications until the follow-up visit
- Percentage of patient request for the same technique to eradicate MTrPs occurring on the other muscles during the follow-up visits.

2. Efficacy reported as acceptable pain-tolerated duration
    - The acceptable pain-tolerated period was defined as

intervention first follow-up interval period which patients did not seek for additional treatments for pain relieving. If patients have multiple sessions of the procedure on the same muscle, the shortest duration was retrieved as the data for these groups
- Efficacy of acceptable pain-tolerated duration was defined as the percentage of patients having an acceptable pain-tolerated duration >3 months.

3. Adverse events after intervention were defined as major adverse events which lead to consultation for further management. The major adverse events included pneumothorax, skin & soft tissue infection.

Ultrasound-guided physiological saline injection technique

1. Sterile normal saline at physiological concentration of 5–10 mL was used per injection site. The volume depended on muscle size. The 5 mL was used for muscles lying on the chest wall, paracervical spine, and limbs. The 10 mL was used for muscles lying on the lower back and hip region
2. US-guided injection in-plane needle approaching was performed with aseptic technique [Figure 1]
3. The interfascial injection was performed over the affected fascia [Figure 2]. For the US-guided PSI technique, the affected fascia was defined as the muscle fascia that causes either local pain or referred pain similarly to compression during physical examination together with or without local twitch response
4. Pain improvement was immediately assessed after the intervention
5. Range of motion was assessed by physical examination compared before and immediately after the intervention
6. Postinjection soreness was prevented by acetaminophen and cryotherapy after the intervention.

Results

There were 142 patients who had complete electronic medical records for treating myofascial pain with this technique. The average age of patients was 55 ± 15.1 years. Most of the patients were female (68.3%). Most of the patients (76.8%) had chronic suffering from myofascial pain with onset >6 months [Table 1]. Approximately half of the patients (56.4%) had currently received pain-relieving medications such as gabapentin and pregabalin (39.3%), nonsteroidal anti-inflammatory drugs (7.4%), tricyclic antidepressant (3.7%), muscle relaxant (3.7%), acetaminophen plus opioid (2.5%), and selective serotonin–norepinephrine reuptake inhibitor (0.6%). Upper trapezius muscle (19.5%) was the most common muscle receiving the procedure, followed by multifidus (10.0%) and quadratus lumborum (9.5%). Rhomboid muscle (6.8%) was another muscle lying on the chest wall receiving the procedure. Deltoid (8.4%) and pyriformis (8.4%) were the most common muscles receiving the procedure on the upper and lower limbs. Most of the patients (86.8%) received a procedure on one muscle. None of the analyzed patients has taken acetaminophen after the intervention. Cryotherapy was only used among these patients.

Most of the patients (114 of 142 patients; 80.28%) were identified as a response group [Table 2]. Patients discontinuing or reducing pain-relieving medications after the procedure were 29.8%. Patients who could immediately stop using medication

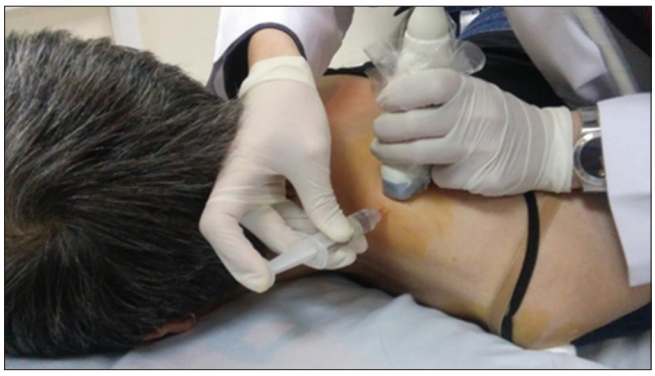

Figure 1: Ultrasound-guided physiological saline injection technique on the upper trapezius muscle

Table 1: Demographic data among the total reviewed outpatient record

Demographic data	*n*=142
Female (%)	68.3
Average age (mean±SD)	55±15.1
Duration of symptom, months (%)	
<3	12.7
3-5	23.2
≥6	76.8
Receiving pain-reliving medication (%)	56.4
Common muscles receiving procedure (%)	62.6
Muscles over the chest wall	
Upper trapezius	19.5
Rhomboid	6.8
Core muscle stabilizers	
Multifidus	10.0
Quadratus lumborum	9.5
Limbs	
Deltoid	8.4
Pyriformis	8.4

