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Research Article

Mechanical Needling with Sterile Water versus Steroids Injection for Facet Joint Syndrome: A Retrospective Observational Study

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Objective. This present study aimed to explore the clinical effects of ultrasound-guided (USG) mechanical needling with sterile water injection for lumbar facet joint syndrome. *Methods*. This was a retrospective cohort study that assessed the clinical outcome of ageing patients who received USG mechanical needling with sterile water injection. In addition, the clinical outcome of age- and gender-matched patients randomly selected from patients who received mechanical needling with sterile water was compared to the patients injected with steroids in a 2 : 1 ratio. The data were extracted from the medical records of ageing patients with facet joint syndrome who received USG injection at the lumbosacral spine by the first author. Low back pain or axial pain, and leg pain or radicular pain were assessed by the visual analogue scale (VAS), and gait ability with walking distance was obtained at 6 different time points. *Results*. A total of 4,276 medical records were examined. Four thousand two hundred twenty-eight ageing patients received needling with sterile water injection and found that the efficacy lasted up to 6 months. Ninety-six patients were compared with 48 patients who received steroid injection. Those who received steroids had less back and leg pain at 1 week after injection; however, pain returned at 3 months and 6 months after injection. *Conclusions*. USG mechanical needling with sterile water could help relieve axial and radicular pain for at least 6 months. Reduced sensitization and removal of calcification and fibrosis were all possible mechanisms.Keywords: Mechanical needling, Sterile water, Ultrasound guided (USG) injection, Facet joint syndrome, Pain

1. Introduction

Facet joint syndrome is an arthritis-like syndrome in which the cartilage between the inferior and superior articular processes breaks down and becomes inflamed, causing pain signals to be sent to the innervated medial branch nerve endings [1–6]. The L4-L5 region of the lumbar spine is the most prevalent site of facet joint syndrome [2, 4–8]. Radicular pain in facet joint syndrome is caused by inflammation or compression of the spinal nerve root, with disk herniation being the most prevalent cause [2, 4–8].

The injection of corticosteroids, lidocaine, 5% dextrose water, hyaluronic acid (HA), or autologous platelet rich plasma (PRP) into the facet joints has been recommended to treat back pain or axial pain and leg pain or radicular pain induced by facet joint syndrome [2, 3, 9–15]. However, needle insertion into the facet joints can be challenging due to spur development and degenerative changes [3, 8, 13, 16].

Corticosteroids have been utilized in intra-articular injections because of the anti-inflammatory and immunosuppressive properties. Steroids are commonly used in epidural injections, facet joint injections, and medial branch block [3, 4, 6, 7, 17]. However, the negative side effects of

steroid injections are of concern. Several active chemical substances have tried to replace or reduce the need of steroids, such as local anesthetic agents [7, 18]. Yet, powerful local anesthetics have central nervous system (CNS) toxicity which frequently results in cardiac toxicity [7, 13, 18].

We developed the treatment that can be used to relieve axial and radicular pain by using ultrasound-guided (USG) mechanical needling with sterile water injection to calcification or spur and fibrosis around the facet joint, the medial branch and nerve root, and at the multifidus muscles. Since this treatment does not require any chemical substances or pharmaceuticals, therefore, it can be implemented in aging patients with multiple diseases and polypharmacy.

2. Materials and Methods

2.1. Design. This retrospective cohort study assessed the changes of clinical outcome of patients who received USG mechanical needling with sterile water injection. The clinical outcome of the procedure was assessed at 6 time points. The study also compared the clinical outcome of USG mechanical needling with sterile water and steroid injections. In addition, the clinical outcome of age- and gender-matched patients randomly selected from patients who received mechanical needling with sterile water was compared to the patients injected with steroids in a 2 : 1 ratio.

2.2. Settings. The data were extracted from the medical records of patients with facet joint syndrome who received USG injection at the lumbosacral spine by the first author at the outpatient clinic of the Department of Rehabilitation Medicine at the King Chulalongkorn Memorial Hospital, Bangkok, Thailand, between January 1st, 2019, and December 31st, 2020.

2.3. Patients' Population. The researchers analyzed the medical data from patients aged 60 to 92 years who had axial and radicular pain from facet joint syndrome and were given either needling with sterile water injection or steroid injection. Patients who had low back pain from infection, inflammation, or tumor were excluded from the study. The following symptoms were used to diagnose patients with lumbar facet joint pain syndrome: (1) unilateral/bilateral axial lumbar pain and (2) improvement with rest. Patients then were selected to be recruited if there were the following signs: (1) Kemp's sign, (2) induced pain in the articular or transverse apophysis, and (3) sign of facet tension or new lumbar facet sign. Patients were excluded if there were red flag sign and abnormal mass in lumbosacral magnetic resonance imaging, and discogenic pain from acute disc herniation by positive straight leg raising test. Patients with incomplete medical records and who had been treated with any nonsteroidal anti-inflammatory drugs (NSAIDs), analgesic drugs, rehabilitation, other lumbar interventions, or back surgery were also excluded from the study.

