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Management of Post-lumbar-operation Back Pain using Myofascial Trigger Point Injection: A Retrospective Study

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Abstract

Objectives: This study aimed to investigate the therapeutic effect of trigger point (TrP) injection of paravertebral muscle to control postoperative lumbar pain.

Methods: The medical records of 46 patients who underwent lumbar surgery in our hospital between January 2013 and January 2020 were retrospectively analysed. The patients included in the study were divided into an observation group (n=26) and a control group (n=20) based on the certainty of their myofascial pain TrP diagnosis. The TrPs were found and injected with a 1:5 mixture of compound betamethasone/lidocaine (2 mL). The Visual Analogue Scale (VAS) scores and Patient Satisfaction Index (PSI) scores of the two groups were recorded before injection, on the day after injection, and one and two weeks after injection. The two groups' postoperative bedridden time and analgesic medication treatment duration were calculated. All the scores were then compared.

Results: The VAS scores of the observation group and the control group before injection were 7.00 ± 0.63 and 6.85 ± 0.59, respectively, and no significant difference was observed between the two groups (P>0.05). The VAS scores on the day and one and two weeks after injection were 2.65 ± 0.63, 3.46 ± 0.51, and 2.62 ± 0.50 in the observation group and 3.75 ± 0.44, 4.70 ± 0.47 and 4.95 ± 0.51 in the control group. Within the same group, the difference in patients at different time points was statistically significant (P<0.01), and the difference between the two groups at the same time point after injection was also statistically significant (P<0.01). The PSI score of the observation group was significantly lower than that of the control group (P<0.01). The bedridden time of the observation group was 2.71 ± 0.45 d, which was shorter than the bedridden time of the control group (4.42 ± 0.49 d; P<0.01). The duration of non-steroidal drug use was also shorter in the observation group than in the control group (P<0.01).

Conclusion: Accurate injection of compound betamethasone/lidocaine mixture at the pain TrP can effectively control the early pain response after lumbar surgery. It is also beneficial to the early recovery of postoperative function and improves the patient's satisfaction with the surgery.

Keywords: Analgesia, Back pain, Injection, Lumbar vertebrae operation, Trigger point

1. Background

Myofascial pain (MP) after lumbar surgery refers to the pain response in patients after lumbar surgery, which is clinically extremely common (1). Myofascial pain is a painful condition of muscles characterised by pain transmitted from trigger points (TrPs) within myofascial structures (the connective tissue surrounding and separating muscles). If such pain not effectively controlled, it will affect postoperative walking and functional exercise, increasing the incidence of complications and the difficulty of further treatment (2). When MP becomes chronic, it may develop into patterns of maladaptive behaviour and impair long-term health (3). Long-term repeated pain will lead to adverse consequences, such as decreased postoperative satisfaction, reduced self-efficacy, and decreased quality of life (4). The effective relief of lumbar postoperative pain is the focus of postoperative clinical treatment.

There have been a number of studies of MP treatment, including block therapy using various drugs and traditional Chinese and Western medicine (5-9). Myofascial pain syndrome may be associated with myofascial TrPs, and there is growing research into this (10,11). Myofascial TrPs are focal areas of taut bands found in skeletal muscle that are hypersensitive to palpation. Manual pressure applied on a myofascial TrP produces a distinct local and referred pain consistent with the patient's presenting pain symptoms (12). Myofascial TrPs can be diagnosed according to criteria suggested by Simons, which include TrPs in one or more taut bands, referred pains of a typical pattern, palpable or visible local twitch responses induced by touching the most sensitive portion of taut bands, and restrictions in lateral bending of the neck (13). During previous clinical pain interventions, myofascial TrPs were often ignored. However, in recent years, there have been more and more clinical reports on myofascial TrPs in the treatment of pain disorders (14, 15). Treatments for MP syndrome include pharmacotherapy, physical therapy, and therapeutic exercise and trigger point injections (TPIs). The latter directly target myofascial TrPs using local anaesthetics and are useful in the primary or adjunctive management of pain related to them (16).

