Original Article

The Feasibility of Vitamin B Complex Additive to Lidocaine for Myofascial Trigger Point Injection in Neck and Upper Back Muscles: A Pilot Trial

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ABSTRACT

Objectives: To explore the feasibility and result of adding the vitamin B complex to lidocaine for a myofascial trigger point (MTrP) injection in reducing pain and disability in patients with myofascial pain syndrome (MPS).

Study design: A pilot randomized double-blind controlled trial.

Setting: Thammasat University Hospital, Thailand.

Subjects: Thirty-eight patients aged between 18 to 70-year-old with active MTrP on neck and upper back and pain less than 6 months.

Methods: The patients were randomly assigned into two groups. The treatment group (n = 20, side = 33) were treated with 0.4 ml mixture of vitamin B complex and 1% lidocaine (1:1 ratio) whereas the control group (n = 18, side = 29) was treated with 0.2 ml of 1% lidocaine only. The patients and assessors were blinded to the treatments assigned. Numeric rating scale (NRS) for pain and neck disability index (NDI) were rated by the patients at baseline and at the end of week 1, 2 and 4. A linear mixed effect model was used.

Results: The NRS and NDI scores were significantly decreased at the end of week 1, 2 and 4 but no significant differences between the two groups (*p*-value = 0.802 and 0.072, respectively). Post-injection soreness was mostly found with significant difference between the two groups ($p = 0.042$).

Conclusions: Adding vitamin B complex to lidocaine for MTrP injection in neck and upper back muscles does not give better outcomes in pain and disability than injection with lidocaine alone. The feasibility and result of pilot study in term of design is useful, although vitamin B complex as an intervention should be reconsidered in preparation and adverse event.

Keywords: pain, myofascial pain syndrome, trigger point injection, lidocaine, vitamin B complex

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Introduction

Myofascial pain syndrome (MPS) is defined as a regional pain syndrome characterized by muscle pain caused by myofascial trigger point (MTrP), a tender spot in a palpable taut band of skeletal muscle fibers.[1] Pressure on MTrP can produce pain, referred pain, and local twitch response (LTR).[1] The most popular hypothesis by Travel and Simon is the pain caused by over releases acetylcholine in the synaptic cleft that stimulates sarcoplasmic reticulum (SR) to release a calcium causing sustained sarcomere contraction, and consequently increasing metabolic demand and local ischemia.[1] Impaired uptake of calcium into the SR in the setting of depleted ATP increases calcium concentration and subsequently increases contractile activity.[1] Mitochondria in muscle cell mainly produces ATP by the Krebs' cycle and electron transport chain (ETC).[2] Vitamin B is a co-enzyme in biochemical pathways of the Krebs' cycle. Vitamin B2 and B3 is a precursor of $FADH_2$ and NADH that electron carrier in the Krebs' cycle.[2-4]

Treatments of MPS include analgesic medication, physical modality, massage, MTrP injection, dry needling, and life-style modification.[1] Lidocaine and botulinum toxin MTrP injections are effective in reducing pain scores and have been shown to improve quality of life.[1,5] Overall, lidocaine is more cost effective than botulinum toxin injection,[6] reduces a pain scores within 2 weeks[7,8] and has less post-needling soreness than the dry needling technique.[7-9] Moreover, previous studies using hyaluronidase with lidocaine or ozone gas injected into MTrP was reported to reduce pain along treatment period.[10,11]

Nowadays, modern lifestyle of using a laptop or a smartphone causes an abnormal ergonomic posture of neck and upper back which results in pain and tightness of related muscles. In a randomized controlled trial (RCT) of patients with severe osteoarthritis after total knee arthroplasty, an intramuscular injection of vitamin B plus diclofenac showed an analgesic effect superior to diclofenac alone.[12] Theoretically, the vitamin B helps increase the ATP production in a muscle cell that will improve the energy crisis at MTrP area. Therefore, the researchers did a pilot RCT to explore the feasibility and result of adding the vitamin B complex to lidocaine for a MTrP injection in reducing pain and disability in patients with MPS.

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Methods

This pilot randomized parallel double-blind controlled trial was approved by the Human Research Ethics Committee of Faculty of Medicine, Thammasat University on 14th January 2019 (registration number MTU-EC-RM-2-220/61) and was registered in the Thai clinical trials registry (TCTR No. 20190308005).