2.4. Treatment Procedures. The innovative treatment procedure administered at the facet joint, the medial branch of the dorsal rami that innervated the facet joint, and the multifidus muscle with a single needle was previously published [19] and was used in all patients in this study. The USG mechanical needling with sterile water injection or USG steroid injection in all patients in this study was done by the first author. The most common areas of degeneration, bilateral L4-5 and L5-S1, were determined by US scanning, and the largest degrees of calcification and fibrosis accumulation were found.

Patients in the sterile water group received USG mechanical needling with an injection of 2.5 ml of sterile water plus 0.5 ml of 1% lidocaine without adrenaline per area, totally sterile water 10 ml + 1% lidocaine 2 ml, 1 ml at the medial branch, 1 ml at the facet joint, and 1 ml at the multifidus muscles, 3 ml at each level. The injector (the first author) used ultrasound to scan for calcification or spur and fibrosis around the facet joint, medial branch, and multifidus. The calcification and fibrosis were manually removed with the needle, and the region was cleaned with a large amount of sterile water. A low dose of lidocaine was administered to alleviate the pain of the procedure. The total time of treatment procedures per area was only 1 minute. The treatment was done with the same technique, same volume, and same area once a week for 4 consecutive weeks to clear the calcification and fibrosis little by little, to prevent injury to all tissues each time the treatment was repeated. The steroid group received 6 ml of 10 mg/ml or 60 mg triamcinolone acetonide injection, 0.5 ml at the medial branch, 0.5 ml at the facet joint, and 0.5 ml at the multifidus, 1.5 ml at each level, one time.

2.5. Outcomes Analysis. Self-reported visual analogue scale (VAS) was used to assess the severity of low back pain or axial pain, leg pain, or radicular pain after injection. The gait ability with a walking distance before calf pain was analyzed. The symptoms and satisfaction details of all patients were also analyzed. The outcome analysis was done at 6 time points: preinjection (T0), immediately after injection (T1), 1 week after injection (before the 2nd treatment of sterile water) (T2), 1 month after injection (1 week after the 4th treatment of sterile water) (T3), 3 months after injection (T4), and 6 months after injection (T5). The clinical outcomes at the 6 time points were compared.

2.6. Statistical Analysis. The characteristics of the cohort were presented as mean, standard deviation, and frequency. Changes in clinical outcomes at 6 time points were analyzed by using repeated measures ANOVA. In case of broken sphericity assumption, the Greenhouse–Geisser correction was used. Student's *t*-tests or Mann-Whitney *U* tests for continuous variables (depending on normality) and chi-square tests for categorical data were used for comparison between mechanical needling with sterile water injection and steroid injection. The significant level was $P < 0.05$.