Due to the deep location of the soft tissue of the

lumbar paravertebral spine, the precise location of the pain is hard to find, which increases the difficulty in accurately locating the TrP, and there is no unified and standardised TrP detection method in clinical practice. The present study observed and compared the clinical effect of myofascial TPI therapy on postoperative pain after lumbar spine surgery by injecting drugs containing the compound betamethasone and lidocaine into myofascial TrPs of the paravertebral soft tissue and gluteal muscles. This study aimed to explore the use of targeted interventions after lumbar spine surgery to reduce the pain and treatment burden, improve the quality of life of patients after surgery, and provide a clinical reference for using myofascial TPI in the treatment of postoperative pain in the lumbar spine.

2. Objectives

This study aimed to investigate the therapeutic effect of trigger point (TrP) injection of paravertebral muscle to control postoperative lumbar pain.

3. Methods

2.1. Clinical data

A retrospective analysis of the treatment data of 46 patients who underwent lumbar interbody fusion between January 2013 and January 2020 and experienced significant postoperative lumbar pain was undertaken. They included 20 males and 26 females, aged between 20 and 78 years old, with an average of 47.5 years. All received oral ibuprofen extended-release capsules after reporting postoperative lower back pain.

In all patients, myofascial TrPs in the paraspinal and gluteal muscles were identified and located by palpation on day three after surgery according to the diagnostic criteria for myofascial TrPs, i.e., a hypersensitive bundle or nodule of muscle fibres that are harder than the normal consistency. The most painful TrP was marked. The enrolled patients were divided into an observation group (n=26) and a control group (n=20) according to the diagnosis of fascia TrPs they received. The observation group were patients in which myofascial TrPs were accurately located. On palpation, there was a short-term contraction of the muscle fibres, and the patients experienced increased pain, an enlarged pain area, and muscle referred pain. The patients in the control group were diagnosed as having suspected fascial TrPs, as there were hypersensitive bundles or nodules of muscle fibres with a harder-than-normal consistency at the palpation points; however, these patients had no obvious pain increase and muscle referred pain. The baseline conditions of age, sex, surgical scope, and pre-treatment pain scores of the two groups were not significantly different. The treatment process was reviewed and approved by the Hospital Ethics Committee. All the patients or their families signed informed consent forms.

Patients who met the following criteria were recruited: (1) Muscle pain around the surgery incision was obvious after surgery and was increased during activity and body position change; (2) routine analgesic drugs had no obvious effect; (3) there was local tenderness and pain when nodules or bundles in the muscles were touched; and (4) the patient could understand and cooperate with the relevant treatment.

The exclusion criteria were as follows: (1) Pain was mild and could be controlled by oral or intravenous pain medication; (2) the pain was combined with cerebrospinal fluid leakage or local haematoma; (3) the pain was combined with lower back pain caused by a visceral disease; (4) there was a local infection, poor incision healing, skin necrosis, a tumour or coagulation dysfunction; (5) the patient was oversensitive to pain, had mental abnormalities or was unwilling to accept or follow the treatment; (6) the source of pain could not be accurately identified; or (7) the pain had other causes, such as complications during surgery.

2.2. Methods

2.2.1. Drug preparation

A compound injection of betamethasone and lidocaine was prepared. The ratio was 1:5; therefore, a 2 mL mixture contained 0.33 ml of betamethasone and 1.67 ml of lidocaine.

2.2.2. Identification and localisation of trigger points

The pain points of the paravertebral muscles are generally located within 3-5 cm of the spinous process. The pain points around the gluteus muscle are generally located within the outside third of the posterior and lower edge of the iliac crest, 2-3 cm below the outside of the spina iliaca posterior superior, corresponding to the posterior upper margin of the large sciatic osteotomy (17). The myofascial TrPs of the patients in this study were diagnosed by a doctor's examination, and the patient's most painful TrP was marked. Typically, TrPs are identified by the clinician feeling the muscle for knots or small areas of muscle spasm within a taut or tense band of muscle, which are tender and cause referred pain. When the TrP is pressed, patients will experience local pain and referred pain in the buttocks, the back of the thigh, and even the back of the calf, but the pain rarely exceeds the knee and does not exceed the ankle joint.

2.2.3. Injection method

In the observation group, the drug was injected into the myofascial TrPs of the paraspinal and gluteal muscles. First, the TrP was identified, and the body surface was marked and disinfected with iodophor. An empty syringe was connected to a long needle, the skin was stabbed at the TrP, and the needle was inserted and pushed slowly through the fascia layer. When the needle penetrated the myofascial TrP, the patient

experienced some local muscle soreness rather than a distinct tingling. Provided there was no fresh red bleeding or dark haematocele when pumping back, the needle was stabilised with the right hand, and the empty syringe was removed and replaced with a syringe containing 2 mL of drug mixture, which was then injected into the TrP. If a dark haematocele was drawn out from the empty syringe when pumping back, it was removed as far as possible, and then the syringe was replaced and the drug injected. After the injection, the needle was pulled out, and a cotton swab was pressed on the injection site for 1 min, after which a dressing was applied. Each TrP was injected once, each time with 2 mL. All the injections were performed independently by the same physician.