Participants

Patients with active MTrP in the neck and/or upper back as determined by the Travel and Simon criteria[1] were recruited at the Physical Medicine and Rehabilitation Outpatient Clinic of Thammasat University Hospital between May 2019 to July 2020. Inclusion criteria were age between 18-70 years and duration of MPS less than 6 months. Exclusion criteria were 1) dry needling, MTrP injection and vitamin B use within the past one month, 2) neck or shoulder surgery within the past year, 3) diagnosis of fibromyalgia, cervical radiculopathy or myelopathy, and bleeding tendency, 4) warfarin use, and 5) vitamin B or lidocaine allergy.

Randomization

After screening and receiving patients' informed consent, the patients were randomized into 2 groups (1:1 ratio) by blocked randomization via computer-generated numbers. The concealed envelopes with serial numbers and group assignments were prepared by research assistant.

Intervention

One researcher, a physiatrist/rehabilitation physician, examined the patients to find active MTrP in neck and upper back areas and administered injections following their assigned group. An injected syringe was covered with opaque paper to blind the patient's treatment medication. Before starting the study, two other general practitioners, assigned as an assessor and were blinded of the treatment assigned.

In the treatment group (B group), MTrP was injected with 0.2 ml of vitamin B complex (1 ml consisted with B1 100 mg, B2 0.5 mg, B3 100 mg, B6 1 mg) plus 0.2 ml of 1% lidocaine without adrenaline, with a total of 0.4 ml (1:1 ratio) at each MTrP. In the control group, MTrP was injected with 0.2 ml of 1% lidocaine without adrenaline at each MTrP. Both groups were injected on the beginning day of the study.

The patients in both groups were instructed to do a self-stretching home exercise program of neck, upper trapezius and infraspinatus muscles, 10 times of each muscle per day, and avoid other physical modalities and Thai-massage during the study period. Analgesic medication was allowed to take and had to report the assessor.

Outcome measurements

Primary outcome was pain on neck and/or upper back rated by the patients using numeric rating scale (NRS) which ranged from 0 of no pain to 10 of the most severe pain, at baseline before treatment and at the end of the 1st, 2nd, and 4th week. Those with the symptoms on both sides had to rate the pain NRS at each side separately. The minimal clinically important change (MCIC) of NRS in patients with neck pain was 2.5 points.[13]

Secondary outcomes were the neck disability index (NDI) Thai-version. The NDI Thai-version consisted of 10 items concerning neck pain affecting activities of daily living including personal care, lifting, reading, headache, concentration, work status, driving, sleeping, and recreation. It is a self-report questionnaires and each item has 5 choices scored ranging from 0, no disability to 5, complete disability, and a total score of 50 being the worst.[14] The internal consistency of Thai-version NDI was 0.835[14] and MCIC of NDI was 3.5 points.[13] The patients completed the NDI Thai-version questionnaire at baseline and at the end of the 1st, 2nd, and 4th week. Those with the symptoms on both sides had to complete the NDI Thai-version based on the most symptomatic side.

Statistical methods

The estimated required number of symptomatic sides in each group was 29 following Viechtbauer et al.[15]

The analysis was performed according to intention to treat principle. Categorical data were presented as frequency and percentages. Continuous data were presented as mean, median, standard deviation (SD), and interquartile range (IQR), depending on the nature of the data. To compare demographic and baseline characteristic data among groups, the researchers used Fisher's exact test for categorical data and t-test or rank-sum test for continuous data. Correlation between observed data, such as symptomatic sides in the same patient and repeated measurement of NRS in each symptomatic side, were analyzed by using a linear mixed-effect model for analysis of treatment efficacy within and among groups. Adverse events comparing between the two groups were analyzed using Fisher's exact test. Statistical significance was accepted at *p*-value less than 0.05. The data were analyzed using Stata version 12.1.

Results

Flow of the study is shown in Fig. 1. No patient was lost to follow-up. Demographic and baseline characteristics of the patients did not have statistically significant differences (Table 1).

The NRS was assessed and analyzed based on symptomatic sides, 33 in the B group and 29 in the control group whereas NDI was assessed and analyzed based on number of patients, 20 in the B group and 18 in the control group.