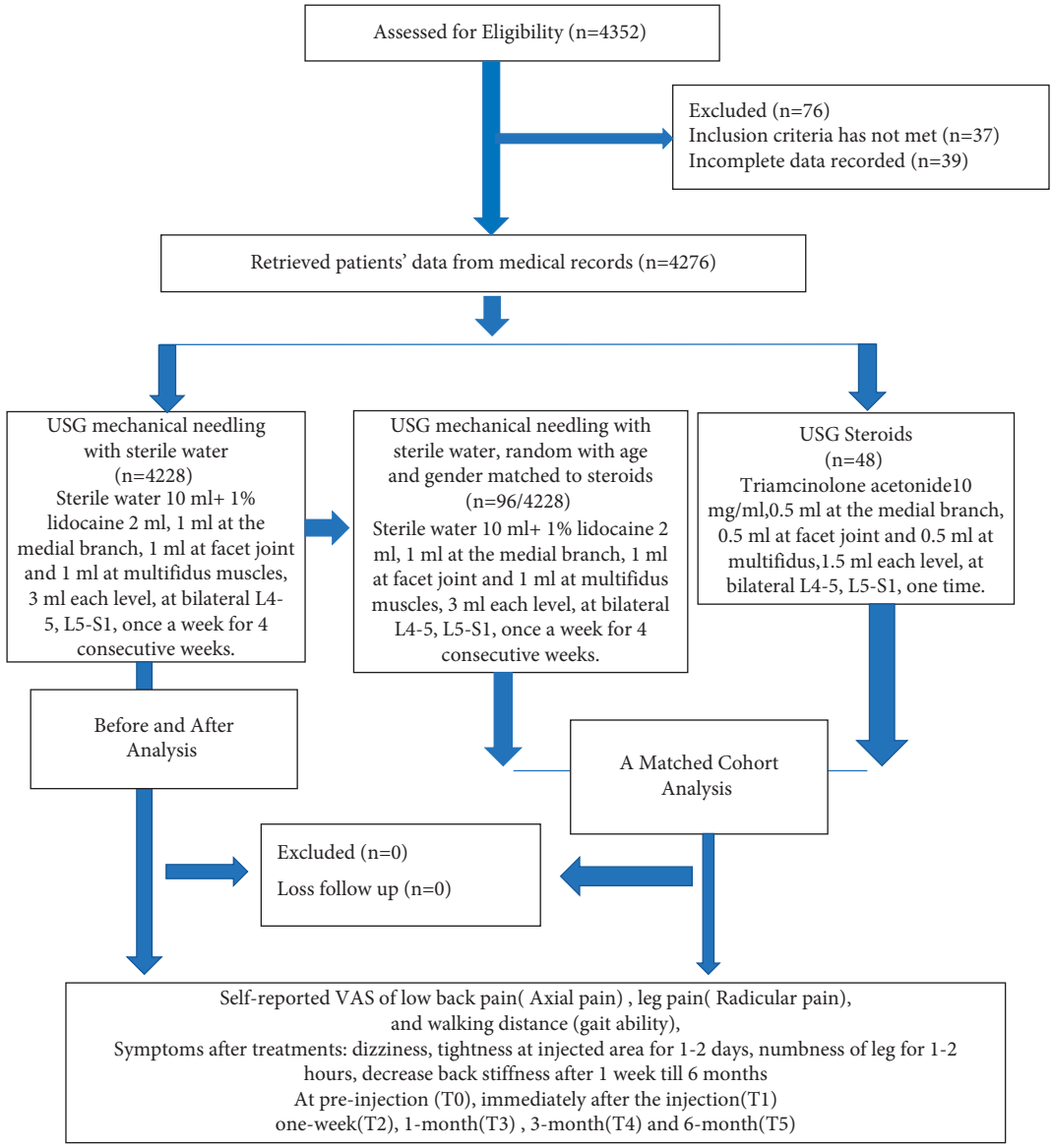

Figure 1: STROBE flowchart.

2.7. Ethics. The Institutional Review Board of the Faculty of Medicine at the Chulalongkorn University in Thailand approved this study (IRB number 426/64). Since this was a retrospective study, written informed consent was waived.

3. Results

The medical records of 4352 facet joint syndrome patients with axial and radicular pain were evaluated for eligibility. The STROBE flowchart, which represents the Strengthening the Reporting of Observational Studies in Epidemiology, is shown in Figure 1. Seventy-six medical records were omitted because they did not meet the inclusion criteria ($n = 37$) or had inadequate data ($n = 39$). There were 4228 medical records of patients who received mechanical needling with sterile water, and 48 of the patients received steroids, resulting in a total of 4276 patients that were analyzed. In a 2 : 1 comparison, 96 patients were randomly selected from the mechanical needling with sterile water group and were age- and gender-matched to 48 patients who received steroids. No patients were lost to follow-up at all time points (T1-T5). The baseline characteristics of the patients are shown in Table 1.

Within the group analysis of 4228 patients who received needling with sterile water injection, the VAS for back pain at T1, T3, T4, and T5 were significantly better than T0 at $P < 0.05$, as shown in Figure 2(a) and Table 2. Moreover, the VAS for leg pain at T1, T3, T4, and T5 were significantly better than T0 at $P < 0.05$, as shown in Figure 3(a) and Table 2. In addition, the walking distances at T3, T4, and T5 were considerably superior to T0 at $P < 0.05$, as shown in Figure 4(a) and Table 2.

Within the group analysis of 96 patients who received mechanical needling with sterile water injection whose age and gender matched those who received steroid injection, the VAS for back pain were significantly better at T1, T3, T4, and T5 compared to T0 at $P < 0.05$, as shown in

Table 1: General characteristics.

	Total (4276)	USG mechanical needling with sterile water ($n = 4228$)	USG mechanical needling with sterile water, random with age- and gender-matched to steroids ($n = 96/4228$)	USG steroids ($n = 48$)	P value
Female (%)	2923 (68.36%)	2889 (68.33%)	34 (69.38%)	34 (69.38%)	
Age (mean ± SD) (years)	71.45 ± 8.23	71.31 ± 8.19	70.59 + 6.12	70.59 + 6.12	
Range (min-max)	60–92	60–92	61–88	61–88	
BMI (kg/m^2)	24.35 ± 3.12 (19.5-32.5)	24.61 ± 3.09 (19.5-32.5)	24.27 + 3.11 (20.5–29.5)	23.92 ± 2.87 (21.0-29.0)	0.892
Duration of LBP (years)	12.09 ± 6.11	12.41 ± 6.27	9.85 + 4.31	8.45 ± 5.24	0.182
Range (min-max)	5–30	6–30	5–20	5–18	

The comparison between random sterile water ($n = 96$) and steroids ($n = 48$) using Mann-Whitney U test; significant difference at $P < 0.05$.