With respect to the patients in the control group, the drug was injected into the area of the suspected myofascial TrP using the same procedure.

2.3. Evaluation indicators

The Visual Analogue Scale (VAS) scores for pain and Patient Satisfaction Index (PSI) scores for analgesia were observed before the injection, on the day after injection, and one and two weeks after injection (18). The PSI was scored as follows: 1 = the treatment has met my expectations; 2 = although the treatment results did not have the full desired effect, I am willing to receive the same treatment if reselected; 3 = the treatment has helped, but I will not do the same treatment to get this effect; 4 = my symptoms did not change, or they got worse compared to before the treatment. These side effects after the injection were observed, including gastrointestinal discomfort, abnormal cardiovascular reactions, respiratory difficulties, urinary retention, skin rupture, swelling, and exudation. In addition, the postoperative bedridden time and analgesic medication treatment duration of the two groups were calculated in days.

2.4. Statistical analysis

Statistical analysis was performed using SPSS software (version 23). Measurement data were expressed as mean ± standard deviation and analyzed using a Student's t-test. Count data were presented as numbers and percentages, and a Chi-squared test, or a Fisher's exact test were used for counting data. For ordinal variables, the median and the first (Q1) and third (Q3) quartiles were calculated. Mann–Whitney U tests were used to compare the groups, and Wilcoxon signed-rank tests were used to compare changes from the baseline within the groups. The significance level was considered $\alpha = 0.05$.

4. Results

4.1. Demographic characteristics and baseline data

The demographic characteristics and baseline data of the patients are presented in Table 1. There were 26 patients in the observation group, with an average age of 45.42 ± 14.64 years, comprising 12 males and 14 females. The body mass index (BMI) of the observation group was 23.36 ± 1.65, and the VAS score before treatment was 7 (7, 7). The control group consisted of 20 patients, 8 males and 12 females, with an average age of 50.60 ± 12.04 years. The BMI of the control group was 23.61 ± 1.29, and the VAS score before treatment was 7 (6.3, 7). No significant difference was found between the observation and control groups regarding age, gender ratio, BMI, or VAS score before treatment (P>0.05), indicating that the two groups were comparable.

4.2. Comparison of VAS scores

Compared with before the injection, the pain relief effect of the two groups of patients on the day of injection was significant (P=0.000). Two weeks after the injection, the VAS scores of the two groups of patients were significantly lower than those before the injection, and the difference was statistically significant (P=0.000). The maintenance effect of the pain relief after injection in the observation group was better than that of the control group. Compared with the control group, the VAS scores of the patients in the observation group were significantly lower on the day of injection, one week after injection, and two weeks after injection, and the differences were statistically significant [P=0.000; Table 2].

4.3. Comparison of PSI score results at different time points after injection

The PSI score results are shown in Table 3. The PSI scores of the patients in the observation group on the day of injection, one and two weeks after injection were significantly lower than the control group (P=0.000). This finding implies higher patient satisfaction with the pain TPI therapy.

Table 1. Demographic characteristics and baseline data of the patients in both groups

	Observation group (n=26)	Control group (n=20)	t/X^2	*P-value*
Age (years)	45.4±14.6	50.6±12.0	-1.315	0.195
Gender			0.1742	0.676
Male	12(46.2%)	8(40%)		
Female	14(53.8%)	12(60%)		
BMI	23.4±1.7	23.6±1.3	-0.558	0.579
VAS score before treatment	7.0（7.0, 7.0）	7.0（6.3, 7.0）	/	0.809

Table 2. Comparison of Visual Analogue Scale (VAS) score results of different time points between the two groups

	Observation group	Control group	*P-value*
Before injection	7.0（7.0, 7.0）	7.0（6.3, 7.0）	0.528
The injection day	3.0（2.0, 3.0）①②	4.0（3.3, 4.0）①	0.000
One week after injection	3.0（3.0, 4.0）①②	5.0（4.0, 5.0）①	0.000
Two weeks after injection	3.0（2.0, 3.0）①②	5.0（5.0, 5.0）①	0.000