The NRS scores were significantly reduced in the first, second, and fourth week in both groups compared with the baseline. In the 1st week post-injection, the mean NRS score notably decreased from 5.8 to 3.3 points (mean difference = 2.5 points) in the B group and 5.4 to 3.8 points (mean difference = 1.6 points) in the control group. NRS scores of the B group

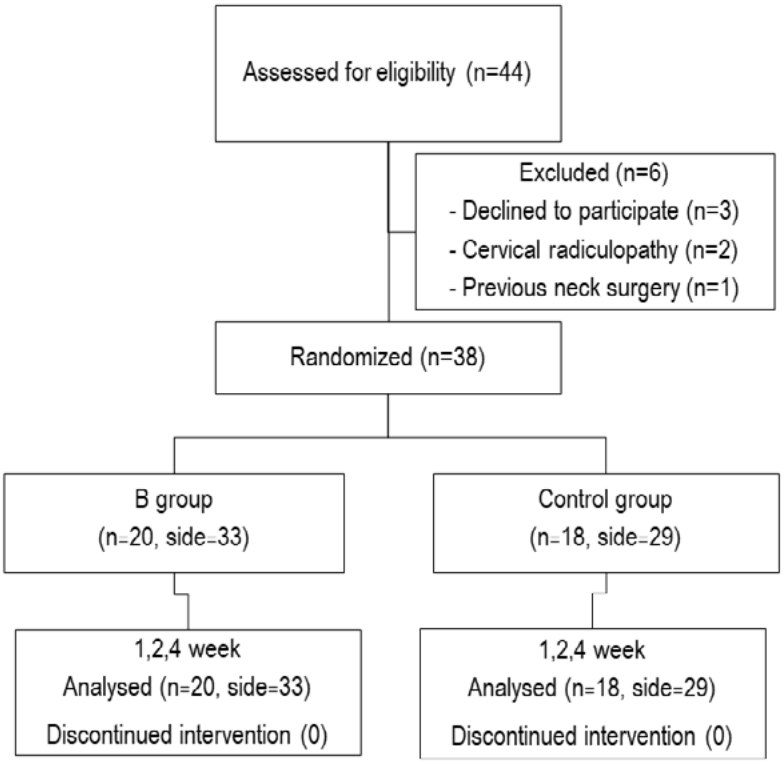

Figure 1. Participant flow chart

Table 1. Demographic and baseline characteristics of the patients

Parameters	Vitamin B group (n = 20, side = 33)	Control group (n = 18, side = 29)	*p*-value
Age (years)[1]	42.3 (11.0)	46.9 (12.7)	0.241[a]
Gender[2]			1.000[b]
Male	4 (20.0)	3 (16.7)	
Female	16 (80.0)	15 (83.3)	
Occupation[2]			0.782[b]
Office worker	11 (55.0)	9 (50.0)	
Housekeeper	3 (15.0)	4 (22.2)	
Factory worker	0	1 (5.6)	
Other	6 (30.0)	4 (22.2)	
Handed[2]			0.232[b]
Right	17 (85.0)	18 (100)	
Left	3 (15.0)	0	
Duration of symptoms (months)[3]	0.8 (0.2, 3)	1 (1, 3)	0.268[c]
Side of symptom[2]			0.899[b]
Right	3 (15.0)	2 (11.1)	
Left	4 (20.0)	5 (27.8)	
Both sides	13 (65.0)	11 (61.1)	
MTrP locations[2]			0.425[b]
Upper trapezius	20 (60.6)	15 (51.7)	
Infraspinatus	2 (6.1)	1 (3.5)	
Upper trapezius + Infraspinatus	10 (30.3)	8 (27.6)	
Upper trapezius + neck	1 (3.0)	2 (6.9)	
Upper trapezius + infraspinatus + neck	0	3 (10.3)	
NRS[1]	5.8 (1.4)	5.4 (2.4)	0.397[a]
NDI[3]	13.5 (10.5,18.5)	14.5 (12,20)	0.500[c]

[1]Mean (SD), [2]number (%), [3]median (Q1, Q3); [a]Independent t-test, [b]Fisher's exact test, [c]Rank-sum test

MTrP, myofascial trigger point; NRS, numeric rating scale; NDI, neck disability index

Treatment solutions: vitamin B group with vitamin B complex plus 1% lidocaine, control group with 1% lidocaine

were reduced in subsequent follow-up periods but did not show a statistically significant difference when compared to the control group (mean difference -0.04, 95% CI -0.35 to 0.27, p = 0.802).