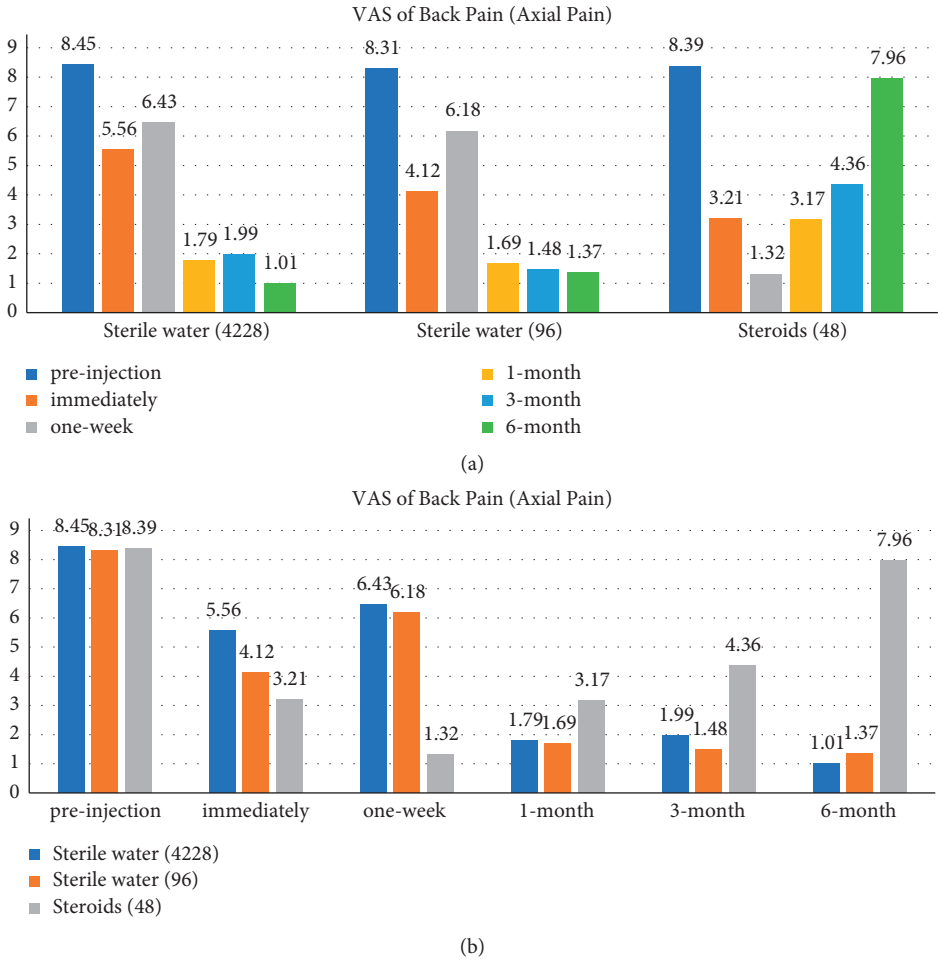

Figure 2: The comparison within group (a) and between groups (b) of VAS for back pain (axial pain) at 6 time points as preinjection (T0), immediately (T1), one week (T2), 1 month (T3), 3 months (T4), and 6 months (T5) after injection.

Figure 2(a) and Table 2. In addition, the VAS for leg pain were significantly better at T1, T3, T4, and T5 compared to T0 at $P < 0.05$, as shown in Figure 3(a) and Table 2. In addition, the walking distances at T3, T4, and T5 were significantly better than T0 at $P < 0.05$, as shown in Figure 4(a) and Table 2.

Within the group analysis of 48 patients who received steroid injection, the VAS of back pain were significantly better at T1, T2, T3, and T4 compared to T0 at $P < 0.05$, as shown in Figure 2(a) and Table 2. In addition, the VAS of leg pain at T1, T2, T3, and T4 were significantly better than T0 at $P < 0.05$, as shown in Figure 3(a) and Table 2. In addition, the walking distances at T2, T3, and T4 were significantly better than T0 at $P < 0.05$, as shown in Figure 4(a) and Table 2.

An age- and gender-matched subset randomly selected from the mechanical needling with sterile water group was

Table 2: Outcome of treatments.

		Sterile water ($n = 4228$)	P value*	Sterile water ($n = 96/4228$)	P value*	Steroids ($n = 48$)	P value*	P value**
VAS of back pain (Mean ± SD)	Preinjection (T0)	8.45 ± 0.99		8.31 ± 0.46		8.29 ± 1.02		0.823
	Immediately after the first injection (T1)	5.56 ± 1.56	0.041*	5.13 ± 1.56	0.039*	4.37 ± 1.32	0.035*	0.129
	One week after the first injection (T2)	6.43 ± 1.91	0.312	6.57 ± 1.46	0.256	1.83 ± 1.41	0.044*	0.016**
	1 month after the first injection (T3)	1.79 ± 1.14	0.000*	1.34 ± 1.24	0.000*	1.44 ± 1.32	0.042*	0.058
	3 months after the first injection (T4)	1.99 ± 1.25	0.000*	1.47 ± 1.12	0.000*	3.56 ± 2.31	0.046*	0.014**
	6 months after the first injection (T5)	1.01 ± 1.56	0.000*	1.11 ± 1.21	0.000*	7.58 ± 1.92	0.783	0.000**
VAS of leg pain (Mean ± SD)	Preinjection (T0)	8.12 ± 1.19		8.09 ± 1.11		8.39 ± 1.02		0.814
	Immediately after the first injection (T1)	4.01 ± 1.31	0.048*	4.12 ± 1.24	0.042*	3.21 ± 1.89	0.012*	0.136
	One week after the first injection (T2)	6.45 ± 1.03	0.741	6.18 ± 1.02	0.589	1.32 ± 1.25	0.019*	0.013**
	1 month after the first injection (T3)	1.89 ± 1.21	0.000*	1.69 ± 1.09	0.000*	1.17 ± 1.29	0.045*	0.699
	3 months after the first injection (T4)	1.57 ± 1.12	0.000*	1.48 ± 1.03	0.000*	4.36 ± 1.37	0.049*	0.000**
	6 months after the first injection (T5)	1.24 ± 1.36	0.000*	1.37 ± 1.14	0.000*	7.96 ± 1.35	0.592	0.000**
Walking distance (meters)	Preinjection (T0)	311 ± 37		307 ± 46		324 ± 65		0.826
	Immediately after the first injection (T1)	—		—		—		
	One week after the first injection (T2)	401 ± 47	0.812	386 ± 38	0.746	592 ± 69	0.041*	0.049*
	1 month after the first injection (T3)	752 ± 56	0.000*	698 ± 34	0.000*	945 ± 35	0.000*	0.038*
	3 months after the first injection (T4)	847 ± 79	0.000*	812 ± 68	0.000*	568 ± 53	0.034*	0.041*
	6 months after the first injection (T5)	1384 + 92	0.000*	1121 ± 71	0.000*	497 ± 45	0.739	0.000*