Note: ①*P*<0.05, compared with before injection
②*P*<0.05, compared with the control group

Table 3. Comparison of Patient Satisfaction Index score results at different time points after injection in the two groups

	Observation group	Control group	*P-value*
The injection day	1.0（1.0, 2.0）①	3.0（3.0, 3.0）	0.000
One week after injection	1.0（1.0, 2.0）①	3.0（3.0, 3.0）	0.000
Two weeks after injection	1.0（1.0, 1.0）①	3.0（3.0, 3.0）	0.000

Note: ①*P*<0.05, compared with the control group

4.4. Comparison of postoperative bedridden time and analgesic medication treatment duration

The postoperative bedridden time of the control group and the treatment duration of non-steroidal anti-inflammatory painkillers were longer (see Table 4 for details). The postoperative bed rest time and the course of analgesics were significantly shorter in the observation group than in the control group (P=0.000).

4.5. Complications or adverse reactions

After the TPI, no obvious gastrointestinal discomfort, abnormal cardiovascular reactions, respiratory difficulties, urinary retention or other systemic reactions were found. However, people with diabetes will have a brief blood glucose increase for 1-2 days, which requires appropriate observation and/or a temporary increase in hypoglycaemic drugs. No skin rupture, swelling, and exudation were found at the puncture injection sites, and no allergic reactions to the drugs occurred.

Table 4. Comparison of postoperative bedridden time and analgesic medication treatment duration between the two groups ($\bar{x}$±SD)

	Observation group	Control group	*t*	*P-value*
Bedridden time (d)	2.71±0.45	4.42±0.49	-12.255	0.000
Nonsteroidal drug use duration (d)	3.23±0.51	6.05±0.60	-17.071	0.000

5. Discussion

5.1. Cause and mechanism of postoperative pain

The injury of soft tissue, such as muscle, and the resulting traumatic inflammation are important pain-causing factors after lumbar surgery. The traditional posterior median approach can cause severe muscle damage, especially to the multifidi muscles. Surgical damage to the muscle tissue is mainly caused by the following: (1) cutting off/stripping of the muscle attachment points; (2) local thermal damage and tissue necrosis caused by excessive use of electric knives; (3) surgical instruments, such as an automatic retractor, causing reduced perfusion and necrosis within the muscle, the degree of muscle injury being closely related to the pressure on the muscle and pulling time; (19) and (4) denervation. The latter is an important factor in muscle degeneration and atrophy, and an increased T2 signal can still be seen on nuclear magnetic slices six months after surgery (20). Significant muscle necrosis, fibrosis, and fat infiltration were found in the biopsy of muscle tissue in patients with significant pain, with abnormal changes in electromyography still visible 2-5 years after surgery (21). After muscle tissue degeneration and necrosis, lactic acid, prostaglandin 2, phospholipase, and other substances with strong stimulation and pain-causing effects can be released. In addition, nerve fibre tissue damage related to muscle can cause nerve cells to release the substance P interleukin, histamine, and other inflammatory mediators, resulting in increased local vascular permeability and tissue oedema. Necrotic tissue and inflammatory substances, combined with the vascular response between muscle tissue, can cause further damage to muscle tissue and stimulate surrounding nerve endings to produce pain in the surgical area (22).

In the central or abdominal part of the damaged muscles in patients with MP syndrome, the junction between the muscles and the tendon, the edge of the myofascial strain and the muscles attached to the bone process, there are local highly sensitive tenderness points contained in the accessible tight muscle band (23). A puncture biopsy and electron microscopy of tenderness points in patients with MP revealed a mesh fibre network connecting myofibres, similar to 'rubber bands', whose stenosis may be a trigger for myofibre contraction and eventually lead to local pain and necrotic atrophy of the myofibres (24–26). An animal

model showed disordered muscle fibre arrangement, fracture, distortion, local muscle fibres fibrosis, contracture thickening and different muscle gap size, and, in local areas, there were inflammatory cells, such as macrophages, and large adhesions in contracture nodules (27).