The NDI scores were significantly reduced in the first, second, and fourth week in both groups compared with the baseline. However, the reduction of NDI score in the B group was less than in the control group along the 4-week follow-up period but did not show a statistically significant difference between groups (mean difference 1.2, 95% CI -0.1 to 2.6, p = 0.072). (Table 2, Fig. 2 and 3.)

Adverse events are shown in Table 3. Post-injection soreness was the most common complaint found in both groups and showed statistically significant difference between the two groups (80% in the B group and 44.4% in the control group, p = 0.042). No significant difference between groups in other adverse events such as contusion and dizziness were found. All adverse events recovered spontaneously without treatment.

Discussion

This study mixed vitamin B complex with 1% lidocaine for MTrP injections to neck and upper back muscles. It revealed that the NRS scores in the B and control groups declined along the 4 weeks without statistically significant difference. The addition of vitamin B to lidocaine did not demonstrate a difference in pain reduction as expected. In theory, vitamin B increases ATP which consequently mitigates the energy crisis within the muscle cells.[2,3] Moreover, the chemical effect of lidocaine injection leads to local anesthesia by prolonged relative refractory period and limited maximum frequency of impulse conduction of the peripheral nerve.[16]

The NRS scores in both groups showed notable decrease at the first week post-injection, this differs from previous studies which showed decreased scores mostly after the second week.[7,8] One of these studies injected 0.2 ml of 0.5% lidocaine at each MTrP,[8] different concentration from this study using 0.2 ml of 1% lidocaine. However, the mean difference of NRS score reached the MCIC of 2.5 points at the first week in the

Table 2. Comparison of NRS and NDI between baseline and follow-up within group, and between groups

Outcome variable	Vitamin B group (n = 20, side = 33)		Control group (n = 18, side = 29)		Between groups		
	Mean (SD)	p-value	Mean (SD)	p-value	Mean difference	95% CI	p-value
NRS					-0.04	-0.35 to 0.27	0.802
Baseline	5.8 (1.4)		5.4 (2.4)				
1st week	3.3 (2.6)	< 0.001*	3.8 (2.4)	< 0.001*			
2nd week	3.7 (2.5)	< 0.001*	3.6 (2.6)	< 0.001*			
4th week	3.5 (2.8)	< 0.001*	3.4 (2.4)	< 0.001*			
NDI					1.2	-0.1 to 2.6	0.072
Baseline	15.1 (7.7)		15.7 (5.1)				
1st week	8.8 (7.6)	< 0.001*	10.2 (5.8)	< 0.001*			
2nd week	10.9 (7.5)	< 0.001*	9.3 (6.1)	< 0.001*			
4th week	11.1 (9.0)	0.001*	8.0 (5.5)	< 0.001*			

Linear mixed effect model; *p < 0.05

NRS, numeric rating scale; NDI, neck disability index

Injection solutions: vitamin B group with vitamin B complex plus 1% lidocaine, control group with 1% lidocaine