SD: Standard deviation

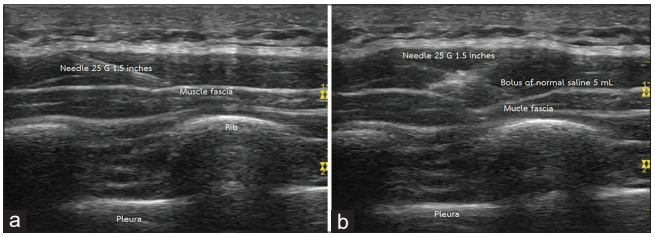

Figure 2: Sonographic imaging during intervention with in-plane technique. (a) Demonstrating needle tip touch the affected muscle fascia. (b) Demonstrating the bolus of normal saline 5 mL spread over the muscle fascia causing local pressure at this fascia

were 21.1%. Among the response patients, approximately half (54.4%) requested for the repeated procedure on the other muscles. The median of acceptable tolerated pain period was 63 days, from 7 days to 365 days with IQR (Q3-Q1 as 84–118 days). The percentage of patients having an acceptable pain period >3 months was 43.9%. NRS was completely recorded among 31 patients. Data from subgroup analysis were demonstrated among these patients [Table 3]. No major adverse events were demonstrated among all of the 142 patients.

Table 2: Efficacy of ultrasound-guided physiological saline injection among response patients

Efficacy	(*n*=114)
Percentage of response patient	
Based on the NRS criteria	27.2
Based on clinical record criteria	72.8
Acceptable tolerated pain period, weeks (%)	
<4	15.8
4-8	25.4
9-11	14.9
≥12	43.9
Discontinuing pain-relived medications after the procedure (%)	30.0

NRS: Numeric Rating Scale

Table 3: Subgroup analysis among patients having completely recorded Numeric Rating Scale

Demographic data	(*n*=31)
Female (*n*)	22.0
Average age (mean±SD)	54±14.1
Duration of symptom, months (*n*)	
<3	
3-5	25.0
≥6	6.0
Pretreatment NRS, median (IQR)	6 (5-8)
Posttreatment NRS, median (IQR)	0 (0-2)
NRS difference, median (IQR)	5 (3-7)
Acceptable tolerated pain period (days), median (IQR)	56 (58-125)
Acceptable tolerated pain period , weeks (*n*)	
<4	7
4-8	8
9-11	4
≥12	12
Receiving pain-relived medications (*n*)	12
Discontinuing/reducing pain relieving medications after the procedure (*n*)	6

IQR: Q3-Q1. IQR: Interquartile range, NRS: Numeric Rating Scale, SD: Standard deviation

Discussion

The presence of neural structure on the fascia confirms that MTrP was related to the fascia and possibly related to the peripheral and central sensitization. Previous article mentioning US-guided interfascial hydrodissection in myofascial pain is only the case report. The similar technique using anesthetic and steroid solution was successfully reduced pain on one case with myofascial pain.[4] However, the interfascial block can occur without an anesthetic agent. MTrP is eradicated by injection of normal saline with the volume targeting at the fascia. The MTrP eradication occurs from reactive hyperemia mechanism.

Reactive hyperemia was the accepted concept for explaining the mechanical effect of massage and ischemic compression.[16,17] Reactive hyperemia as known as the increased microvascular exchange was found among the previous studies leading to an increase in blood flow.[18-20] Then, full oxidize glucose and lactate were re-established. The zone around MTrP was mentioned by Simon that it is in an ischemic condition.[21] Then, the shortage of glucose and oxygen for metabolism occurred after a muscle is in the overload state.

This is the first study that retrospectively reveals the overview of this technique among 142 patients with myofascial pain. Instead of using the anesthetic agent, the authors chose normal saline with precise injection on the affected fascia. The improvement of pain and the range of motions were clinically observed. The response group was the patients having pain reduction greater than 50% or NRS reduction greater than half. More than half of the patients can completely solve MTrPs at injected muscle; then, they request the same technique on the other muscles. Hence, placebo effect may be unlikely explained the significant effect for few months. The first author did not involve in the MSK US clinic and independently analyze the data to avoid bias.