**The comparison between random sterile water ($n = 96$) and steroids ($n = 48$) using Mann-Whitney U tests with significant difference at $P < 0.05$. *The comparison within each group using repeated measure ANOVA with significant difference at $P < 0.05$.

compared to the steroid group in a ratio 2 : 1. The VAS of back pain in the patients who received mechanical needling with sterile water were significantly better than those who received steroids at T4 and T5 at $P < 0.05$, as shown in Figure 2(b) and Table 2. The VAS of leg pain in the patients who received mechanical needling with sterile water were significantly better than those who received steroids at T4 and T5 at $P < 0.05$, as shown in Figure 3(b) and Table 2. In addition, the walking distances in the patients who received mechanical needling with sterile water were significantly better than those who received steroids at T4 and T5 at $P < 0.05$, as shown in Figure 4(b) and Table 2. In addition, the VAS of back pain and leg pain at T2 and the walking distances at T2 and T3 in patients who received steroids were significantly better than the patients who received needling with sterile water at $P < 0.05$, as shown in Figures 2(b), 3(b), and 4(b) and Table 2.

There were significantly higher incidences of tightness of the injected area for 1–2 days and a decrease in back stiffness at 1 month to 6 months after needling with sterile water injection at $P < 0.05$, as shown in Table 3.

4. Discussion

We retrospectively analyzed a total of 4276 medical records of patients with facet joint syndrome; 4228 patients received mechanical needling with sterile water, and 48 patients received steroid injections. Ninety-six patients were randomly selected from the mechanical needling with sterile water group to match the patients in the steroid group by age and gender. Conventional steroid injections were used to decrease inflammation and pain in 48 patients.

In this study, all patients received an innovative technique that used USG injections at the facet joint, the medial branch of the dorsal rami that innervates the facet joint, and the multifidus muscle with a single needle, as previously published [19]. There were statistically significant reductions in back pain or axial pain, and leg pain or radicular pain in 4228 patients who received mechanical needling with sterile water immediately after injection, at 1 month after injection (1 week after the 4th treatment), 3 months after injection, and 6 months after injection compared to preinjection or at baseline ($P < 0.05$). There were statistically significant