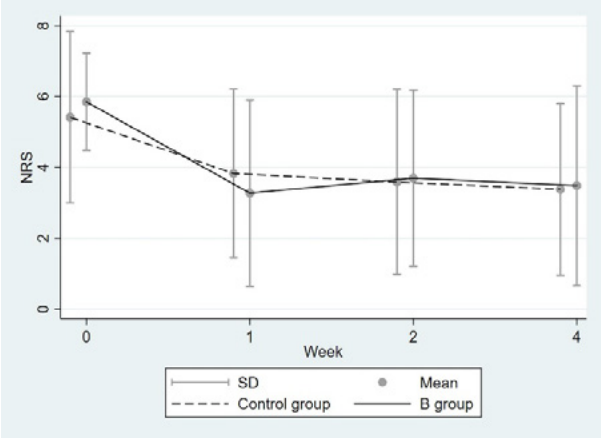

Figure 2. Numeric rating scale (NRS) for pain

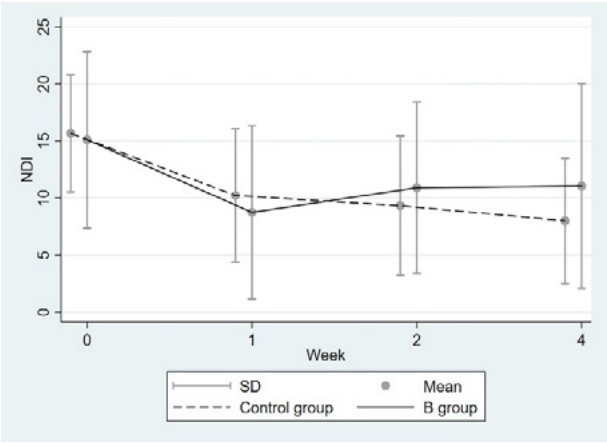

Figure 3. Neck disability index (NDI) scores

Table 3. Adverse events

	Vitamin B group (n = 20)	Control group (n = 18)	*p*-value
Post-injection soreness	16 (80.0)	8 (44.4)	0.042
Contusion			
< 4 cm	3 (15.0)	0	0.232
≥ 4 cm	0	1 (5.6)	0.474
Dizziness	1 (5.0)	1 (5.6)	1.000

B group but not in the control group. This finding could be due to several reasons. First, vitamin B complex (B1, B2, B3, B6) might increase the ATP production via the Krebs' cycle and electron transport chain within the muscle cell.[4] ATP production provides muscle cells the chemical energy needed to break vicious cycle of an energy crisis and stop excess prolonged contraction cycle and reduce pain.[1] Second, the total volumes of injected solution at each MTrP were not equal, 0.4 ml in the B group but 0.2 ml in the control group. A larger volume of the injected solution in the B group may dilute and wash out more sensitive substances in MTrP than the control group does.[5,17]

In addition, in the B group there was an increase in NRS at the end of 2nd week but lower than the baseline. This may be due to a short half-life of vitamin B, 1.8 days for B1.[18] Vitamin B complex (B1, B2, B3, B6) has a short half-life and is eliminated via urination.[4] Thus the effect of vitamin B is not sustained for long periods of time.

The second outcome of this study was the NDI score which assesses the metric of disability among patients with neck pain.[14] The NDI scores at each point in our study did not demonstrate a statistically significant difference between groups. According to a previous study, MCIC of NDI for patients with neck pain is 3.5 points.[13] Our study showed NDI score difference achieved MCIC at 1st, 2nd and 4th week after injection in both groups. Yoon et al. reported the lidocaine injection decreased NDI score at the end of 1st and 2nd week like the findings of this study.[19] Another finding in the B group in our study was the NDI score declined at the 1st week but then increased at the 2nd and 4th weeks after post-injection whereas in the control group, the NDI scores declined subsequently after injection. In addition, the decreasing trend of the NDI and NRS score seemed similar at each point post-injection at in both groups which supports a highly correlation between the pain score and the NDI score, with correlation coefficient (r) = 0.886.[14]

Post-injection soreness was common adverse event. In our study, more patients in the B group reported post-injection soreness than those in the control group 80% and 44.4%, respectively with statistical difference. The percentage in the control group in our study is rather similar with 38.1-57% of patients injected with lidocaine reported in previous studies.[7-9] The high percentage of post-injection soreness in those injected with vitamin B complex may be caused by nicotinamide (vitamin B3) which is hydrolyzed to nicotinic acid in a physiological pH as 7.35-7.45, and the latter can result in skin irritation and cause a pain sensation.[20,21] An increased ATP caused by vitamin B may activate neural pathways of pain sensation. These two explanations may translate to increased post-injection soreness after vitamin B intramuscular injection. All adverse events spontaneously resolved and did not require treatment. A different form of vitamin B or a different mixture like saline, bicarbonate can be an alternative option in the future trial.[21,22]

This pilot study was feasible in terms of design, setting and participant recruitment. However, an unequally MTrP-injected volumes between the two groups, vitamin B preparation, intergroup different outcomes and post-injection soreness should be considered. Adding an objective outcome as the pain pressure threshold on MTrP by algometer should be measured. The method and outcomes of this pilot study may offer an initial way for future trial planning.

Conclusions

Adding vitamin B complex to lidocaine for MTrP injection in neck and upper back muscles does not give better outcomes in pain and disability than injection with lidocaine alone. The feasibility and result of pilot study in term of design is useful, although vitamin B complex as an intervention should be reconsidered in preparation and adverse event.

Disclosure

The authors declare no conflict of interest.

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