This present study demonstrates longer pain relief duration than dry needling (8 weeks vs. 6 weeks), the most common invasive procedure performed among patients with myofascial pain.[22-24] Dry needling is a blinded procedure; thus, pneumothorax may incidentally occur.[10,11] However, US-guided PSI requires skilled interventionist and costs higher than dry needling. This technique provided a close duration to local injection of anesthetic agent plus a steroid for 8.5 weeks.[25] This technique has two components as US-guided during the procedure and using the physiological normal saline injection; hence, these components did not lead to adverse events, whereas the adverse events can occur from anesthetic agent injection (hypokalemic paralysis), muscle atrophy (steroid), and botulinum toxin (muscle weakness and antibody).[26] Moreover, saline is more susceptible to steroid phobia patients.

US-guided PSI demonstrated efficacy in most of the patients. More than half of the patients who requested for the same technique to eradicate MTrPs implied that this group impressed this technique. No adverse events were demonstrated among all the patients. To avoid pneumothorax, this procedure requires skilled interventionists, especially when performing in muscles lying on the chest wall. This technique could immediately reduce pain and increase muscle flexibility; thus, it could help patients to start exercise immediately after the intervention. Stretching and strengthening exercises are considered as mandatory treatments for myofascial pain.[27]

Furthermore, this procedure can be performed among special populations including pregnant and lactating women, children, the elderly, patients with either hepatic or renal

impairment, and athletes without concern for the detrimental effect on vital organs, overdosage, drug interaction, and doping. The present study provided an overview of patients who require this procedure, especially safety issue. These data are important for having the approval to perform the further randomized controlled trial study for having objective measurements (improvement of pain and range of motion) and controlling confounding factors.

Conclusion

US-guided PSI technique demonstrated pain reduction in 72.8% of the analyzed patients, with an acceptable pain period of 63 days. No major adverse events were demonstrated among all the patients. This technique should be considered as another invasive procedure for eradication MTrP.

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Conflicts of interest

There are no conflicts of interest.