The exact pathophysiology and aetiology of myofascial TrPs and MP syndrome are still unknown. However, many proposed mechanisms have been studied and reported in the literature. It has been suggested that the development of myofascial TrPs is related to an excess release of acetylcholine, leading to sustained contraction of the muscle and formation of a TrP (28). This sustained contraction of the muscle can lead to a significant increase in the concentration of inflammatory and nociceptive transmitters within the TrP, as measured by real-time microdialysis in a landmark study by Shah et al. (29). Persistent peripheral muscle nociceptive activation by these inflammatory and nociceptive compounds is converted into a permanent stimulus that facilitates pain neurotransmission and leads to central sensitisation and glial activation (30-32).

5.2. Analysis of postoperative pain and study results

The results of the current study showed that TrPs were more common in patients with postoperative MP, accounting for approximately 25% of patients undergoing lumbar surgery in the same period. In the two groups in the study, the injection medication was the same, and the results showed that the analgesic effect in the observation group was significantly better than the control group, indicating that in patients with an accurate TPI and a clear response, the analgesic effect was good, suggesting that the drug injection through the TrP was better compared with conventional therapy. The findings of the present study are consistent with previous findings. Rhim et al.(33) claimed that TPIs with lidocaine could be an effective and safe treatment for patients with chronic abdominal MP syndrome. Moreover, Lee et al. (34) argued that TPI is an alternative and effective pain control modality for advanced cancer patients with MP syndrome. These studies suggest that myofascial TPIs are effective in treating MP disorders.

5.3. Mechanism of the trigger point block injection

The drugs injected into the TrPs in this study were narcotic pain drugs. The rapid pain relief of the anaesthetic and the delayed long-range anti-inflammatory effects of hormones enabled the vicious cycle of local pain to be broken, and the combined result was rapid and lasting pain relief. The maintenance of pain relief for a long time postoperatively may also be due to the temporary blocking of local pain perception conduction pathways, allowing the brain to judge the local pain afresh (35).

Compared with a traditional injection, a block injection into a TrP does not need to be transmitted by blood, and it can quickly and efficiently inhibit the pain and directly target the cause of the pain (16). Block injection in the TrP realises early anti-inflammatory and pain relief, which then allows early patient turn-over and timely lower limb exercise and back muscle adaptive training. Muscle contraction accelerates the local blood circulation, which can promote the absorption of harmful substances, such as local necrotic tissue, lactic acid, and inflammatory molecules, and reduce local pain.

At present, there is no unified standard method for detecting myofascial TrPs. Although manual palpation is the most common, this is highly influenced by subjective factors; therefore, it is difficult to evaluate the accuracy of the method (36). Studies have found that using ultrasonic guidance to find TrPs largely avoids interference from external factors and ensures an accurate injection location is identified (12,36). In recent years, magnetic resonance imaging (MRI) and infrared thermal imaging technologies have also been applied successfully in the detection of myofascial TrPs (37).

There were some limitations to this study. Palpation was used to judge the existence of myofascial TrPs, and the patients were grouped according to whether they felt pain or not when the myofascial TrPs were pressed. Both the palpation and this grouping method were greatly influenced by subjective factors, since the location of a TrP is also affected by individual differences, and it is difficult to locate a TrP precisely by palpation alone (38). In addition, the sample size was relatively small. In future studies, it is suggested to increase the sample size, and the location of myofascial TrPs should be confirmed using a combination of methods. For example, the TrP could first be determined by palpation, and then its specific location could be identified by ultrasound combined with MRI results to ensure the optimal injection site is located. In addition, this study used a limited number of standard outcome measures. These limitations will be fully considered in any future studies.

6. Conclusion

In conclusion, treating MP after lumbar surgery with a block injection in a TrP can be effective, and this type of therapy has a good clinical application value. However, there is no unified myofascial TrP detection method in use at present, and palpation alone depends on the subjectivity of the clinician and the patient, resulting in reduced accuracy. Future methodological studies should focus on improving the accuracy of the TrP diagnosis and the precise determination of injection location and making better choices for the dosage and type of drugs. Higher levels of TPI therapy also require in-depth research and multicentric validation.

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Not applicable.

Footnotes

Conflicts of Interest: All the authors declared that they had no personal, financial, commercial, or academic conflicts of interest.

Author Contribution: Xin-yu Zhang and Bao-gan Peng conceived of the study, and Zhe Zhao and Bing Wu participated in its design and coordination and Zeng-biao Ma and Guan-jun Wang helped to draft the manuscript. All authors read and approved the final manuscript.

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