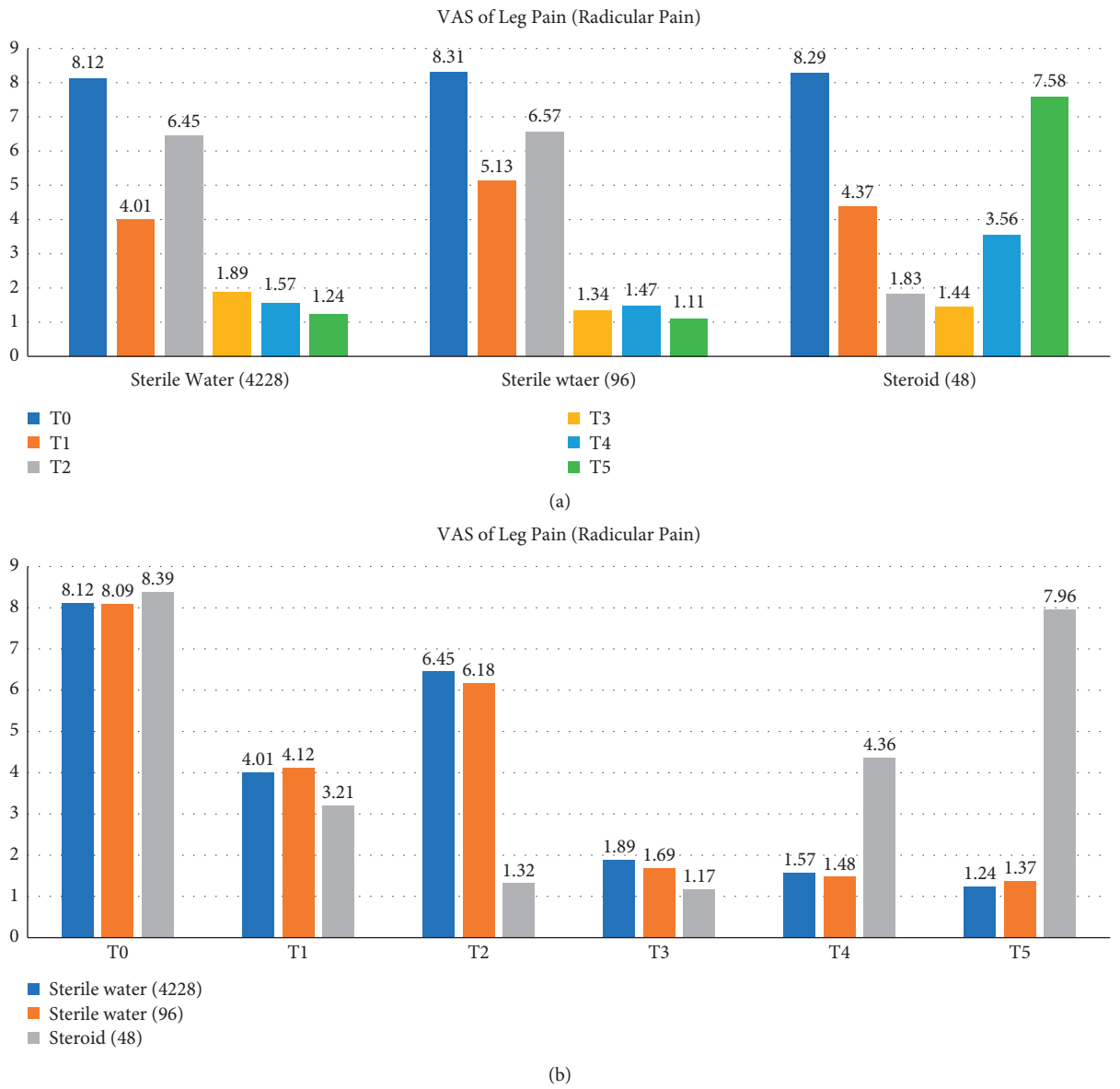

Figure 3: The comparison within group (a) and between groups (b) of VAS for leg pain (radicular pain) at 6 time points as preinjection (T0), immediately (T1), one week (T2), 1 month (T3), 3 months (T4), and 6 months (T5) after injection.

reduction of back pain or axial pain, and leg pain or radicular pain and improvement in walking distance at 3 months and 6 months after injection in 96 patients who received mechanical needling with sterile water compared to the 48 patients who received steroids. At 1 week after injection, the patients in the steroids group experienced lesser back and leg pain than those who received mechanical needling with sterile water. However, in the steroid group, the back and leg pain returned at 3 months and 6 months after injection. We found that mechanical needling with sterile water was useful in reducing axial and radicular pain for at least 6 months. Immediately after injection and at 1 month after injection, the efficacy of mechanical needling with sterile water was comparable to steroids.

Since the large amount of sterile water generated pressure at the facet joints, medial branches, and multifidus muscles, 39.58% of those who received mechanical needling with sterile water and 4.17% of those who received steroids had back discomfort. However, within 1–2 days, the liquids in the interstitial tissues should be dissolved and return to the blood vessel.

After calcification and fibrosis were removed from the facet joints and muscles, the back stiffness greatly improved in 93.75% of those who received mechanical needling with sterile water and 25% of those who received steroids. These results might be due to the gliding of facet joints and revascularization of the facet joints and regeneration of the nerves since there was less calcification or fibrosis blockage. However, additional studies should be conducted to confirm this.

In recent decades, a variety of local anesthetics, as well as a variety of steroids, have been routinely used for spinal