References

1. Chang KV, Wu WT, Han DS, Özçakar L. Static and dynamic shoulder imaging to predict initial effectiveness and recurrence after ultrasound-guided subacromial corticosteroid injections. Arch Phys Med Rehabil 2017;98:1984-94.
2. Chang KV, Wu WT, Huang KC, Jan WH, Han DS. Limb muscle quality and quantity in elderly adults with dynapenia but not sarcopenia: An ultrasound imaging study. Exp Gerontol 2018;108:54-61.
3. Domingo T, Blasi J, Casals M, Mayoral V, Ortiz-Sagristá JC, Miguel-Pérez M, *et al.* Is interfascial block with ultrasound-guided puncture useful in treatment of myofascial pain of the trapezius muscle? Clin J Pain 2011;27:297-303.
4. Piraccini E, Corso RM, Maitan S. Ultrasound guided erector spinae plane block for myofascial pain syndrome. J Clin Anesth 2019;57:121.
5. Piraccini E, Biondi G, Byrne H, Calli M, Bellantonio D, Musetti G, *et al.* Ultrasound guided transversus thoracic plane block, parasternal block and fascial planes hydrodissection for internal mammary post thoracotomy pain syndrome. Eur J Pain 2018;22:1673-7.
6. Ueshima H, Sakai R, Otake H. Clinical experiences of ultrasound-guided thoracolumbar interfascial plane block: A clinical experience. J Clin Anesth 2016;33:499.
7. Ueshima H. Ultrasound-guided interfascial hydrodissection for severe pain in mastitis. J Clin Anesth 2019;57:40.
8. Frost FA, Jessen B, Siggaard-Andersen J. A control, double-blind comparison of mepivacaine injection versus saline injection for myofascial pain. Lancet 1980;1:499-500.
9. Ahiskalioglu EO, Alici HA, Dostbil A, Celik M, Ahiskalioglu A, Aksoy M. Pneumothorax after trigger point injection: A case report and review of literature. J Back Musculoskelet Rehabil 2016;29:895-7.
10. Cummings M, Ross-Marrs R, Gerwin R. Pneumothorax complication of deep dry needling demonstration. Acupunct Med 2014;32:517-9.
11. Ronconi G, De Giorgio F, Ricci E, Maggi L, Spagnolo AG, Ferrara PE. Pneumothorax following dry needling treatment: Legal and ethical aspects. Ig Sanita Pubbl 2016;72:505-12.
12. Halder GE, Scott L, Wyman A, Mora N, Miladinovic B, Bassaly R, *et al.* Botox combined with myofascial release physical therapy as a treatment for myofascial pelvic pain. Investig Clin Urol 2017;58:134-9.
13. Kamanli A, Kaya A, Ardicoglu O, Ozgocmen S, Zengin FO, Bayik Y. Comparison of lidocaine injection, botulinum toxin injection, and dry needling to trigger points in myofascial pain syndrome. Rheumatol Int 2005;25:604-11.
14. Kwanchuay P, Petchnumsin T, Yiemsiri P, Pasuk N, Srikanok W, Hathaiareerug C. Efficacy and safety of single botulinum toxin type A (Botox®) injection for relief of upper trapezius myofascial trigger point: A Randomized, double-blind, placebo-controlled study. J Med Assoc Thai 2015;98:1231-6.
15. Gerwin RD. Myofascial trigger point pain syndromes. Semin Neurol 2016;36:469-73.
16. Hou CR, Tsai LC, Cheng KF, Chung KC, Hong CZ. Immediate effects of various physical therapeutic modalities on cervical myofascial pain and trigger-point sensitivity. Arch Phys Med Rehabil 2002;83:1406-14.
17. Moraska AF, Hickner RC, Kohrt WM, Brewer A. Changes in blood flow and cellular metabolism at a myofascial trigger point with trigger point release (ischemic compression): A proof-of-principle pilot study. Arch Phys Med Rehabil 2013;94:196-200.
18. Ashina M, Stallknecht B, Bendtsen L, Pedersen JF, Galbo H, Dalgaard P, *et al. In vivo* evidence of altered skeletal muscle blood flow in chronic tension-type headache. Brain 2002;125:320-6.
19. Ashina M, Stallknecht B, Bendtsen L, Pedersen JF, Schifter S, Galbo H, *et al.* Tender points are not sites of ongoing inflammation-*in vivo* evidence in patients with chronic tension-type headache. Cephalalgia 2003;23:109-16.
20. McIver KL, Evans C, Kraus RM, Ispas L, Sciotti VM, Hickner RC. NO-mediated alterations in skeletal muscle nutritive blood flow and lactate metabolism in fibromyalgia. Pain 2006;120:161-9.
21. Simons DG. Review of enigmatic MTrPs as a common cause of enigmatic musculoskeletal pain and dysfunction. J Electromyogr Kinesiol 2004;14:95-107.
22. Gerber LH, Shah J, Rosenberger W, Armstrong K, Turo D, Otto P, *et al.* Dry needling alters trigger points in the upper trapezius muscle and reduces pain in subjects with chronic myofascial pain. PM R 2015;7:711-8.
23. Gerber LH, Sikdar S, Aredo JV, Armstrong K, Rosenberger WF, Shao H, *et al.* Beneficial effects of dry needling for treatment of chronic myofascial pain persist for 6 weeks after treatment completion. PM R 2017;9:105-12.
24. Gerber LH, Sikdar S, Armstrong K, Diao G, Heimur J, Kopecky J, *et al.* A systematic comparison between subjects with no pain and pain associated with active myofascial trigger points. PM R 2013;5:931-8.
25. Cartagena-Sevilla J, García-Fernández MR, Vicente-Villena JP. Analgesic effect of botulinum toxin A in myofascial pain syndrome patients previously treated with local infiltration of anesthetic and steroids. J Pain Palliat Care Pharmacother 2016;30:269-75.
26. Soriano PK, Bhattarai M, Vogler CN, Hudali TH. A case of trigger-point injection-induced hypokalemic paralysis. Am J Case Rep 2017;18:454-7.
27. Mata Diz JB, de Souza JR, Leopoldino AA, Oliveira VC. Exercise, especially combined stretching and strengthening exercise, reduces myofascial pain: A systematic review. J Physiother 2017;63:17-22.