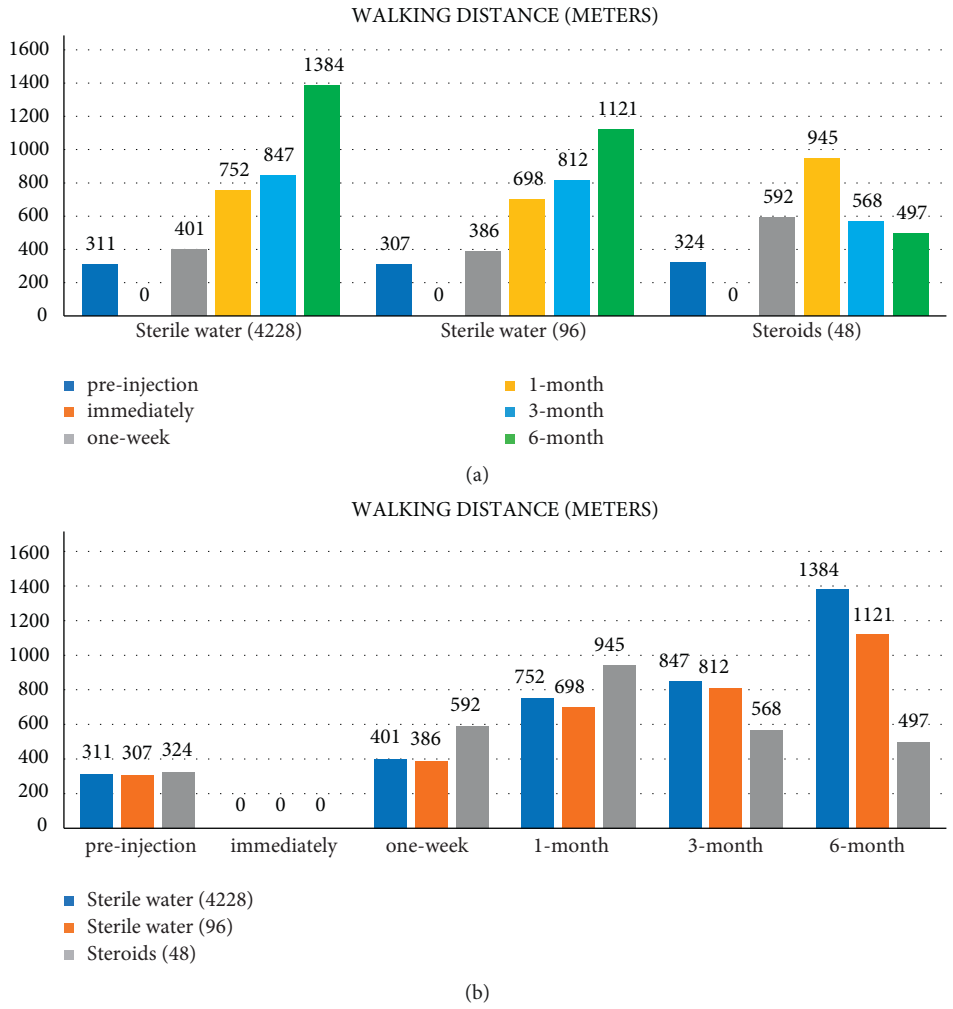

Figure 4: The comparison within group (a) and between groups (b) of walking distance at 6 time points as preinjection (T0), immediately (T1), one week (T2), 1 month (T3), 3 months (T4), and 6 months (T5) after injection.

Table 3: Symptoms after injections.

	Sterile water (4228)	Sterile water (96)	Steroids (48)	P value
Dizziness after injection	150 (3.5%)	5 (5.21%)	3 (6.25%)	0.296
Tightness of injected area for 1–2 days	1528 (35.63%)	38 (39.58%)	2 (4.17%)	0.000*
Numbness of leg for 1–2 hours	16 (3.73%)	3 (3.12%)	1 (2.08%)	0.092
Decrease back stiffness after 1 week till 6 months	4122 (96.13%)	90 (93.75%)	12 (25.0%)	0.000*

The comparison between random sterile water ($n = 96$) and steroids ($n = 48$) using chi-square, with significant difference at $P < 0.05$.

injection. In a recent meta-analysis [6], evaluated lumbar intra-articular steroid injections as Level III, and based on three high-quality RCTs, it was shown that the efficacy lasted for a short period of time. There was little evidence of long-term effectiveness. Furthermore, the number of unfavorable studies and negative publications increased. When dual diagnostic facet joint nerve block with an 80% criterion standard is met, lumbar intra-articular steroid injections can be administered. However, the evidence for lumbar intra-articular steroid injections without the use of local anesthetic for therapeutic purposes is Level III for short-term relief with a weak recommendation. Level IV evidence exists for long-term improvement. As a result of this, the recommendation's strength is low [6]. This study also found short-term relief of steroids; the reduction of the pain lasted for 1–3 months.

In high-risk patients with myofascial pain syndrome, there was evidence of desensitization when a diluted local anesthetic was used, without any negative effects [11, 12].

Recent research suggests that central sensitization and other processes play a role in chronic facet joint syndrome [6–8, 16, 18–23]. Magnetic resonance imaging (MRI) did not reveal a strong correlation between symptoms and facet joint syndrome. The standard of care for facet joint syndrome is still unclear [6–8, 16, 18–23]. Disc herniation, spinal stenosis, postsurgical syndrome, discogenic pain, and other

disorders are treated with epidural injections, caudal in the sacrum, and interlaminar in the cervical, thoracic, and lumbar areas, as well as transforaminal in the cervical, thoracic, and lumbar regions [5–7, 23].

Treatment with hyaluronic acid (HA), autologous platelet rich plasma (PRP), or steroids in the facet joint may be beneficial. However, it is still debatable whether the injectant is the most effective treatment or not. This could be related to the limited size of the facet joint, which can only hold around 2 mL of fluid [14, 15]. It can sometimes be difficult to inject the facet joint successfully, especially in the elderly [5, 6, 14, 15]. Even under ultrasound or fluoroscopic guidance, spurs and cartilaginous metaplasia can obstruct effective insertion into the facet joints. As a result of these findings, research implies that facet joint injections may not be the best treatment choice for facet joint conditions. Instead, accurate medial branch block (MBB) is the preferred treatment [5, 6, 20]. Not only does MBB confirm the diagnosis of facet joint disease, but it can also be followed by radiofrequency or cryoablation of the medial branches [5, 6].

Image guidance with computed tomography (CT) or fluoroscopy is well established and routinely used in facet joints and periradicular injections. Ultrasound-guided spine injection therapy, on the other hand, is a new but promising technique that has been shown to be reliable, and it does not require ionizing radiation or expensive equipment and facilities [5, 6, 8, 17, 19, 20].

Facet joint syndrome is caused by a prolonged inflammatory process in the facet joints, followed by fibrosis and calcification [6–8, 16, 18–23]. In this study, the USG mechanical needling with injection of sterile water may break the myofascial trigger points, reduce sensitization of the muscles and soft tissue at the facet joints, and block the medial branches of the dorsal rami that innervate the facet joints. The mechanical needling and sterile water can reduce peripheral and central sensitization and might create the mechanical effect of removing calcification and fibrosis around the facet joints [9, 24–26] and alter the neurochemistry [9, 24–34] of the deeper tissue structures that may provide an enhanced analgesic response [30–34]. From a neurophysiological standpoint, mechanical needling may reduce both peripheral and central sensitization by removing the source of peripheral nociception, such as the trigger point (TrP) region, calcification, and fibrosis of the facet joint, as seen in this study, changing spinal dorsal horn activity, and activating central inhibitory pain pathways. The insertion of a needle into the body is known to elicit a variety of natural neurophysiological mechanisms, such as stimulation of the A and C fibers or activation of cortical brain areas [9, 10, 24–36]. The mechanical needling with sterile water action as the water jet mechanism can clear the calcification and fibrosis from the facet joint, nerves, and muscle. In this study, the efficacy of the procedure lasted up to 6 months. This procedure is more effective and can achieve faster results compared to mechanical lumbar traction [35]. Since the procedure can remove the source of mobility restriction, inflammation, pain, and neurovascular compression, mechanical needling with sterile water injection should be safer and more effective than steroid injection which only has an anti-inflammatory mechanism. The mechanical needling with sterile water is inexpensive and safe since it has no chemical substance and does not require the utilization of several medical facilities. However, it does involve accurate injection by the qualified USG injector.

5. Study Strengths and Limitations

The strengths of this study were its large sample size and having 6 different time points that assessed the clinical outcome after USG mechanical needling with sterile water injection. Moreover, this study showed the comparison between mechanical needling with sterile water injection and steroid injection. Last, this study had a subset of randomly selected patients that were age- and gender-matched to the steroid group in a ratio of 2 : 1.

However, this is a retrospective data analysis study that was conducted in only 1 institution and had 1 expert USG injector.

Additional prospective randomized controlled trial should be conducted in an international, multicenter setting with a large sample size to assess sensitization through quantitative sensory testing and using ultrasonography to detect hyperechoic areas such as dense connective tissue, fibrosis, and calcification at baseline, during, and after completion of the treatment, as well as multiple follow-up visits, and longer follow-up period. Further study should also confirm whether increased facet joint gliding after calcification and fibrosis clearance results in joint revascularization and nerve regeneration or not.

6. Conclusions

USG mechanical needling with sterile water injection at the lumbar facet joints, medial branch of the facet joint, and multifidus muscles reduced the pain for at least 6 months. The calcification and fibrosis removal and reduced sensitization that might lead to joint gliding with vasculature for joint and nerve regeneration were all plausible mechanisms. Since there was no chemical or drug used, the treatment was affordable and extremely safe.

Data Availability

Data will be available upon request to the corresponding author.

Additional Points

USG mechanical needling with sterile water injection had significant efficacy at 1 week after treatment and could last up to 6 months. At 1 week after injection, the patients who received steroids experienced less back and leg pain than those who received mechanical needling with sterile water. However, back and leg pain returned at 3 and 6 months after steroid treatment. USG steroid injections only reduced inflammation at the facet joints, medial branches, and

multifidus muscles. The ultrasound scanning for calcification or spur and fibrosis around the facet joint, medial branch, and multifidus was crucial in identifying the location of the tip of the needle. The mechanical needling and the large amount of sterile water injection were expected to clear the calcification and fibrosis, which should contribute to joint gliding with vasculature for joint and nerve regeneration. Since there was no chemical or drug used, the treatment was affordable and extremely safe.

Ethical Approval

This study was performed in accordance with the principles of the Declaration of Helsinki and was also approved by the Institutional Review Board of the Faculty of Medicine at the Chulalongkorn University in Thailand (IRB number 426/64).

Consent

Since this was a retrospective study, written informed consent was waived.

Disclosure

The research was performed as part of the first author's employment at King Chulalongkorn Memorial Hospital, Bangkok, Thailand.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

All authors, Areerat Suputtitada, Carl PC Chen, and Krit Pongpirul, have read and approved the final version of the manuscript. Study design was developed by Areerat Suputtitada and Krit Pongpirul. Acquisiton of data was performed by Areerat Suputtitada and Krit Pongpirul. Interpretation of the data was performed by Areerat Suputtitada and Carl PC Chen. Literature search was performed by Areerat Suputtitada and Carl Chen. Manuscript preparation and drafting were done by Areerat Suputtitada. Manuscript editing was done by Areerat Suputtitada and Carl PC Chen.

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